

THE MODERATING EFFECTS OF SELF AND OTHER EFFICACY ON MOTIVATION
GAINS IN SWIMMING RELAYS

By

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ABSTRACT

THE MODERATING EFFECTS OF SELF AND OTHER EFFICACY ON MOTIVATION GAINS IN SWIMMING RELAYS

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This dissertation investigated the moderating effects of self- and other-efficacy on the Köhler motivation gain effect in swimming relays. The study was an extension of the motivation gain literature in sport. The Köhler effect has been found to promote motivation gains for inferior group members when participating with moderately more capable partners. Self-efficacy research has also demonstrated a strong relationship with performance in sport. However, research on efficacy beliefs about others in one's group indicates other efficacy may be a stronger predictor of performance compared to self-efficacy (Dunlop, Beatty, & Beauchamp, 2011). Participants were 199 swimmers at the Division II and III levels who swam the 200, 400, or 800 yard freestyle relay at their fall invitational meets. Both relay times performed at the meet as well as individual best times for each participant were collected. Participants also completed questionnaires regarding their self- and other efficacy beliefs of their relay performances. Using an HLM cross-classified model, the results indicated that the fourth ranked member performed faster in the relay compared to their individual performance, demonstrating a motivation gain. Further, under conditions of high self- or other efficacy, this effect was modified by gender. In female relays, only the fourth ranked member showed a motivation gain, while in male relays both the third and fourth ranked relay member demonstrated a motivation gain. Findings of the study contribute to the motivation gain literature in sport and how both self- and other efficacy can successfully change performance of weaker relay members.

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TABLE OF CONTENTS

LIST OF TABLES	vii
LIST OF FIGURES	ix
CHAPTER 1	
Introduction	1
Purpose of the Study.....	10
Contextual Factors.....	10
Hypotheses	11
Research Questions	11
Delimitations	12
Definitions	12
CHAPTER 2	
REVIEW OF LITERATURE	
Group Motivation Research	14
The Köhler Motivation Gain Effect	17
Self-Efficacy and Performance.....	24
Other Efficacy	25
Summary.....	32
CHAPTER 3	
METHOD	
PILOT STUDY	
Participants	34
Measures.....	34
Demographics.....	34
Motivation Gain.....	35
Procedure.....	35
Standardization of Relay Times	36
Results	37
Discussion.....	38
DISSERTATION	
Participants	40
Measures.....	40
Demographics.....	40
Self-Efficacy.....	41
Other Efficacy	41
RISE	41
RPE.....	42
Motivation Gain.....	42
Procedure.....	42
Treatment of Data.....	44

CHAPTER 4 RESULTS

Descriptives	48
Bivariate Correlations.....	53
Hypothesis Testing	53
Research Questions	74

CHAPTER 5 DISCUSSION

Performance Results	114
Moderating Effects of Efficacy Beliefs	116
Strengths and Limitations.....	123
Implications	125
Future Directions	126
Conclusion.....	127

APPENDICES	129
Appendix A Demographic Questionnaire.....	130
Appendix B Self-Efficacy Scale, Individual, Female 50 Freestyle	131
Appendix C Self-Efficacy Scale, Individual, Male 50 Freestyle.....	132
Appendix D Self-Efficacy Scale, Individual, Female 100 Freestyle	133
Appendix E Self-Efficacy Scale, Individual, Male 100 Freestyle	134
Appendix F Self-Efficacy Scale, Individual, Female 200 Freestyle.....	135
Appendix G Self-Efficacy Scale, Individual, Male 200 Freestyle.....	136
Appendix H Self-Efficacy Scale, Relay, Female 50 Freestyle	137
Appendix I Self-Efficacy Scale, Relay, Male 50 Freestyle	138
Appendix J Self-Efficacy Scale, Relay, Female 100 Freestyle	139
Appendix K Self-Efficacy Scale, Relay, Male 100 Freestyle.....	140
Appendix L Self-Efficacy Scale, Relay, Female 200 Freestyle.....	141
Appendix M Self-Efficacy Scale, Relay, Male 200 Freestyle	142
Appendix N Other Efficacy Scale, Female 200 Freestyle Relay	143
Appendix O Other Efficacy Scale, Male 200 Freestyle Relay	144
Appendix P Other Efficacy Scale, Female 400 Freestyle Relay	145
Appendix Q Other Efficacy Scale, Male 400 Freestyle Relay	146
Appendix R Other Efficacy Scale, Female 800 Freestyle Relay.	147
Appendix S Other Efficacy Scale, Male 800 Freestyle Relay.	148
Appendix T Relation-Inferred Self-Efficacy Scale, Female 200 Freestyle Relay.....	149
Appendix U Relation-Inferred Self-Efficacy Scale, Female 400 Freestyle Relay.....	150
Appendix V Relation-Inferred Self-Efficacy Scale, Female 800 Freestyle Relay.....	151
Appendix W Relation-Inferred Self-Efficacy Scale, Male 200 Freestyle Relay	152
Appendix X Relation-Inferred Self-Efficacy Scale, Male 400 Freestyle Relay	153
Appendix Y Relation-Inferred Self-Efficacy Scale, Male 800 Freestyle Relay	154
Appendix Z Pre Relay Questionnaire	155
Appendix AA Post Relay Questionnaire	156
Appendix AB Confidentiality Assurance.	157

REFERENCES	158
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LIST OF TABLES

Table 1 Pilot Study Swimmer Demographics.....	49
Table 2 Estimated marginal performance means and confidence intervals between ranks across conditions	50
Table 3 Dissertation Study Swimmer Demographics	51
Table 4 Dissertation Study Relay Variables	52
Table 5 Correlations between self-efficacy, other efficacy, RISE beliefs and individual and relay performances for the 200 yard freestyle relay.....	54
Table 6 Correlations between self-efficacy, other efficacy, RISE beliefs and individual and relay performances for the 400 yard freestyle relay.....	55
Table 7 Correlations between self-efficacy, other efficacy, RISE beliefs and individual and relay performances for the 800 yard freestyle relay.....	56
Table 8 Model 1 for performance time	61
Table 9 Model 1 Estimated mean times and percent changes between relay and individual performance	62
Table 10 Model 2 for performance time, including the moderating effects of self-efficacy.....	67
Table 11 Model 2 Estimated mean times and percent changes between relay and individual performance	68
Table 12 Model 2 for performance time, including the moderating effects of other efficacy.	75
Table 13 Model 3 Estimated mean times and performance changes between relay and individual performance	76
Table 14 Deviance comparisons between hypotheses models	80
Table 15 ICCs of random effects pertaining to hypotheses models	80
Table 16 Model 4 for performance time	83
Table 17 Model 4 Estimated mean times and percent changes between relay and	

individual performance	84
Table 18 Model 5 for performance time, including the moderating effects of self-efficacy and gender.	90
Table 19 Model 5 Estimated mean times and percent changes between relay and individual performance for females	92
Table 20 Model 5 Estimated mean times and percent changes between relay and individual performance for males	94
Table 21 Model 6 for performance time, including the moderating effects of other efficacy and gender.	99
Table 22 Model 6 Estimated mean times and performance changes between relay and individual performance for females	101
Table 23 Model 6 Estimated mean times and performance changes between relay and individual performance for males	102
Table 24 Model 7 for performance time, including the moderating effects of RISE beliefs.	108
Table 25 Model 6 Estimated mean times and performance changes between relay and individual performance	109

LIST OF FIGURES

Figure 1. Individual and relay performance by rank in the 200 distance	63
Figure 2. Individual and relay performance by rank in the 400 distance	63
Figure 3. Individual and relay performance by rank in the 800 distance	64
Figure 4. Individual and relay performance by rank with low and high self-efficacy beliefs at the 200 distance	69
Figure 5. Individual and relay performance by rank with low and high self-efficacy beliefs at the 400 distance	70
Figure 6. Individual and relay performance by rank with low and high self-efficacy beliefs at the 800 distance	71
Figure 7. Individual and relay performance by rank with low and high other efficacy beliefs at the 200 distance	77
Figure 8. Individual and relay performance by rank with low and high other efficacy beliefs at the 400 distance	78
Figure 9. Individual and relay performance by rank with low and high other efficacy beliefs at the 800 distance	79
Figure 10. Individual and relay performance by position in the 200 distance.....	85
Figure 11. Individual and relay performance by position in the 400 distance.....	85
Figure 12. Individual and relay performance by position in the 800 distance.....	86
Figure 13. Individual and relay performance by rank and gender with low and high self-efficacy beliefs at the 200 distance	94
Figure 14. Individual and relay performance by rank and gender with low and high self-efficacy beliefs at the 400 distance	95
Figure 15. Individual and relay performance by rank and gender with low and high self-efficacy beliefs at the 800 distance	96

Figure 16. Individual and relay performance by rank and gender with low and high other efficacy beliefs at the 200 distance	103
Figure 17. Individual and relay performance by rank and gender with low and high other efficacy beliefs at the 400 distance	104
Figure 18. Individual and relay performance by rank and gender with low and high other efficacy beliefs at the 800 distance	105
Figure 19. Individual and relay performance by rank with low and high RISE beliefs at the 200 distance.....	110
Figure 20. Individual and relay performance by rank with low and high RISE beliefs at the 400 distance.....	111
Figure 21. Individual and relay performance by rank with low and high RISE beliefs at the 800 distance.....	112

CHAPTER 1

Introduction

In certain sports, competition can be categorized as both team and individually based. At the individual level, one is focused solely on his or her performance. At the team level, individuals have to focus on both their own performance as well as the performance of others. Swimming is a great example of a sport in which this dual categorization can be found. The majority of events swum are individual, however there are also team relays where the competition is interdependent. In these situations motivation intensities may vary between individual and group performance. Further, it is practical to assume that swimmers themselves should hold beliefs about their own capabilities to perform, as well as the capabilities of their teammates in a relay task. Such beliefs can also influence the performance motivation of an athlete in sports such as swimming where there are individual and team demands.

Motivation has been a widely studied phenomenon, especially motivation in groups. Much of the literature has focused on motivation losses, or social loafing. Social loafing is the tendency for individuals to perform worse in a group situation compared to an individual situation (Karau & Williams, 1993). A few reasons as to why social loafing occurs may be that group members either feel less personally identifiable therefore giving less effort to the group task, or they may be able to “free-ride” on others’ efforts and therefore reduce their efforts accordingly (Baron & Kerr, 2003).

One social loafing study specifically in regards to swimming relays, has demonstrated that these social loafing effects can be eliminated if groups are threatened with punishment if a certain performance time is not met (Miles & Greenberg, 1993). Further in this study, follow-up questions indicated that individuals worked harder in groups compared to working alone. They

also expressed more concern for letting down their team members in a group setting. The results of this study indicate that individuals put forth more effort while in the group task and it may be relevant to study performance gains in groups rather than performance losses.

Recent research has focused on motivation gains in which performance increases within a group setting compared to individual performance (e.g., Weber & Hertel, 2007). Sports teams may be a good place to study motivation gains specifically because athletes in a competitive setting are thought to be highly motivated already as the task is important to them. Further, in terms of practical significance, coaches are interested in understanding how to maximize individual motivation within teams.

Two cognitive-based theories of motivation gain in groups are social compensation and the Köhler effect. Social compensation occurs when individuals increase their performance in order to compensate for other anticipated weaker performances of group members (Karau & Williams, 1997). This motivation gain is usually demonstrated by the strongest member of the group who would be able to compensate or make up for weaker group members, thus performing better in the group setting. The Köhler effect occurs when a less capable individual performs better in a group setting compared to performing a task individually either through social comparison or increased feelings of indispensability (Baron & Kerr, 2003).

While both social compensation and the Köhler effect have been demonstrated in the literature, this dissertation focused on the performance differences of the weakest member of the group and therefore the theoretical focus was on the Köhler effect. The Köhler effect was originally studied by Otto Köhler in the 1920s who studied rowing teams. He found that those who worked in a dyad condition at an arm curling task persisted longer than they did when they performed the same task individually (Kerr et al., 2007).

The Köhler effect has been studied in a variety of both physical and cognitive tasks (Gockel, Kerr, Soek, & Harris, 2008; Hertel, Deter, & Konradt, 2003; Hertel, Kerr, & Messé, 2000; Hertel, Niemeyer, & Clauss, 2008; Kerr, Messé, Park, & Sambolec, 2005). The Köhler effect has also been shown to be task dependent. According to Steiner's (1972) task taxonomy, conjunctive tasks, or ones where the result of the group is dependent on the performance of the weakest group member, are seen to provide the greatest motivation gains for those weakest group members (Weber & Hertel, 2007). Other task demands, like an additive or coactive task demand have also shown motivation gains, although less so than conjunctive task demands.

Two different processes have been proposed for the Köhler effect: indispensability and social comparison (Hertel et al., 2008). The first is when individuals feel indispensable to the group and therefore perform better than their individual performance. This process should occur especially in conjunctive task demands when the group is especially dependent on the weakest individual (Hertel et al., 2008). Social comparison occurs when individuals compare themselves with a superior member of the team and revise their performance goal upward to try to match the performance of the superior member's (Kerr et al., 2007).

These processes of indispensability and social comparison are thought to occur simultaneously in group tasks. However, there are a few moderators of the Köhler effect on which this dissertation focused: gender and self-efficacy. In terms of gender, women demonstrate greater performances in group situations compared to their individual performance under conjunctive demands. Women also display better performances in group situations under coactive and additive demands but to a lesser degree, respectively (Kerr et al., 2007; Weber & Hertel, 2007). Men have been shown to exhibit motivation gains when information is provided about a superior coworker regardless of whether they are in a group task or performing

individually. These gender-based findings indicate that social comparison may be more salient for men; whereas, indispensability may be more salient for women (Weber & Hertel, 2007).

One other moderator of the Köhler effect is self-efficacy. Seok (2004) found that under conjunctive task demands, individuals performed better at a group task compared to their individual performance. In this study, self-efficacy was manipulated through false feedback. When participants were separated into high and low self-efficacy categories, individuals with low self-efficacy had greater motivation gains than individuals with high self-efficacy. Seok reasoned that the high self-efficacy individuals may have been overconfident in their abilities for the subsequent trial. Further, these high self-efficacy participants may have felt like they did not have to prove themselves to either the researcher or their partner, so they may have decreased their effort.

While Seok (2004) looked directly at the relationship between the Köhler motivation gain effect and self-efficacy, efficacy research in sport has looked directly at the relationship between efficacy and performance. One meta-analysis has demonstrated that there is a moderate and positive correlation between self-efficacy and performance (Moritz, Feltz, Fahrback, & Mack, 2000). This relationship is strengthened when measurements between performance and efficacy beliefs are both concordant as well as assessed close together. Further, this relationship is seen to be reciprocal in that self-efficacy increases performance while performance also enhances subsequent self-efficacy (Feltz, 1982; McAuley, 1985).

One extension of self-efficacy theory was proposed by Lent and Lopez (2002) in their tripartite model of efficacy beliefs. In this model, there are three types of efficacy beliefs: self-efficacy (e.g., an individual's own belief in his/her abilities to swim a given distance in under a certain time), other efficacy (e.g., an individual's belief in his/her other relay members to swim a

given distance in under a certain time), and relation-inferred self-efficacy (RISE) (e.g., an individual's perception of other relay member's beliefs in his/her own abilities to swim a given distance in under a certain time). Lent and Lopez stated that self-efficacy theory ignores interpersonal relations and argued that these relations can have an impact on self-efficacy beliefs. This model was primarily built for groups in which members are in a close relationship, meaning they have an impact on other group members, as well as being interdependent. Sports groups, and especially relay teams, do have both these relational aspects, and the tripartite model of efficacy is likely to be important in relay situations and may impact subsequent self-efficacy and other-efficacy of relay members.

Feltz, Short & Sullivan (2008) define ability-focused other-efficacy beliefs as an individual's beliefs about their teammate's abilities. However, these beliefs can also be reciprocal in that the second teammate can also have other efficacy beliefs about the first teammate as well as additional teammates. That is, in teams greater than two, each teammate would have beliefs about each of his or her other teammates. An athlete's other-efficacy beliefs could, then, be aggregated from his/her separate beliefs of each teammate. Sources of these beliefs can come from a variety of outside factors and can include perceptions of the teammate's accomplishments in past situations, experiences with the athlete, or information conveyed by third party observers (e.g., coach's beliefs about the teammate). In turn other-efficacy beliefs can also influence behavior including the type and amount of effort employed in a joint task or persistence intentions.

Similarly RISE beliefs, as stated previously, are defined as an individual's beliefs regarding how significant others view the individual's efficacy at a particular task. While these beliefs are generally a measure of individuals' reflection on how their partners view them, they

may actually be very important in situations in which individuals have limited sources for self-efficacy beliefs. RISE beliefs may further help to predict other group outcomes like persistence on a task or relationship satisfaction (Lent & Lopez, 2002).

There have been a few studies that have validated Lent and Lopez's (2002) original suggestions. One study by Jackson, Knapp, and Beauchamp (2008) investigated the sources of other-efficacy beliefs. Jackson et al. found that the sources of other-efficacy included one's partner's past performances individually, past performance as a dyad, comparisons with past partners and other athletes in general, and the partner's motivation (e.g., desire to succeed, achieve goals, willingness to work hard, etc.). Sources for RISE included one's own self-efficacy and mastery experiences, past mastery experiences as a dyad as well as dyad experience, motivation, one's partner's verbal and nonverbal behavior, and physiological factors.

Jackson, Grove, and Beauchamp (2010) studied the relational efficacy beliefs in a coach-athlete dyad. Here they found that high other-efficacy beliefs predicted enhanced commitment for both dyad members which supports Lent and Lopez's (2002) original theory. However RISE beliefs were seen to exert different effects for coaches and athletes. When coaches believed that their athletes were confident in their coaching abilities, commitment from both the coach and athlete increased. However when athletes thought their coach was confident in their abilities, this led to lowered commitment from both coaches and athletes. While this finding goes against the proposed theory, the authors speculated that athletes might become complacent in their relationship, which would result in less commitment and social loafing.

To date, there have not been any studies that have looked at RISE beliefs in relation to performance measures. However, there have been a handful of recent research studies concerning performance and other efficacy. The first study conducted by Beauchamp and

Whinton (2005) studied self-efficacy between rider and horse in equestrian dyads. Riders assessed their own self-efficacy as well as their other (i.e., horse's) efficacy prior to each phase of competition. Results indicated that other efficacy was related to performance and accounted for 4% of the variance in performance scores beyond just self-efficacy alone. One of the limitations of this study was the use of rider-horse dyads where only the human member has cognitive beliefs, however the findings suggest that other-efficacy beliefs make a significant contribution to performance and should be investigated further in other partnerships.

One such study used female high-school aged volleyball teams and studied how other efficacy, collective efficacy, trust, and performance were related over the course of a season (Dithurbide, 2011). In this study, there were surprisingly no significant results between other efficacy and performance. One of the main factors as to why this result occurred may have been due to the team nature of the other efficacy measure. While other efficacy has been demonstrated to work well in dyad partnerships where it is easy to establish a "me versus partner" approach where one's partner's contribution is different than oneself, this may not be the case in a highly interdependent team sport like volleyball. In this type of sport, it may be difficult to separate how an individual contributes directly to the team. In groups larger than dyads, other efficacy may be better distinguishable if there is a separate and distinct contribution to the performance. This way, an individual can use past performance as a basis for the other-efficacy beliefs.

One other study (Dunlop et al., 2011) also looked at the relationship between self-efficacy, other efficacy, and performance. They used dyads performing in a dance-based videogame. Other efficacy was shown to be a significantly related to performance regardless of self-efficacy levels. So those individuals who believed they had a high-ability partner outperformed those who believed they had a low-ability partner. The authors postulated that

other-efficacy beliefs may be a stronger predictor of performance than self-efficacy beliefs in dyad performance situations.

Dunlop et al. (2011) believed that those individuals in the high other efficacy condition may have thought they were more capable of a good performance given their partner's high ability and therefore increased effort on subsequent trials. The low other efficacy individuals may have felt like they did not have a chance due to their partner's lack of ability and therefore decreased effort. These findings may help to explain motivation in groups larger than dyads; specifically groups where performance can be broken up into significant contributions, thus making it easier for group members to identify each separate member's contribution.

Swimming relays may be an ideal place to study motivation in group contexts and how both self-efficacy and other efficacy modify this performance relationship. Relays are technically an additive task according to Steiner's (1972) taxonomy of group tasks. However, they function as a quasi-conjunctive task due to their characteristics (Kerr et al., 2005). Relays are divisible, meaning that each member of the relay must adequately complete his or her leg of the relay for the team to have a successful performance. Additionally, relays are sequential, meaning that each member of the relay must complete his or her leg of the relay before the next leg can be started. These characteristics allow for this group to function as a quasi-conjunctive group in that any failure to perform by any group member results in a poor performance for the relay team.

Previous research on motivation in swimming relays has demonstrated that the weakest members of the relay perform significantly faster in the relay condition compared to the individual condition (Osborn, Irwin, Skogsberg, & Feltz, 2012). Motivation gains were greater as the task became more important (i.e., in a scoring relay as opposed to a preliminary race). Another similar study looked at indispensability in swimming relays and found similar findings

(Huffmeier & Hertel, 2011). Those individuals in the later positions of the relay had greater motivation gains than the individuals in the beginning positions of the relay compared to their individual times. The authors suggested that indispensability increased as a result of the position of the relay.

Huffmeier and Hertel's results were supported by an additional study using archival data by Huffmeier, Krumm, Kanthak, and Hertel (2012). Here, they used archival data to verify that one's serial position in a relay does increase a member's indispensability. This increase in indispensability was compared to other explanations of motivation gain based on the differences between an individual start and a relay start. Swimmers were faster in the relay condition compared to the individual condition when the swimmer's performance was instrumental for the team (i.e., later serial position in the relay) and when the group's performance was important (i.e., the relay had a higher chance of winning a medal).

While these previous studies provide support for motivation gains within relays, one limitation is that there is no subjective information concerning performance. By using real time relays, subjective measures like an individuals' perceived exertion, feelings of indispensability or whether individuals socially compare themselves to teammates can be assessed. One way to measure this is through ratings of perceived exertion (RPE) using the Borg scale (Borg, 1970). The Borg scale is a widely used tool to assess subjective perceptions of effort during physical activity. The Borg scale has been validated against a variety of objective measures (Skatard-Mickelson, Benson, Hannon, & Askew, 2011) and has been used in physical activities ranging from strength training (Buckley & Borg, 2011) to cardiovascular exercise tests (Scherr, Wolfarth, Christle, Pressler, Wagenpfeil, & Halle, 2013). RPE should correlate positively with

performance and this can help to validate whether individuals are accurate in their assessments of performance.

While these studies demonstrate motivation gains in swimming relays, they were all conducted with archival data. In order to get a better understanding of the cognitive processes underlying motivation gains, it is necessary to use real relay teams in a competitive environment.

Purpose of the Study

The purpose of this study was to test the Köhler motivation gain effect in swimming relays. The pilot study aimed to determine if the Köhler motivation gain effect could be replicated in real-time relays based on findings from the analysis of archival data. The dissertation study strived to replicate the previous Köhler effect research with real relay teams and investigate the potential moderating effects of self- and other efficacy on performance. This dissertation aimed to demonstrate the importance of other efficacy in groups beyond a dyadic partnership and the importance both self- and other efficacy may have in regards to motivation. Further this study aimed to understand the processes of the Köhler effect in groups larger than dyads.

Contextual Factors

The context chosen for this dissertation was sport and specifically swimming relays. Swimming relays have been used to show motivation gains in the weakest member of the group in past research. A competitive setting was chosen for the second study as it is likely that swimmers would already be highly motivated. Further, these relays allowed for the measurement of performance times so that individuals could directly see the contribution that both the individual and other team members made to the relay. Relays also comprise four members which

may help individuals have more accurate other-efficacy beliefs concerning their relay meets due to knowing how exactly an individual contributes to the group's overall performance.

Hypotheses

- 1) Self-efficacy and other efficacy will be negatively related to performance times.
- 2) Swimmers will swim faster times in the relay condition compared to their individual times.
- 3) The weakest relay member will demonstrate a motivation gain in the relay compared to their individual condition.
- 4) The strongest relay member will demonstrate a motivation loss in the relay compared to their individual condition.
- 5) Self-efficacy will moderate the motivation gain relationship so that those with low self-efficacy will show a motivation gain in the relay condition compared to their individual condition. Further, high self-efficacy beliefs will result in increased performance times from the individual to relay condition, resulting in a motivation loss.
- 6) Other efficacy will moderate the motivation gain relationship, in that those with higher other efficacy will demonstrate a motivation gain from individual to the relay condition.

Research Questions

- 1) Will there be a performance-change difference from individual to relay performance depending on the serial position of the relay?
- 2) Are there differences with respect to gender and the moderating effects of self- and other efficacy on the Köhler motivation gain effect?

- 3) Will a social compensation effect emerge as a result of low other-efficacy?
- 4) Will there be a relationship between RISE beliefs and performance?
- 5) Do relay members indicate that they socially compare themselves to the others in their team?
- 6) Do relay members believe their performance will make a substantial contribution to the relay as a whole? Does this differ according to whether the assessment is before or after the relay?
- 7) How much effort do relay members perceive they gave in their performance?

Delimitations

The study was delimited to collegiate level swimmers in swimming relays. The results of the study may not be applicable to other types of groups in which the task demands are different than a relay task. Further, it may not be applicable to other sports teams that are more interdependent and do not have a way to measure an individual's contribution to a group performance directly.

Definitions

Motivation Gain: a decrease in swimming split time from the individual condition to the relay condition.

Motivation Loss: an increase in swimming split time from the individual condition to the relay condition.

Other Efficacy: an individual's belief in another's capabilities to organize and execute the courses of action necessary to produce certain levels of attainment. In this study, other-efficacy beliefs are an individual's beliefs in his/her other relay members' abilities to swim a given distance in under a certain time.

Relation-Inferred Self-Efficacy (RISE): an individual's beliefs regarding how significant others view the individual's efficacy at a particular task. In this study, an individual's perceptions of their other relay member's beliefs in their own abilities to swim a given distance in under a certain time.

Self-Efficacy: an individual's beliefs in his or her capabilities to organize and execute the courses of action necessary to produce certain levels of attainment. In this study, self-efficacy beliefs are an individual's beliefs in his/her abilities to swim a given distance in under a certain split time.

Social Compensation: a decrease in swimming split time from the individual condition to the relay condition as performed by the strongest member of the group.

CHAPTER 2

REVIEW OF LITERATURE

The purpose of this chapter is to provide a review of literature that is relevant to the variables and procedures in this study. The chapter begins with a review of group motivation research and theory. Next, a review of the research and empirical literature of the Köhler motivation gain effect is provided. This is followed by a review of two potential moderating variables of the Köhler motivation gain effect: self-efficacy and other-efficacy.

Group Motivation Research

There are many different theories of group motivation; however in the majority of these theories, motivation is based on a cognitive antecedent. An individual's thoughts determine an individual's motivational intensity and direction (Roberts, 1992). Due to the cognitive nature of motivation, it is difficult to measure motivation directly. However the literature commonly infers that performance is an accurate measure of motivation. These performance differences are inferred from effort, which is then inferred to be a result of motivation.

Motivation in groups has been widely studied in the social psychology literature for the past 30 years. This research has primarily focused on motivation losses. Social loafing is the tendency for individuals to perform worse in a group situation compared to an individual situation, and thus is a motivation loss for the group (Everett, Smith, & Williams, 1992; Karau & Williams, 1993; Williams & Karau, 1991; Williams, Nida, Baca, & Latané, 1989). Baron and Kerr (2003) provide possible causes for this decrease in performance in a group environment. Group members (a) may feel less personally identifiable in a group situation and therefore less subject to evaluation; (b) may recognize that in some instances they may be able to free-ride on other group members' efforts; or (c) may reduce their efforts rather than contribute to what they perceive to be more than their fair share of the collective effort.

Social-loafing research has been conducted specifically on ad-hoc relays in sport but has found contradictory results (Everett et al., 1992; Williams et al., 1989). Williams et al. (1989) found a social loafing effect in swimming when team members were unidentifiable and therefore not held accountable for their performance. In this study, performance increased in the relay condition compared to the individual condition when swimmers were identifiable. Everett et al. (1992) replicated this study and also studied team cohesion. While they did not find a social loafing effect, individuals' performance may not have been affected by varying levels of identifiability because team cohesion was high. Social loafing may occur when a group comprises individuals of different abilities. More capable individuals might revise their performance goals lower to match those of their teammates, resulting in less effort.

Another social loafing study conducted by Miles and Greenberg (1993), using swimming relays, demonstrated that these social loafing effects can be eliminated if groups are threatened with punishment. Swimmers were required to swim under a certain performance time that was determined to be challenging yet achievable. Half of the participants swam as individuals and the other half swam the task as a group. The threat of punishment was used in the event that swimmers did not swim under the given performance time. The results demonstrated that the threat of punishment did indeed attenuate a social loafing effect. Further, follow-up questions indicated that individuals perceived that they worked harder in groups compared to working individually. They also expressed more concern for letting down their team members in a group setting. The results of this study indicate that individuals put forth more effort while in the group task, and it may be relevant to study performance gains in groups rather than losses. However, in terms of practical implications, threats of punishment may not be a useful way to improve relay performance on a consistent basis.

In terms of motivation gains in groups, two cognitive-based theories of motivation are social compensation and the Köhler effect. Social compensation occurs when individuals increase their performance in order to compensate for other anticipated weaker performances of group members (Karau & Williams, 1997). The Köhler effect occurs when less capable individuals perform better with others compared to performing the task individually (Baron & Kerr, 2003).

Social compensation research has generally shown that this motivation gain is usually demonstrated by the strongest members of the group who would be able to compensate or make up for weaker group members. In one study, dyad student groups were asked to complete an idea generating task. Those individuals who had been partnered with a low-ability partner worked harder to come up with ideas especially when the students were working towards a collective goal rather than working coactively (Karau & Williams, 1997).

While the social compensation effect has been shown in a variety of studies (Karau & Williams, 1997; Todd, Seok, Kerr, & Messé, 2006; Williams & Karau, 1991), task importance and feedback are important components that must be present in order for this effect to occur, but individual contributions should not be identifiable (Williams & Karau, 1991). In one study by Williams and Karau, students were asked to complete an idea-generating task. Students who were given false feedback that the task was not important, underperformed compared to the students who were given information that the task was highly important. This study demonstrated that a task must be highly valued in order for social compensation to occur. Further, the authors postulated that in groups where individualized feedback is not provided, group members may turn to the overall success of the group to determine their individualized success. In this case, social compensation may occur as high-ability members may increase their

effort in order to make up for a weaker member in order to gain a positive group evaluation.

Thus, although swimming relays in competitive meets are likely to meet the criteria of task importance and feedback for social compensation effects to occur, individual performance times are identifiable and may attenuate a social compensation effect.

The Köhler Motivation Gain Effect

In this dissertation, I focused on the Köhler effect because it allows for a focus on the weakest member of the group, which is of primary interest. The Köhler effect occurs when less capable individuals perform better in a group context compared to performing the task individually (Baron & Kerr, 2003). The effect was first discovered by Otto Köhler in the 1920s. He studied rowing teams and had members perform an arm curling task until exhaustion. Rowers performed the task both individually and in a dyad condition (rowers used a weighted bar to curl and were therefore dependent on one another). Köhler found that individuals who were in the dyad condition persisted longer at the task compared to performing the task individually (Kerr et al., 2007).

The Köhler effect has been studied in a variety of physical tasks. Some of these physical tasks have been similar to the original Köhler studies where participants were asked to perform a motor persistence task. Participants held a metal bar at arm's length for as long as possible. In the group condition, partners held the bar over a trip wire, so when one partner stopped, the other partner had to stop as well (Gockel et al., 2008; Hertel et al., 2000; Kerr et al., 2005). Other physical tasks have also been used including an air-blowing task (Kerr & Bruun, 1983) as well as an abdominal plank exercise (Feltz, Irwin, & Kerr, 2011). Most physical tasks that have been used in these studies minimize coordination between partners so coordination losses do not interfere with the resulting motivation gain effects (Hertel et al., 2000).

The Köhler effect has not been limited to physical tasks but has also been studied in cognitive computer-mediated tasks where face to face contact is eliminated. Researchers had used varying tasks like an idea-generating task (Hertel et al., 2003) or a simulated retail game (Hertel et al., 2008). These computer-mediated tasks have demonstrated the Köhler motivation gain effect particularly when indispensability of group members is increased. Despite the fact that computer-mediated work has demonstrated these motivation gains, Hertel et al. (2008) showed that face to face groups still show larger motivation gains when compared to the motivation gains of computer-mediated tasks. In this dissertation, the focus is on a face to face group participating in a physical task.

Köhler motivation gain effects have been seen to be task dependent. Steiner's (1972) task taxonomy for groups has provided three task demands that have been studied in the Köhler effect literature: additive, co-active, and conjunctive. An additive task is one in which the group result is the sum of the individual member parts. A co-active task demand is one where individuals perform a task at the same time however their outcomes are independent of one another. A conjunctive task demand is one where the performance of the group is dependent on the weakest group member. All three of these task conditions have been used to demonstrate motivation gains; however, conjunctive task demands result in the largest motivation gain for the weakest group member (Weber & Hertel, 2007).

Additionally there are two processes by which the Köhler effect is thought to occur: indispensability and social comparison. The first suggests that it is a group member's feelings of indispensability to the group that elicits a motivation gain. In this process, motivation gains should be the greatest in conjunctive tasks where the group as a whole can only do as well as their weakest member (Hertel et al., 2008; Kerr et al., 2007). Inferior members in this case

should demonstrate the greatest motivation gain because the success of the group is dependent on their performance. In social comparison, group members either make social comparisons to stronger individuals in the group, revising their performance goals upwards, or they can make a successful performance their goal (Kerr et al., 2007). It is likely that both indispensability and social comparison occur simultaneously in group tasks; however, the strongest motivation effects have been demonstrated in conjunctive tasks (Kerr et al., 2007; Weber & Hertel, 2007).

There are some boundary conditions concerning the Köhler motivation gain effect including gender, feedback, and discrepancy in ability between partners, however in this dissertation the focus was solely on gender, discrepancy in ability, and self-efficacy as moderators of the Köhler effect. Gender has been found to moderate motivation gains. Women have shown motivation gains in all three task conditions. Conjunctive task demands have yielded the greatest motivation gains, with coactive and then additive being increasingly lower. (Kerr et al., 2007; Weber & Hertel, 2007). One reason why women might show greater motivation gains in conjunctive tasks is due to the finding that women are more focused on the relational aspects of groups compared to men. This may cause women's feelings of indispensability to be additionally heightened. Men have been shown to exhibit motivation gains when information is provided about a superior coworker regardless of whether they are in a group task or performing individually. These gender findings indicate that social comparison may be more salient for men; whereas, indispensability may be more salient for women (Weber & Hertel, 2007).

Another important consideration is the discrepancy in ability between group members. The greatest increases in motivation occur when the weaker group member's performance is roughly 1.4 times lower than other group members' (Messé, Hertel, Kerr, Lount, & Park, 2002). If the discrepancy between the weakest and most capable members is too large, motivation losses

(or free-riding) have been found to occur (Hertel et al., 2008). In addition, Feltz et al. (2011) have found that motivation attenuates as a result of too high or too low of a discrepancy between partners. Weaker partners may assume that to keep up with, or even beat a stronger partner, may be unachievable. Additionally, those weaker partners may feel as if their performance will not significantly contribute to the group's performance. However, outside of laboratory conditions, such as in swimming relay performance, discrepancies may be considerably less than 40% and still be viewed as comparably relevant. In a 200 yard freestyle relay for example, the range of times within a relay might be 1-3 seconds, which in a 20-something second race, might equate to a discrepancy of 10-12%.

One additional moderator of the Köhler motivation gain effect is self-efficacy. Seok (2004) replicated the Köhler effect physical task paradigm by having female dyadic participants hold a bar over a trip wire. He additionally gave participants false self-efficacy feedback by showing participants their likelihood of doing well on the next task as based upon their performance from the first trial. All individuals in the study demonstrated a motivation gain in a conjunctive task condition where the participant was the weakest group member. However, this was moderated by self-efficacy in that those individuals in the low self-efficacy conditions demonstrated the highest motivation gains particularly when partnered with a moderately more capable partner.

Seok (2004) provided some rationales for these findings. The first was that the high self-efficacy individuals may have been overconfident after their original performance so they may not have increased their effort on subsequent performances. Another reason may have been that the high self-efficacy individuals may not have had to prove themselves to their partners or the experimenter, whereas the low self-efficacy individuals may have viewed subsequent

performances as a second chance, therefore initiating a self-presentation effect for those weaker members. This rationale was supported statistically in that the low self-efficacy individuals perceived it to be significantly more important to perform well in the last trial compared to the first two trials. Additionally the participants were all female and according to other Köhler effect literature (Weber & Hertel, 2007), indispensability may be more salient for women in these types of tasks.

While the Köhler effect has been studied in many physical tasks, it has only recently been studied in sports teams. Huffmeier & Hertel (2011) looked at the indispensability of group members in swimming relays. They used Olympic archival data of these relays to compare individual times that were swum at the Olympic meet to those times swum in the relay condition. They hypothesized that swimmers would swim faster in the relay condition compared to their individual swims due to more intergroup competition compared to inter-individual competition in the individual condition. Their analysis confirmed this hypothesis and swimmers did swim faster in the relay condition compared to the individual condition. Further, they serial ordered the relay (first, second, third, and fourth) and examined how motivation changed as a result of one's position on the relay. They found that those individuals who swam in the latter positions of the relay, specifically those who swam last, had greater motivation gains than swimmers in the earlier legs of the relay. The authors credited these findings to a greater sense of indispensability in latter relay positions.

Huffmeier and Hertel's results were supported by an additional study using archival data by Huffmeier, Krumm, Kanthak, and Hertel (2012). Here, they used archival data to verify that one's serial position in a relay does increase a member's indispensability. This increase in indispensability was compared to other explanations of motivation gains based on the differences

between an individual start and a relay start. Swimmers were faster in the relay condition compared to the individual condition when the swimmer's performance was instrumental for the team (i.e., later serial position in the relay) and when the group's performance was important (i.e. the relay had a higher chance of winning a medal).

Osborn, et al. (2012) also looked at archival data of National Collegiate Athletic Association (NCAA) swimming relays. In this study, they compared an individual's fastest individual race time during the season to their relay split time at the NCAA championship meet. The authors found similar results to Hüffmeier & Hertel (2011) that individuals swam faster in the relay conditions than they did in the individual conditions. Further, the findings in Osborn et al. (2012) indicated that these motivation gains increased as the task became more important, for example in a scoring relay situation compared to a preliminary race.

In Osborn et al. (2012), gender also modified this task importance relationship with females showing motivation gains when the task was less important (i.e. the preliminary race) compared to men who only demonstrated this motivation gain during the scoring relay race. These gender findings support previous Köhler effect research (Weber & Hertel, 2007), which indicates that indispensability may be more salient for women where women show motivation gains in less important task settings. While men may be more sensitive to social comparison and may only demonstrate motivation gains when the task is very important and they can positively compare themselves to stronger others.

One other important finding from the Osborn et al. (2012) study was that they rank ordered the individuals in the relay according to ability. Those who were ranked first on the relay were the fastest in the individual event. Similarly, those who were ranked fourth, were the slowest individuals in the relay with the second and third ranked individuals in the middle with

respective speeds. The researchers found that Köhler motivation gains were greatest in the fourth ranked member. This member swam significantly faster in the relay condition compared to the individual condition. Further there was a non-significant social loafing trend in the first ranked member, where the first ranked member swam slightly slower in the relay condition compared to the individual condition.

Osborn et al. (2012) then compared the rank order effects (based on time) to those of Hüffmeier & Hertel's (2011) serial ranks, based on relay position (1st, 2nd, 3rd, and 4th). Osborn et al. (2012) found that similar to Hüffmeier & Hertel (2012), those individuals who swam in the later positions of the relay (3rd and 4th) had greater motivation gains than those individuals who swam first on the relay. However there were an equal percentage of individuals who were ranked according to their time 3rd and 4th who swam in the last position of the relay. These results indicated that rank ordering individuals based on time might provided stronger motivation gain effects compared to serial ordering individuals based on relay position.

Sports teams may be an ideal place to examine the Köhler effect given that motivation should be sufficiently high in a competitive setting. Similarly, sports teams have set groups that should be accustomed to both practicing and competing with one another and therefore should be familiar with other teammate's abilities. Sports settings also provide feedback as to how both individuals and the team are doing, so this feedback can be used to evaluate a group's performance.

Relays, in particular, are one type of additive task. However, Kerr et al. (2005) specified that relays have certain characteristics that allow them to function more like quasi-conjunctive tasks. Relays are divisible in that each member of the relay must adequately complete his or her

leg of the relay for the team to be successful overall. Similarly relays are sequential. Each member of the relay must adequately complete his or her leg of the relay before the next leg can be started. Hertel et al. (2003) found motivation gains in a divisible computer-mediated cognitive task in which additive task groups had slightly better performance than those groups performing under individual conditions. These studies suggest that additive tasks when performed divisibly may increase identifiability which may lead to greater motivation games. Additionally, when an additive task is performed sequentially (and one cannot start until the previous teammate finishes), this may add an extra layer of indispensability.

Self-Efficacy and Performance

Self-efficacy is defined as one's beliefs in his or her abilities to succeed in a certain situation or task (Bandura, 1997). In the sports field, self-efficacy has commonly been examined in accordance with performance and particularly performance over time (Feltz, 1982, 1988; Feltz, Landers, & Reader, 1979; Feltz & Mungo, 1983). There has been a variety of methodologies, measurements, sports and other motor tasks used in self-efficacy research. A meta-analysis (Moritz et al., 2000) has demonstrated that there is a moderate correlation between self-efficacy and performance. Generally this performance is strengthened when measurements between the self-efficacy belief and the performance measure are concordant and also when the measures are taken closer together. Self-efficacy and performance has also demonstrated a reciprocal relationship. Self-efficacy is seen to enhance performance, while successful performance is seen to increase one's self-efficacy beliefs (Feltz, 1982; McAuley, 1985).

There have been some studies that have found a negative relationship between self-efficacy and performance. Vancouver and colleagues (Vancouver, Thompson, Tischner, & Putka, 2002) argued that a better performance would increase self-efficacy, which would in turn

lead to overconfidence and a subsequent performance decrease. Low self-efficacy, in turn, would lead to more practice at the task and increased effort, which would help performances in the future. Vancouver and his colleagues did indeed find that self-efficacy was negatively related to performance in a within-person analysis over time but positively related to performance at the between-person level (Vancouver, Thompson, & Williams, 2001; Vancouver et al., 2002; Vancouver & Kendall, 2006). However, these original studies were conducted on ambiguous cognitive tasks, using either computer game outcomes or academic performance as the performance measure, and where participants had little incentive to act on their efficacy beliefs (Feltz et al., 2008).

In recent research in sport, there have been multiple studies that have examined self-efficacy's positive or negative relationship with performance. In one study, Beattie, Lief, Adamoulas, & Oliver (2011) used a golf putting task and found that overall there was a significant and positive correlation between self-efficacy and performance. But, self-efficacy had a slight negative, yet non-significant, effect on subsequent performance. Other research by Gilson, Chow, and Feltz (2012) found that using a squat-lifting task, self-efficacy was positively related to performance at both the between-person and within-person levels even while controlling for the participants' past performance. This study lends support for the positive relationship between self-efficacy and performance in sports tasks. Overall, the literature indicates that self-efficacy demonstrates a strong, positive relationship with sport performance.

Other Efficacy

Lent and Lopez (2002) proposed a tripartite model of efficacy beliefs, which includes self-efficacy, other efficacy, and relation-inferred self-efficacy (RISE). The rationale for this model was that self-efficacy theory commonly ignores interpersonal relations and the effects of

these relationships on self-efficacy. In this model, relationships are close because those individuals have a mutual impact on each other. Further, these relationships are high in interdependence. Sports teams are a good place to study these interpersonal relations because they are an interdependent group. Swimming is a sport where most of the competition takes place at an individual level. However, relays are an integral part of a swimming competition and are both interdependent and offer a starting point to study the interpersonal relations among teammates. In social cognitive theory, the social environment has a large impact on efficacy beliefs. Teammates and particularly relay members may hold beliefs about themselves or their other relay members, which in turn constitute the social environment and may therefore have an effect on efficacy beliefs.

Lent and Lopez (2002) define other-efficacy beliefs as an individual's beliefs about his/her partner's abilities to perform a specific behavior. However, this belief is also reciprocal in that the second partner will also have other-efficacy beliefs concerning the first partner as well. Sources of these beliefs can come from a variety of outside factors and include perceptions of the partner's accomplishments in past situations, experiences with the partner, or information conveyed by third party observers (e.g., coach's beliefs about the partner). In turn, other-efficacy beliefs can also influence behavior including the type and amount of effort employed in a joint task or persistence intentions.

Lent and Lopez (2002) also define RISE beliefs as an individual's beliefs regarding how significant others view the individual's efficacy at a particular task. This is a generally a measure of an individual's reflection on how their partner sees them. RISE beliefs may not be similar to the individual's own self-efficacy beliefs and may help determine other group outcomes like persistence and relationship satisfaction. RISE may function as a filter through which group

behavior is interpreted. Feedback, either positive or negative, may be interpreted differently depending on an individual's RISE beliefs. For example, a comment about how well the group can do may be interpreted as supportive if an individual's RISE beliefs are high. However the same comment may be interpreted as shallow and insincere if RISE beliefs are low. These interpretations of RISE may affect subsequent group behavior. Lent and Lopez postulate that RISE beliefs are most influential when individuals have other limited sources for self-efficacy beliefs.

Jackson, Beauchamp, and Knapp (2007) did not study efficacy and performance directly, but rather looked at the relationships between the three aspects of the tripartite model of efficacy. The authors used tennis doubles to study the relationships between the three types of efficacy beliefs and both satisfaction and commitment to their partnership. They also looked at actor and partner effects within this relationship. Actor effects are when the predictor and the outcome variable occur within an individual (e.g., self-efficacy influences an individual's own performance), while partner effects are when the predictor variable within one person influences the outcome variable in the partner (e.g. other-efficacy beliefs that individuals hold about their partners affect how their partners perform). The three forms of efficacy that one partner holds may influence both the motives and behaviors not only toward their partner but also the motives and behaviors of that partner.

Results of Jackson et al. (2007) showed that both self- and other efficacy were both significantly correlated with satisfaction and commitment. There were also significant actor effects for RISE and other efficacy in relation to self-efficacy. The more that individuals believed in their partners the greater were the self-efficacy beliefs for those individuals respectively. There were no partner effects found in relation to the different aspects of efficacy;

however, there was a partner effect between self-efficacy and commitment. These results indicate that as self-efficacy increases in an individual, his or her partner should feel increased commitment to the relationship. This study demonstrates that relational beliefs may have an impact on both the individual as well as other group members.

Jackson and colleagues (Jackson et al., 2008) furthered the literature concerning the tripartite model of efficacy beliefs by conducting qualitative surveys of elite international-level athlete dyads. Here they wanted to evaluate the antecedents and consequences of self-efficacy, other efficacy, and RISE as a way to further support Lent and Lopez's (2002) original model. Results indicated that there were four higher-order themes across the efficacy measures: oneself, one's partner, the dyad, and external factors. Perceptions regarding oneself were most frequently cited as sources for self-efficacy. These included past performance mastery achievements, sport experience, and pre-competition preparation. Verbal persuasion as well as other-efficacy and RISE beliefs also were found to be sources of self-efficacy. Sources of other efficacy included the partner's past performances individually, past performance as a dyad, comparisons with past partners and with other athletes in general, and the partner's motivation (e.g. desire to succeed, achieve goals, willingness to work hard, etc.). Sources for RISE included ones' own self-efficacy and mastery experiences, past mastery experiences as a dyad as well as dyad experience, motivation, ones' partner's verbal and nonverbal behavior, and physiological factors.

There was a distinction between intrapersonal and interpersonal concepts with respect to the consequences of each efficacy belief (Jackson et al., 2008). Self-efficacy consequences included improved individual performance, greater effort and motivation, greater ability to concentrate on the task as well as improved affect. Other efficacy outcomes included greater responsiveness to the partner, more open and positive verbal behavior towards the partner, and

increased satisfaction in the relationship. However some athletes thought that higher levels of other efficacy could lead to negative affective responses and the possible breakdowns of relationships. The consequences of RISE included enhanced self-efficacy beliefs, increased motivation in a relational context, greater relationship persistence intentions and overall higher relationship satisfaction. These results provide support for the existence of these relational efficacy sources and consequences and align with those originally proposed by Lent and Lopez's (2002) model.

One specific study that supports the tripartite model and these relationships between self, other-efficacy and RISE beliefs was done by Jackson et al. (2010). They studied relational efficacy beliefs in a coach-athlete dyad. Here they found that high other-efficacy beliefs predicted enhanced commitment for both dyad members, which supports Lent and Lopez's (2002) original theory. RISE beliefs were seen to exert different effects for coaches and athletes. When coaches believed that their athletes were confident in their coaching abilities, commitment from both the coach and athlete increased. However when athletes thought their coach was confident in their abilities, this led to lowered commitment from both coaches and athletes. The authors explanation for these findings were that athletes may receive behavioral feedback that reinforces their own self-efficacy beliefs which may lead to athletes feeling confident in their abilities to compete at higher levels and therefore feeling less commitment to this specific coach. This study demonstrates that the tripartite model has a practical application for commitment in groups. However, these results may not be replicated in other studies in which the partnership or group is not based upon a hierarchy as with a coach-athlete relationship.

The research concerning other efficacy in sport has been limited and has consisted of a few recent studies that primarily focus on the relationship between other efficacy and

performance. Beauchamp & Whinton (2005) studied self- and other efficacy between rider and horse in equestrian dyads. Participants were recruited from a 1-day competition where they competed in three different equestrian events (dressage, cross-country, and show-jumping). Before each event, self and other (horse) efficacy were evaluated by the participants. The authors wanted to look specifically at the relationship between self-efficacy, other efficacy, and performance. They hypothesized that other efficacy would be able to explain significant variation in performance beyond self-efficacy alone. The authors' hypothesis was supported in the dressage category where other-efficacy explained 4% more of the variance in performance than just self-efficacy alone. However, there were no significant effects found in the other two events of cross-country or show-jumping. The authors mentioned this result could be due to the minimal variation in the scores within these two events. While the authors address the limitations of using a human-horse dyad, the findings do suggest that other efficacy does make a significant contribution towards performance beyond that of self-efficacy alone.

Two more recent studies have also studied this relationship between other efficacy and performance. Dithurbide (2011) looked at high-school aged women's volleyball teams and the relationship between other efficacy, collective efficacy, trust, and performance over the course of a club volleyball season. However the results indicated that other efficacy did not have a relationship with performance for the season. The author provided a few rationales for why there was no effect found. The first was that these athletes were high school aged and the other studies concerning other efficacy have been conducted with adults. Trust and other efficacy were highly correlated in this study and therefore these participants may have had difficulty distinguishing between the two constructs; whereas adults may better understand the nuances between the two concepts. Another reason may have been the nature of this team task. To date, other efficacy has

been exclusively studied in dyads. Dithurbide postulated that it may be easier to establish a sense of “me and other” at the beginning of the season when individuals are first creating a team. Further, it may be more difficult as the season goes on to distinguish between the self and others in a highly interdependent team sport and establish the necessary feeling of “other” for other-efficacy to be sufficiently studied compared to a dyadic relationship.

One other study also studied dyadic relationships and the relationship between self-, other-efficacy, and performance (Dunlop et al., 2011). Female dyads performed a series of dance-based videogames for practice and were given false efficacy feedback concerning their coordination abilities. Dyads performed one final dance trial after this feedback was given and performance was measured compared to the performance on the trials. Results indicated a main effect for other-efficacy, where those in the high other-efficacy condition outperformed those in the low other-efficacy condition, regardless of their own self-efficacy beliefs. However, there was no effect for self-efficacy on this task. These results suggest that the effects of other-efficacy may be stronger than those of self-efficacy in relation to performance.

Dunlop et al. (2011) explained these findings through Karau and William’s (1993) collective effort model. The model proposes that the level of engagement one portrays in an interdependent activity is determined by both personal effort and the possibility of the attainment of the desired outcome. When an individual perceives that he or she can contribute to the outcome, he or she becomes engaged in the task. However, if that individual perceives that his or her actions will not sufficiently affect the outcome, disengagement occurs. In the Dunlop et al. study, those partners in the high other-efficacy condition may have thought a successful performance was more attainable given their beliefs in the abilities of their partner and therefore increased performance. Similarly, those in the low other-efficacy condition may have thought

that a successful performance was unattainable given their partner's low abilities. While this may be a reasonable explanation, the performance measure in this study was based upon the success of the dyad as a whole rather than the individuals making a unique contribution to the group. Research has yet to demonstrate whether a unique contribution has an effect on the relationship between other-efficacy and performance.

Summary

Both Köhler's experimental work and subsequent research have demonstrated motivation gains in physical tasks where weaker individuals perform better on tasks when paired with a moderately more capable partner (Weber & Hertel, 2007). The Köhler effect has two separate processes, social comparison and indispensability. When partnered with a more capable partner, individuals may revise their performance goals upward (social comparison) or individuals may feel that their effort is highly instrumental for the team to be successful overall (indispensability). While the Köhler effect has been strongest in conjunctive task demands, relays function as a quasi-conjunctive demand in which the relay is both divisible and sequential, so each relay member must perform adequately on his or her own performance in order for the team to do well overall.

Only one study to date has looked at the relationship between the Köhler motivation gain effect and self-efficacy. Seok (2004) found that those in a low-efficacy condition demonstrated the largest motivation gain in a conjunctive task demand. Meanwhile, research in sport has demonstrated a strong, reciprocal relationship between self-efficacy and performance (Feltz, 1982; McAuley, 1985). However, research on efficacy beliefs has indicated that other-efficacy or one's beliefs about their partner's abilities to perform a specific behavior, may also be important to performance (Dunlop et al., 2011; Lent & Lopez, 2002). With limited information on sport

performance and the Köhler effect, it is necessary to look at how both self-efficacy and other-efficacy may moderate the Köhler motivation gain effect in real sports teams. Further, this research may lead to more information regarding motivation in sports teams.

CHAPTER 3

METHOD

The purpose of this dissertation study was to replicate the previous Köhler effect research with real, intact relay teams and investigate the potential moderating effects of self- and other efficacy on performance. First, a pilot study was conducted to determine if the Köhler motivation gain effect could be replicated in real-time relays based on findings from the analysis of archival data. Based on results from the pilot data, a full-scale study was designed to test the hypotheses put forth in Chapter 1.

PILOT STUDY

Participants

Participants in the pilot study were 44 high-school aged swimmers (28 women, 16 men) recruited from three large swim teams in the state of Wisconsin. In order to participate in the study, participants had to be high school age or older. Those individuals who were starting high school at the end of the summer were also invited to participate in the study. The average age of study participants was 15.9 years ($SD = 1.5$). Swimmers' average experience participating in swimming was 7.3 years ($SD = 2.7$). And, swimmers swam on their respective teams for an average of 5.6 years ($SD = 3.1$). Participants were organized into 11 same-sex relay teams each containing four members.

Measures

Demographics. A demographics questionnaire was used to obtain background information from the participants. Items included age, years of competitive swimming experience, years swimming on current team, long or short course swimming preference, top three events, personal best times for those best events, personal best times in the 100 freestyle,

and the participant's personal and team goals for the season. The questionnaire also asked about how much participants enjoyed being on relays, in general, as well as how important it was to each participant to be on the 400 yard freestyle relay at his or her championship meet at the end of the season. The demographics questionnaire also asked if participants ever swam on a freestyle championship relay before and if so, what their favorite position is and why. Descriptive statistics for the swimmers are presented in Table 1.

Motivation Gain. Individual times of the participants were collected at two points in the season. These were then averaged to get a most consistent measure of what the participants swim time was throughout the season. These averaged individual times were used to place participants into relays. Relays were created so that the final times of the relays (i.e., sum of individual times) would be similar to one another, and therefore, more competitive as each relay team would have an equal chance of winning. Participants swam an individual and relay condition swim at one time toward the end of the season. These times, respectively, were compared to determine if motivation gains occurred.

Procedure

Participants were recruited from among three large swim teams in the State of Wisconsin. Both parental consent and participant assent were obtained from participants. Swimmers swam two baseline 100 yard race-pace swims on two separate practice days. The times were hand timed by coaches and were recorded by the researcher. Participants' times were averaged together to make a more consistent measure of how these swimmers usually swim in practice.

The averaged swim times were then used to place the swimmers into ad-hoc relay groups for a third practice. At the third practice, swimmers swam both an individual 100-yard race and 400-yard freestyle relay (relay condition of the event). Times were collected on both of the

swims and were once again hand timed by the coaches and recorded by the researcher.

Participants had about 15 min. for rest between each swim. In swimming, it is common practice for coaches to conduct timed swims during a practice setting. During most of these race-pace efforts, there is less time to rest in between swimming repeats and 15 min. was deemed an appropriate time for swimmers to effectively “warm down” by doing easy swimming in between the individual and the relay swim.

Standardization of Swimming Times

In swimming, there are differences between a regular start and a relay exchange start that greatly affect one's time in leaving the block. A relay exchange is usually much faster, sometimes being as low as 0.2 to 0.3 s while in a regular start, a good reaction time can be around 0.6 to 0.7. These differences account for the fact that swimmers in a relay can see when they should leave the block as they wait for the swimmer in the water to finish, leaving them with a “reaction time” in which they must anticipate when to start. These differences can lead to relay swim split times to be slightly faster due to the nature of the start. In order to correct for these faster times, the reaction time can be added to the split time in order to obtain a standardized split time (Osborn et al., 2012). An example of this would be the average reaction time of 0.3 s added to a split time of 58.42. This would result in the standardized split time of 58.72 s.

In this pilot study, due to the fact that these times were collected in practice, relay exchange technology was not available and was, therefore, not used. In order to standardize these split times, the average reaction time from the archival data set used in Osborn et al. (2012) was used. This split time was 0.3 and was added to each individual's time who used a relay exchange start in order to obtain the standardized split times for the rest of the data analysis.

Results

A repeated measures ANOVA was used to determine performance differences between individual and relay swims. Ranking of the individuals in the relay groups was determined by their life-time best swim performances. Individuals with the fastest life-time best performance in the relay were ranked 1st, while individuals with the slowest life-time best performance were ranked 4th. The 2nd and 3rd place rankings were also given respectively by life-time best time, so that within one relay group, there would be one person with each rank status. Life-time best performance times were used as these may be a more consistent measure of performance. Other research within swimming has found that faster swimmers are more consistent in the same event between competitions compared to slower swimmers (Stewart & Hopkins, 2000). Due to this finding, slower swimmers may have been less consistent on the 2 days in practice that times were collected for the pilot study, which may have resulted in a skewed individual average of performance. By basing individual performance off life-time best times, this kept individual performance more consistent across both fast and slow swimmers.

In order to check the rankings that were given to relay members, a manipulation check was performed so that swimmers who were ranked higher should swim faster overall than lower ranked swimmers. A 4 x 2 (Rank x Condition: individual, relay) analysis of variance (ANOVA) with repeated measures on the last factor was conducted, using swim performance as the dependent variable. There was a significant rank main effect, $F(3, 40) = 2.85, p = .049, \eta_p^2 = 0.176$. A Tukey post hoc analysis was used to perform pair-wise comparisons between the ranked members. This analysis showed that the fourth ranked members performed worse ($M =$

71.27, $SD = 7.45$) than the first ranked members ($M = 65.57$, $SD = 3.00$). Thus the ranking manipulation was successful. There was no significant main effect for condition.

In the 4 x 2 repeated measures ANOVA there was a marginal Rank x Condition interaction, $F(3,40) = 2.32$, $p = .09$, $\eta_p^2 = .148$. This trend was investigated further by conducting a 2 x 2 (Rank x Condition: individual, relay) ANOVA with repeated measures on the last measure. There was a significant Rank x Condition interaction, $F(1, 20) = 5.64$, $p = .02$, $\eta_p^2 = .220$. According to 95% confidence intervals, the second ranked individual performed better in the relay condition, $M = 66.49$, CI [64.20, 68.77] than in the individual condition, $M = 68.50$, CI [66.07, 71.01], although this was not significant. Means for the fourth ranked swimmers individual condition, $M = 71.39$, CI [68.09, 74.69] compared to the relay condition, $M = 71.15$, CI [68.27, 74.03] demonstrated no change. There was also no change for the first ranked members' individual performance, $M = 65.57$, CI [62.27, 68.86] compared to their relay performance, $M = 65.45$, CI [62.57, 68.33]. Swim performance time data is presented in Table 2.

Discussion

The manipulation check results indicated that the rank ordering used to place individuals into relays was accurate. Individuals who swam faster in practice were also the faster members of the relay team.

While the slowest individual on the relay did not demonstrate the greatest motivation gain, interesting trends emerged. Second ranked swimmers were seen to perform almost 2 s better in the relay performance compared to their individual performance. The calculated power was only .27, thus there was not much power to find a significant effect with only 11 swimmers at each rank. While a power analysis was performed before the pilot study was conducted, the study was limited by both the number of swimmers who showed up to practice on the day of the

timed relay event as well as swimmers who were still participating in practice in the late part of the season.

However, while not statistically significant, 2 s can make a large practical impact on the final time in a swimming relay. Further, this trend supports previous research concerning the Köhler effect. Previous research has shown that the Köhler effect is more pronounced when one is partnered with a moderately more capable partner (Messé et al., 2002). In these practice relays, the range of times was quite large (i.e., 24 s). The first ranked individual, though most likely moderately more capable than the second individual was much more capable than the third or fourth ranked members. This may be why the second ranked member was the only person to demonstrate a trend toward performance increase during the relay, because these individuals were the only ones who may have been able to successfully compare themselves to the first ranked individual or to think they could make a significant contribution to the relay performance. The first ranked individuals' performance was also not significantly worse in the relay condition compared to the individual condition. Again, the power was low to find any significant effect.

The pilot study provided several suggestions for the dissertation study. First, in order for the Köhler motivation gain effect to occur where the least capable individual demonstrates a greater motivation gain in the group task, relay members should be closer in ability. The range between the first and fourth ranked member in the pilot study was much larger than may be typical for relays in a competitive setting. Performance differences may occur if participants in the relay are closer in ability and feel as if they can (a) socially compare themselves to the others in the group and (b) feel like their performance will make a substantial contribution to the relay as a whole. In this study, relay members' times may have been too far apart for them to realistically feel that they could have an impact on the relay's overall result.

Further, while these pilot study results indicate that there are performance differences in a practice environment, a competitive environment may be a stronger place to study these motivation effects as swimmers will already be highly motivated. Lastly, a larger sample size and more relay teams are recommended to have greater power to detect differences. A power analysis following f index recommendations suggests that a sample size of 140 is needed to observe a moderate ($f=.30$) Köhler effect with probability $> .80$.

DISSERTATION

Participants

Six Division II and III NCAA swimming teams were recruited to participate in the study. Of the six teams, five consisted of both a men and women's team, while the last team comprised only women. Participants were 199 NCAA swimmers (111 females, 88 males). In terms of academic grade in college, 66 = freshman, 34 = sophomore, 37 = junior, 30 = senior. The other 32 participants did not indicate a grade. Swimmers ranged in age from 18 to 22 years ($M = 19.3$, $SD = 1.2$) and had been swimming competitively from 1 to 18 years ($M = 10.2$, $SD = 3.35$). In order for participants to be included in the study, they had to participate in at least one or more freestyle relay events (200, 400, or 800 yards) at their fall invitation meet during the 2012-2013 season. See Table 3 for descriptive statistics.

Measures

Demographics. A demographics questionnaire was used to obtain background information from the participants. Items included age, year in school (freshman, sophomore, junior, senior, fifth year), years of competitive swimming experience, top three events, personal best times for those best events, personal best times for the 50, 100, and 200 yard freestyle, and the participant's personal and team goals for the season. The questionnaire also asked how much participants enjoyed being on relays in general as well as how important it was to each

participant to be on the 200, 400, and 800 yard freestyle relays at the conference championship meet at the end of the season. See Appendix A for Demographics questionnaires.

Self-Efficacy. The self-efficacy measure comprised nine items. It asked participants how confident they were in their ability to swim 50, 100, or 200 yards in under a given time in seconds (e.g. for females: 50: 28-24, 100: 66-50, 200: 126-110; males: 50: 25-21, 100: 59-43, 200: 117-101). The self-efficacy measure specifically asked how confident participants were in their ability to swim a given distance under a certain time at the fall invitational meet during the season. Items were assessed on an 11-point scale, ranging from 0 (not at all confident) to 10 (totally confident). Self-efficacy was assessed just prior to a team's fall invitational meet. See Appendix for self-efficacy questionnaires at all distances for each gender.

Other Efficacy. The other-efficacy measure also comprised nine items and was used for individuals who swam on a relay at the fall invitational meet. The other-efficacy measure asked each participant how confident he or she was in the abilities of his or her relay team's other members to swim a given distance in under a certain time. The measure used the same times as used in the self-efficacy questionnaire. The measure concerns an individual's belief about his/her relay team as a whole team, rather than each other member separately. Other-efficacy measures were collected before relays during each team's fall invitational meet. Items were assessed on an 11 point scale, with 0 (not at all confident) to 10 (totally confident). See Appendix for other efficacy questionnaires at all distances for each gender.

RISE. RISE also comprised nine items and was used for individuals who swam on a relay at a fall invitational meet. The RISE questionnaire asked each participant how confident he/she thought his/her relay members felt about that participant's own ability to swim a given distance under a certain time. Once again these were the same times as used in both the self- and

other efficacy questionnaires. This measure concerns the individual's belief about his/her relay teams' belief as a whole team rather than each member's belief in the individual separately.

RISE measures were collected before relays during the team's fall invitational meets. Items were assessed on an 11-point scale, ranging from 0 (not at all confident) to 10 (totally confident). See Appendix for RISE questionnaires at all distances for each gender.

RPE. Perceived exertion was measured using the Borg RPE scale (Borg, 1998). The scale ranges from 6 - 20 where 6 means "no exertion at all" and 20 means "maximal exertion." Participants were asked to rate their total feeling of exertion after their relay performance. See Appendix AA for Post Relay Questionnaire.

Motivation Gain. Both an individual and relay measure of performance is needed to indicate performance gains or losses. Relay times of the participants were collected at each team's fall invitational meet for the season. The individual time used, was the individual's life-time best individual performance time in that event. Individual life-time best times were used because not all individuals competed in both the individual and relay freestyle events at these meets. The use of life-time best performances allowed for the individual measures to be kept consistent across the participants. The individual life-time best time was used to rank participants from fastest to slowest. If there was a tie between individual times (i.e., two or more swimmers swam the exact same time), times were verified from the online database www.collegeswimming.org as well as self-reported individual best times. Any differences between these two times were then used to rank participants accordingly. Individual and relay times were then compared to determine if motivation gains occurred.

Procedure

Once IRB approval was obtained, six NCAA Division II and III coaches were contacted about their participation in the study. Once coaches consented to participate, data collection was arranged to take place at each school's fall invitational meet during November and December. During fall invitational meets, swimmers are often rested in order to get more experience swimming races that they might swim in the conference championship at the end of the season. Fall invitational meets function as trial runs prior to the end of the season where most teams will rest in order to get some experience swimming fast and in prelims/finals format similar to their conference championship meet. However, these fall invitational meets may not be as important as the conference championship meet and therefore motivation in relays may still be lower than at the end of the season. Swimmers were informed about the study prior to the first day of the meet. If participants consented to participate, they completed a demographics questionnaire along with a baseline self-efficacy survey concerning the 50, 100, and 200-yard freestyle events prior to the start of the fall invitational meet.

A total of 199 swimmers participated in the study and composed 91 4-person swim relays. When divided by gender, there were 54 female relay teams and 37 male teams. While swimmers could only participate in one relay event in each length, some swimmers swam in multiple relays with varying lengths (i.e., a swimmer could swim in the 200, 400, and 800 freestyle relay, but could not participate in the 200 freestyle relay multiple times). Swimmers were repeated across relays in the following manner; 68 swimmers swam in one relay event, 98 swam in two relay events, and 33 swam in all three relay events. Throughout the meet and prior to any relay swim, participants completed questionnaires concerning their self-efficacy beliefs about their own swim, other-efficacy beliefs and their RISE beliefs of their fellow relay members. They also answered a pre-relay question asking how indispensable they felt their

contribution would be to the relay. See Appendix Z for Pre-Relay Questionnaire. After the relay swim, they answered a post-relay questionnaire which asked questions concerning social comparison, their contribution to the team, as well as RPE using the Borg scale.

The pre-competition questionnaires were administered on deck prior to warm-ups. This provided a time close enough to the meet to accurately reflect efficacy beliefs but did not interfere with competition routines. Post-relay surveys were administered either on-deck after the meet session had concluded or during team lunch or dinner meals immediately after the conclusion of the swimming session. The researcher distributed and collected the surveys during these times. Individual times for each participant were collected from www.collegeswimming.org and relay times were collected from the results of the fall invitational meet of each team.

Treatment of the Data

Prior to data analysis, individuals were ranked within their relay groups based upon their life-time best individual time. Individuals with the fastest life-time best performance were ranked 1st, while individuals with the slowest life-time best performance were ranked 4th. The 2nd and 3rd place rankings were also given respectively by life-time best time, so that within 1 relay group, there would be one person with each rank status. Life-time best performance times were used as these may be a more consistent measure of performance across both slow and fast swimmers. Relay splits were standardized by adding the reaction time (i.e., time between when the swimmer in the water touches the wall, and starting swimmer's feet leave the block) to the relay time of each swimmer as was performed in the pilot study as well as Osborn et al. (2012). An example of this would be the average reaction time of 0.3 s added to a split time of 58.42. This would result in the standardized split time of 58.72 s. In one meet in particular, the reaction

times were not accurately measured for all the relays, which can occur when the timing system is not working correctly. Some of the reaction times from this meet were missing, so the average reaction time from Osborn et al. (2012) was used in place of these missing reaction times to create the standardized relay times.

Descriptive statistics (i.e. means, standard deviations) were calculated for all variables. Bivariate correlations were calculated between self-efficacy, other efficacy, and RISE beliefs as well as between efficacy scores (self-efficacy, other-efficacy, and RISE) and performance (Hypothesis 3). High and low self- and other efficacy were used as predictors in the analyses. The average of the raw efficacy scores was calculated by summing the raw scores and dividing by the number of questions within the scale. These raw efficacy scores were then converted to z-scores. In order to accomplish the high and low groupings, raw efficacy scores were converted to z-scores and the top 33% was deemed high self- or other efficacy while the bottom 33% of scores were categorized as low self- and other efficacy. For brevity of the results, all swimming distances will be reported in yards. These will be referred to as the 50, 100, and 200 individual distances and relate to relay distances of 200, 400, and 800 respectively.

Due to the nested nature of the data, with swimmers grouped into relays, multi-level modeling was used. Multilevel statistical techniques such as hierarchical linear modeling (HLM) account for interdependence of the data and allow for an analysis of data at multiple levels (Raudenbush & Bryk, 2002). For purely hierarchical multi-level models, individuals are assumed to belong to only one group. However, in this case, swimmers could belong to multiple relay groups and hence a cross-classified HLM was used. A cross-classified model allows for level-1 units (i.e. swimmers) to be classified in more than one classification (i.e. relays). One benefit of using this type of HLM model is that it allows for researchers to estimate components of

variance between levels of analyses as well as estimate random effects within the data (Raudenbush & Bush, 2002). Ignoring the cross-classified nature of the data and using a purely hierarchical data model can lead to bias in standard errors and variance components (Garson, 2013).

The first step was to develop an unconditional model in which no individual predictors are entered into the model. This step determines the variance of the model and confirms that HLM is an appropriate statistic to analyze the data. A one way ANOVA was performed indicating heterogeneity of variance in performance times, $F(1, 726) = 11845.65, p < .001$. Raycov and Marcoulides (2008) recommend that for variables with more positive skewness a logarithmic transformation is an appropriate transformation. Thus, a natural log transformation was conducted on the dependent variable, Time.

Further, in cross-classified models, variables can be treated as random if the researcher desires to generalize that effect to other populations (Raudenbush & Bryk, 2002). In this dissertation it is desirable to use both high and low self- and other efficacy as random effects to be able to generalize to other populations. However in preliminary data analysis, when both these variables and their interaction terms (i.e, Relay by high/low efficacy) were treated as random effects, the models would not converge most likely due to a lack of data and degrees of freedom. However, deviance comparisons between using only high or low efficacy as a random effect vs. using these variables as a fixed effect, indicated that there were no differences between the models for self-efficacy, $\chi^2(5) = 9.12, p = .10$, or other efficacy, $\chi^2(5) = 4.83, p > .5$, therefore these variables were treated as fixed effects.

Hypothesis 1 was tested through a series of correlations between efficacy measures and performance. HLM was used to test Hypothesis 2 through 6. Details about the specific models

employed are described in Chapter 4. HLM was also used to test research questions 1 through 4. Means and standard deviations were used to evaluate research questions 5 through 7. All HLM models were tested using HLM v.7 (Raudenbush, Bryk, & Congdon, 2012).

CHAPTER 4

RESULTS

Descriptives

Descriptive statistics for all athletes are presented in Table 3. Relay statistics including efficacy measures as well as pre- and post-relay measures are presented in Table 4. The swimmers' best performance measures varied according to distance raced: 50 ($M = 24.24$, $SD = 1.70$), 100 ($M = 52.89$, $SD = 4.11$), and 200 ($M = 116.05$, $SD = 8.22$). Swimmers reported that they liked being on relays ($M = 8.99$, $SD = 1.42$) and that it was important to be on a championship relay ($M = 7.18$, $SD = 2.84$).

Baseline self-efficacy scores for each distance were moderate; 50 ($M = 5.89$, $SD = 2.29$), 100 ($M = 6.38$, $SD = 1.38$), and 200 ($M = 4.41$, $SD = 2.50$). Relay self-efficacy scores were also moderate and slightly higher than baseline scores; 50 ($M = 6.47$, $SD = 2.38$), 100 ($M = 6.73$, $SD = 1.13$), and 200 ($M = 5.11$, $SD = 2.53$). Other-efficacy scores for the relay were also moderate; 50 ($M = 6.70$, $SD = 2.16$), 100 ($M = 6.83$, $SD = 1.21$), and 200 ($M = 5.40$, $SD = 2.19$). Additionally RISE beliefs for the relay were moderate; 50 ($M = 6.52$, $SD = 2.38$), 100 ($M = 6.78$, $SD = 1.19$), and 200 ($M = 5.45$, $SD = 2.42$).

Standard deviations for efficacy scores indicate that ranges of efficacy scores were large. Approximately 50% of the sample indicated that at least one of the events in which efficacy beliefs were measured was one of their top three events. This indicates that for the rest of the sample, freestyle, and especially freestyle at these distances may not have been their strengths which may account for the large range within the scores.

Table 1

Pilot Study Swimmer Demographics

Variable	M	SD
Age	15.9	1.50
Years of Competitive Swimming	7.30	2.70
Years on Team	5.60	3.19
Best 100 Freestyle Time	62.56	5.27
Do you like being on relays?*	8.67	1.19
Importance of being on a championship freestyle relay?*	6.14	2.92

* Likert scale from 0 = Do Not Like to 10 = Absolutely Like

** Likert scale from 0 = Not important to 10 = Very Important

Table 2

Estimated marginal performance means and confidence intervals between ranks across conditions

Rank	Condition	M	SE	95% <i>CI</i>	
				Lower Bound	Upper Bound
1st ranked	1	65.573	1.631	62.277	68.869
	2	65.458	1.425	62.578	68.339
2nd ranked	1	68.545	1.631	65.248	71.841
	2	66.489	1.425	63.608	69.370
3rd ranked	1	69.591	1.631	66.295	72.887
	2	69.878	1.425	66.998	72.759
4th ranked	1	71.395	1.631	68.099	74.692
	2	71.151	1.425	68.270	74.032

Note: Condition 1 = Individual, Condition 2 = Relay

Table 3

Dissertation Study Swimmer Demographics

Variable	M	SD
Age	19.39	1.20
Years of Competitive Swimming	10.2	3.35
Best 50 Freestyle Time	24.24	1.70
Best 100 Freestyle Time	52.89	4.11
Best 200 Freestyle Time	116.05	8.22
Do you like being on relays?*	8.99	1.42
Importance of being on a championship freestyle relay?*	7.18	2.84

* Likert scale from 0 = Do Not Like to 10 = Absolutely Like

** Likert scale from 0 = Not important to 10 = Very Important

Table 4

Dissertation Study Relay Variables

Variable	200 Yard Relay		400 Yard Relay		800 Yard Relay	
	M	SD	M	SD	M	SD
Baseline Self-efficacy	5.89	2.29	6.38	1.38	4.41	2.50
Relay Self-efficacy	6.47	2.38	6.73	1.13	5.11	2.53
Relay Other efficacy	6.70	2.16	6.83	1.21	5.40	2.19
Relay RISE	6.52	2.38	6.78	1.19	5.45	2.42
Pre-Relay Indispensability	7.78	2.15	8.25	1.60	7.91	1.70
Post-Relay Indispensability	8.37	1.60	8.46	1.41	7.59	1.92
Relay Social Comparison	7.73	2.39	7.68	2.27	7.79	2.19
RPE	18.29	2.05	18.08	1.77	17.80	1.98

Bivariate Correlations

Bivariate correlations between efficacy and pre and post performance measures for the 200, 400, and 800 relays are presented in Tables 5, 6, and 7 respectively. Baseline self-efficacy and relay self-efficacy were highly and significantly correlated for all relay distances; 200 ($r = .95$), 400 ($r = .80$), and 800 ($r = .93$). Additionally, relay self-efficacy and both other-efficacy and RISE beliefs showed significant relationships at all relay distances respectively; 200 ($r = .76$ and $r = .94$), 400 ($r = .86$ and $r = .94$), and 800 ($r = .89$ and $r = .95$). There were significant correlations between self- and other efficacy beliefs and performance at both the individual and relay level however these relationships are discussed in more detail as they relate to Hypothesis 3.

Hypothesis Testing

Hypothesis 1 stated that there would be a negative relationship between both self-efficacy and other efficacy and performance times. Bivariate correlations between the variables supported this hypothesis. Both baseline self-efficacy and relay self-efficacy were negatively and moderately related to individual performance at the 200 ($r = -.48$ and $r = -.52$), 400 ($r = -.41$ and $r = -.43$), and 800 distance ($r = -.67$ and $r = -.68$). For the relay performance, the same relationship was found at the 200 ($r = -.59$ and $r = -.63$), 400 ($r = -.47$ and $r = -.50$), and 800 distance ($r = -.30$ and $r = -.31$). Efficacy beliefs were stronger at the relay level compared to the individual level with the exception of the 800 distance. The relationship between other efficacy beliefs and performance also demonstrated significantly moderate and negative correlations at the individual and relay levels for the 200 ($r = -.38$ and $r = -.52$), 400 ($r = -.33$ and $r = -.41$) and 800 ($r = -.59$ and $r = -.29$). Thus Hypothesis 1 was supported.

Table 5

Correlations between self-efficacy, other efficacy, RISE beliefs and individual and relay performances for the 200 yard freestyle relay

Variables	1	2	3	4	5	6	7	8	9
1. Baseline Self-efficacy									
2. Relay Self-efficacy	.95**								
3. Relay Other efficacy	.71**	.76**							
4. Relay RISE	.91**	.94**	.81**						
5. Individual Time	-.48**	-.52**	-.38**	-.46**					
6. Relay Time	-.59**	-.63**	-.52**	-.60**	.88**				
7. Pre-Relay Indispensability	.53**	.51**	.38**	.56**	-.32**	-.40**			
8. Post Relay Indispensability	.53**	.52**	.42**	.57**	-.24*	-.40**	.65**		
9. Post Social Comparison	.17	.23	.20	.27*	-.12	-.26*	.26	.47**	
10. RPE	.21	.19	.30*	.23	-.06	-.20	.30*	.35**	.32**

Note ** significant at $p < .01$, * significant at $p < .05$

Table 6

Correlations between self-efficacy, other efficacy, RISE beliefs and individual and relay performances for the 400 yard freestyle relay

Variables	1	2	3	4	5	6	7	8	9
1. Baseline Self-efficacy									
2. Relay Self-efficacy	.80**								
3. Relay Other efficacy	.86**	.86**							
4. Relay RISE	.79**	.94**	.88**						
5. Individual Time	-.41**	-.43**	-.33**	-.44**					
6. Relay Time	-.47**	-.50**	-.41**	-.52**	.89**				
7. Pre-Relay Indispensability	.42**	.38**	.38**	.39**	-.19	-.20*			
8. Post Relay Indispensability	.31**	.28*	.25*	.27*	-.09	-.17	.42**		
9. Post Social Comparison	.24*	.20	.15	.16	-.21	-.17	.24	.30*	
10. RPE	.05	.22	.20	.18	-.01	-.18	.03	.24*	.08

Note ** significant at $p < .01$, * significant at $p < .05$

Table 7

Correlations between self-efficacy, other efficacy, RISE beliefs and individual and relay performances for the 800 yard freestyle relay

Variables	1	2	3	4	5	6	7	8	9
1.Baseline Self-efficacy									
2.Relay Self-efficacy	.93**								
3.Relay Other efficacy	.81**	.89**							
4.Relay RISE	.90**	.95**	.87**						
5.Individual Time	-.67**	-.68**	-.59**	-.68**					
6.Relay Time	-.30**	-.31**	-.29**	-.27**	.46**				
7.Pre-Relay Indispensability	.43**	.40**	.42**	.43**	-.26*	-.05			
8.Post Relay Indispensability	.49**	.48**	.45**	.45**	-.19	-.13	.39**		
9.Post Social Comparison	.25*	.15	.12	.13	-.15	.06	.20	.43**	
10. RPE	.12	.26*	.26*	.24*	-.09	-.10	.08	.36**	.11

Note ** significant at $p < .01$, * significant at $p < .05$

In order to use HLM for testing the hypotheses, an unconditional means model was run to examine the variance of the times between swimmers (i.e. within relays) and between relays within the model. For clarity within the results section, between swimmer variance is referred to as “within relay” variance. The unconditional means model entered and run in HLM appears below:

$$\text{LnTIME} = \theta_0 + b_{00j} + c_{00k} + e_{ijk}$$

In this model and the following models, the subscript j , represents the swimmer while the subscript k , represents the relay. In this model, LnTime was the outcome variable, θ_0 was the overall mean of Time, b_{00j} represents the variance between swimmers, within relays, c_{00k} represents the variance between relays k , and e_{ijk} represents the random error of swimmer j in relay k . The variance interpretation differs slightly in a cross-classified model as it accounts for variance between individuals, between relays, and also provides a residual variance. In most cross-classified models, the within-unit variance is difficult to calculate as the number of data points within each cell is low due to the cross-classification of units within classifications. This within-unit variance is calculated as part of the error or residual variance (Hox & Rogers, 2010).

In the unconditional model, Time varied significantly between relays, $\chi^2(84, N = 85) = 258585.73, p < .001$, but not within relay, $\chi^2(155, N = 156) = 157.96, p = .41$. The intraclass correlation coefficient (ICC) was calculated and indicated that 99% of the variance in Time is explained through differences between relays ($\rho_{c00k} = .99$). While the variance between individuals is not significant, Goldstein (2003) cautions that ICC values for cross-classified models can be affected by the number of units within a classification. In this dissertation, each

classification (i.e., relay) has only four units (i.e., swimmers), so within each relay, variability in times is smaller. This may be a reason as to why in the unconditional model, variability between individuals within each relay is not significant.

In order to use HLM to analyze data, variance should be significant both between classifications as well as within classification, however the cross-classified structure of the data (i.e., units repeated within groups) encourages the use of HLM to analyze these data despite the fact that variance in the unconditional model was only significant between relays. The next step in the HLM process was to add the variables of interests Hypothesis 2 stated that swimmers will swim faster in the relay condition compared to the individual condition. Additionally Hypothesis 3 stated that the weakest relay member would demonstrate a motivation gain in the relay compared to the individual condition, while Hypothesis 4 stated that the strongest relay member would demonstrate a motivation loss in the relay compared to the individual condition. To test these hypotheses the following model was built (Model 1):

$$Y_{ijk} = \pi_{0jk} + \pi_{1jk}*(TEAM_{ijk}) + \pi_{2jk}*(D400_{ijk}) + \pi_{3jk}*(D800_{ijk}) + \pi_{4jk}*(RANK2_{ijk}) + \pi_{5jk}*(RANK3_{ijk}) + \pi_{6jk}*(RANK4_{ijk}) + \pi_{7jk}*(TEAMD400_{ijk}) + \pi_{8jk}*(TEAMD800_{ijk}) + \pi_{9jk}*(TEAMR2_{ijk}) + \pi_{10jk}*(TEAMR3_{ijk}) + \pi_{11jk}*(TEAMR4_{ijk}) + e_{ijk}$$

In Model 1, Y_{ijk} is the performance time of swimmer j in relay k , π_{0jk} is the Level 1 intercept, π_{1jk} is the effect of performing individually or in the relay, π_{2jk} is the effect of the 400 distance individually, π_{3jk} is the effect of the 800 distance individually, π_{4jk} is the effect of the second ranked individual, π_{5jk} is the effect of the third ranked individual, π_{6jk} is the effect of the fourth ranked individual, π_{7jk} is the interaction effect of the relay performance at the 400

relay distance, π_{8jk} is the interaction effect of the relay performance at the 800 relay distance, π_{9jk} is the interaction effect of the second ranked individual on the relay, π_{10jk} is the interaction effect of the third ranked individual on the relay, π_{11jk} is the interaction effect of the fourth ranked person on the relay, and e_{ijk} is the error associated with each swimmer j in relay k .

The results indicated that individually, the second ranked individual, $t(279) = 5.52, p < .001$, third ranked individual $t(279) = 9.28, p < .001$, and fourth ranked individual $t(279) = 13.98, p < .001$ swam slower than the first ranked individual. The first ranked individual also swam slower in the relay condition compared to the individual condition, $t(279) = 8.51, p < .001$. A series of contrasts were performed to determine the differences between performance at the individual level and relay level for other distances and ranks. Results of the contrasts as well as mean times indicated that the first ranked individual swam slower in the relay compared to the individual condition in the 400, $\chi^2(1) = 91.97, p < .001$, and 800 distance, $\chi^2(1) = 123.03, p < .001$. Thus Hypothesis 4 was supported.

The second ranked individual also swam slower in the relay condition compared to the individual condition in the 200, $\chi^2(1) = 14.61, p < .001$, 400, $\chi^2(1) = 21.95, p < .001$, and 800 distance, $\chi^2(1) = 38.04, p < .001$. The third ranked individual showed the same pattern as the first two individuals in the 200, $\chi^2(1) = 4.24, p < .05$, 400, $\chi^2(1) = 7.21, p < .05$, and 800 distance, $\chi^2(1) = 18.66, p < .001$. The fourth ranked individual performed significantly faster on the relay performance compared to the individual performance in the 200, $\chi^2(1) = 4.22, p < .05$, and tended to perform faster on the 400, $\chi^2(1) = 2.87, p = .08$. Thus Hypothesis 3 regarding the

fourth ranked member was supported and Hypothesis 2 concerning a main effect for faster performance times in the relay was not supported.

For Model 1, Time varied significantly between relays, $\chi^2(84, N = 85) = 5363.98, p < .001$ but not within relays, $\chi^2(155, N = 156) = 102.71, p > .5$. The ICC for relays, ($\rho_{c00k} = .90$), demonstrated that 90% of the variance in Time in Model 1 was explained between relays. Deviance between models was compared and Model 1 was significantly different from the unconditional model, $\chi^2(11, N = 15) = 621.32, p < .001$. Complete results for this model can be found in Table 8, while estimated mean times calculated from this model can be found in Table 9 as well as Figure 1 through 3.

Hypothesis 5 stated that self-efficacy would moderate the motivation gain relationship so that individuals with low self-efficacy beliefs would show a motivation gain in the relay condition compared to the individual condition. Further, high self-efficacy beliefs would result in slower times in the relay compared to the individual condition, resulting in a motivation loss. HLM was used again to test this hypothesis. High and Low Self-Efficacy measures as well as Relay/Efficacy interaction effects were added to Model 1 allowing for the creation of Model 2:

$$\begin{aligned} Y_{ijk} = & \pi_{0jk} + \pi_{1jk}*(TEAM_{ijk}) + \pi_{2jk}*(D400_{ijk}) + \pi_{3jk}*(D800_{ijk}) + \pi_{4jk}*(RANK2_{ijk}) \\ & + \pi_{5jk}*(RANK3_{ijk}) + \pi_{6jk}*(RANK4_{ijk}) + \pi_{7jk}*(TEAMD400_{ijk}) + \pi_{8jk}*(TEAMD800_{ijk}) \\ & + \pi_{9jk}*(TEAMR2_{ijk}) + \pi_{10jk}*(TEAMR3_{ijk}) + \pi_{11jk}*(TEAMR4_{ijk}) + \pi_{12jk}*(LOWSE_{ijk}) \\ & + \pi_{13jk}*(HIGHSE_{ijk}) + \pi_{14jk}*(TEAMHSE_{ijk}) + \pi_{15jk}*(TEAMLSE_{ijk}) + e_{ijk} \end{aligned}$$

In Model 2, Y_{ijk} is the performance time of swimmer j in relay k , π_{0jk} is the Level 1 intercept, π_{1jk} is the effect of performing individually or in the relay, π_{2jk} is the effect of the 400

Table 8

Model 1 for performance time

Fixed Effect	Parameter	Coefficient	<i>SE</i>	<i>df</i>	<i>t</i>
Intercept	B ₀₀	3.15	.013	279	228.41**
Relay	B ₁₀	.03	.004	279	8.51**
Distance 400	B ₂₀	.78	.017	279	43.93**
Distance 800	B ₃₀	1.55	.018	279	82.75**
Rank 2	B ₄₀	.02	.003	279	5.52**
Rank 3	B ₅₀	.03	.003	279	9.28**
Rank 4	B ₆₀	.05	.003	279	13.98**
Relay*Distance 400	B ₇₀	.00	.004	279	.49
Relay*Distance 800	B ₈₀	.00	.004	279	2.05*
Relay*Rank 2	B ₉₀	-.02	.005	279	-4.08**
Relay*Rank 3	B ₁₀₀	-.02	.005	279	-5.70**
Relay*Rank 4	B ₁₁₀	-.04	.005	279	-9.28**

Random Effect	Parameter	Variance Component	<i>SD</i>	<i>df</i>	χ^2
Individual	<i>b_{00j}</i>	.000	.000	155	102.71
Relay	<i>c_{00k}</i>	.004	.065	84	5363.98**
Error	<i>e</i>	.000	.020		

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

Table 9

Model 1 Estimated mean times and percent changes between relay and individual performance

		200 Yard Relay	% Change	400 Yard Relay	% Change	800 Yard Relay	% Change
Rank 1	Individual	23.50		51.48		110.91	
	Relay	24.43	3.94**	53.63	4.18**	116.40	4.94**
Rank 2	Individual	23.99		52.55		113.21	
	Relay	24.42	1.81**	53.62	2.04**	116.37	2.79**
Rank 3	Individual	24.80		53.27		114.78	
	Relay	24.55	.96*	53.91	1.19*	117.01	1.94**
Rank 4	Individual	24.80		54.33		117.06	
	Relay	24.55	-1.00*	53.91	-.77	117.01	-.04

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

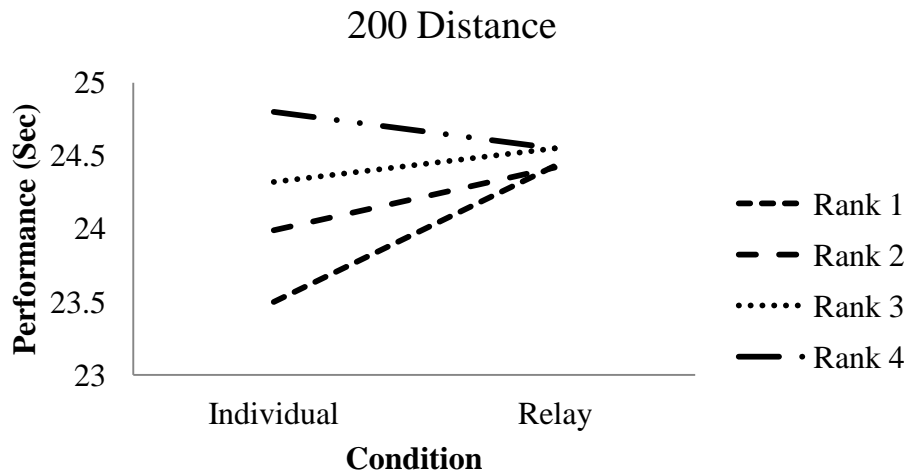


Figure 1. Individual and relay performance by rank at the 200 distance

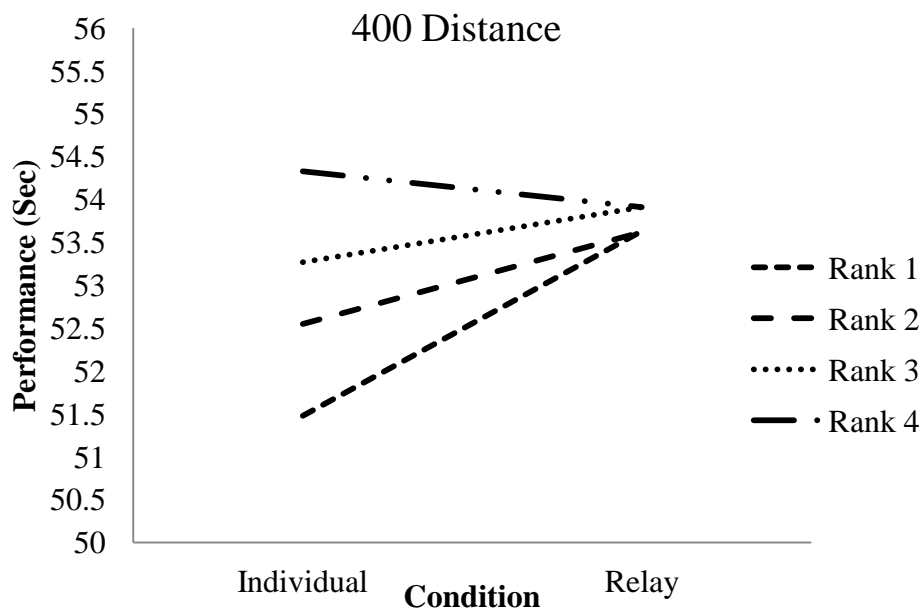


Figure 2. Individual and relay performance by rank at the 400 distance

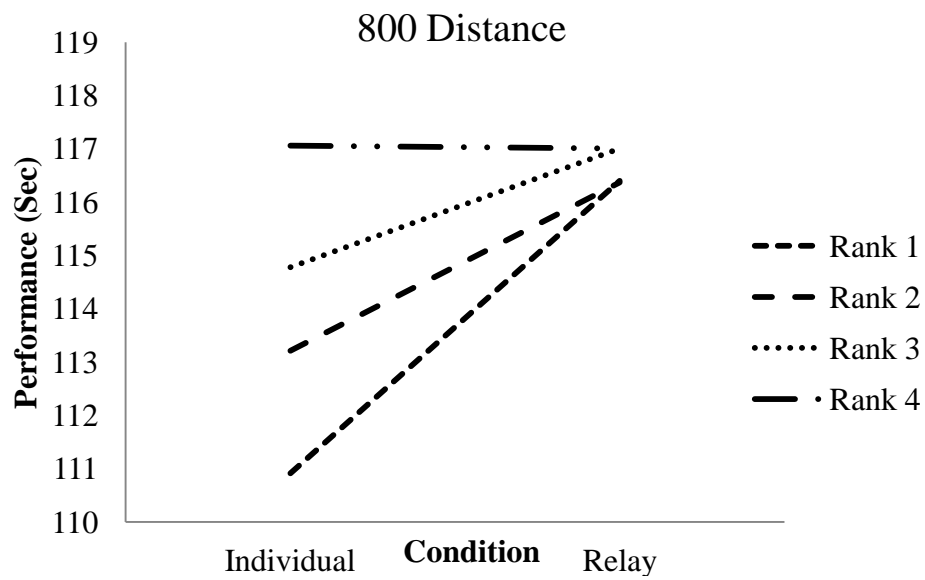


Figure 3. Individual and relay performance by rank at the 800 distance

distance individually, π_{3jk} is the effect of the 800 distance individually, π_{4jk} is the effect of the second ranked individual, π_{5jk} is the effect of the third ranked individual, π_{6jk} is the effect of the fourth ranked individual, π_{7jk} is the interaction effect of the relay performance at the 400 relay distance, π_{8jk} is the interaction effect of the relay performance at the 800 distance, π_{9jk} is the interaction effect of the second ranked individual on the relay, π_{10jk} is the interaction effect of the third ranked individual on the relay, π_{11jk} is the interaction effect of the fourth ranked person on the relay, π_{12jk} is the effect of low self-efficacy individually, π_{13jk} is the effect of high self-efficacy individually, π_{14jk} is the interaction effect between relay and high self-efficacy, π_{15jk} is the interaction effect between relay and low self-efficacy, and e_{ijk} is the error associated with each swimmer j in relay k .

Significant predictors were the same as found in Model 1. The only other significant predictor was the interaction effect between Relay x High Self-Efficacy $t(279) = -5.47, p < .001$, indicating that individuals with high self-efficacy decreased their times from the individual event to the relay, implying that performance improved.

Estimated means were calculated and contrasts were run in order to determine the effects of High or Low Self-Efficacy on performance Time from individual to relay within specific ranks. In general, individuals with low self-efficacy performed worse (increased their times) from the individual to relay condition compared to individuals with high self-efficacy, $\chi^2(1) = 23.68, p < .001$. However, fourth ranked members with low self-efficacy show no performance

difference from individual to relay performance for the 200, $\chi^2(1) = .00, p > .5$, and 400 distances, $\chi^2(1) = .63, p > .5$.

Individuals with high self-efficacy ranked second, showed no significant difference in performance in the 200, $\chi^2(1) = .09, p > .5$, and 400, $\chi^2(1) = 1.13, p = .28$. While third ranked individuals with high self-efficacy showed no difference in performance in the 200, $\chi^2(1) = 2.54, p = .1$, 400, $\chi^2(1) = .99, p > .5$, and 800, $\chi^2(1) = .05, p > .5$. Fourth ranked members with high self-efficacy still performed faster from individual to relay performance in the 200, $\chi^2(1) = 29.96, p < .001$, 400, $\chi^2(1) = 26.33, p < .001$, and 800, $\chi^2(1) = 14.81, p < .001$.

With respect to variance, Time varied significantly between relays, $\chi^2(84, N = 85) = 51.29, p < .001$. ICCs were calculated for relays ($\rho_{c00k} = .91$), demonstrating that 91% of the variance in Time was explained between relays. Deviance comparisons between this model (Model 2) and Model 1 indicated that Model 2 is significantly different, $\chi^2(4) = 66.74, p < .001$. Hypothesis 5 was not supported. Complete results for Model 2 can be found in Table 10. Estimated mean times and percent changes from individual to relay performance can be found in Table 11. Mean times are also displayed in Figure 4 through 6.

Hypothesis 6 predicted that other efficacy would moderate the motivation gain relationship, in that those with higher other efficacy would demonstrate a motivation gain from the individual to the relay condition. HLM was used to analyze this hypothesis. Model 1 was used as a starting point and both High and Low Other Efficacy as well as an interaction effect

Table 10

Model 2 for performance time, including the moderating effects of self-efficacy

Fixed Effect	Parameter	Coefficient	<i>SE</i>	<i>df</i>	<i>t</i>
Intercept	B ₀₀	3.15	.013	279	234.88**
Relay	B ₁₀	.047	.005	279	9.43**
Distance 400	B ₂₀	.784	.017	279	45.94**
Distance 800	B ₃₀	1.55	.017	279	86.57**
Rank 2	B ₄₀	.020	.003	279	5.90**
Rank 3	B ₅₀	.034	.003	279	9.93**
Rank 4	B ₆₀	.053	.003	279	14.48**
Low Self-Efficacy	B ₇₀	.001	.003	279	.52
High Self-Efficacy	B ₈₀	.001	.004	279	.30
Relay*Distance 400	B ₉₀	.003	.004	279	.76
Relay*Distance 800	B ₁₀₀	.009	.004	279	2.09*
Relay*Rank 2	B ₁₁₀	-.022	.004	279	-4.71**
Relay*Rank 3	B ₁₂₀	-.031	.004	279	-6.68**
Relay*Rank 4	B ₁₃₀	-.052	.004	279	-10.55**
Low Self-Efficacy	B ₁₄₀	.001	.003	279	.52
High Self-Efficacy	B ₁₅₀	.001	.004	279	.30

Random Effect	Parameter	Variance Component	<i>SD</i>	<i>df</i>	χ^2
Individual	<i>b</i> _{00j}	.000	.001	155	117.78
Relay	<i>c</i> _{00k}	.003	.062	84	5359.74**
Error	<i>e</i>	.000	.019		

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

Table 11

Model 2 Estimated mean times and percent changes between relay and individual performance

			200 Yard Relay	% Change	400 Yard Relay	% Change	800 Yard Relay	% Change
Low Self- Efficacy	Rank 1	Individual	23.52		51.51		111.01	
		Relay	24.78	5.39**	54.47	5.74**	118.07	6.35**
	Rank 2	Individual	24.01		52.58		113.33	
		Relay	24.74	3.06**	54.37	3.40**	117.87	4.00**
	Rank 3	Individual	24.34		53.32		114.92	
		Relay	24.85	2.08**	54.62	2.42**	118.39	3.02**
	Rank 4	Individual	24.80		54.33		117.09	
		Relay	24.82	.04	54.54	.37	118.22	.95*
High Self- Efficacy	Rank 1	Individual	23.50		51.48		110.94	
		Relay	24.07	2.41**	52.90	2.75**	114.66	3.35**
	Rank 2	Individual	23.99		52.55		113.25	
		Relay	24.03	.15	52.80	.48	114.47	1.07*
	Rank 3	Individual	24.33		53.29		114.84	
		Relay	24.13	-.79	53.04	-.46	114.97	.11
	Rank 4	Individual	24.79		54.30		117.02	
		Relay	24.10	-2.78**	52.96	-2.45**	114.80	-1.89**

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

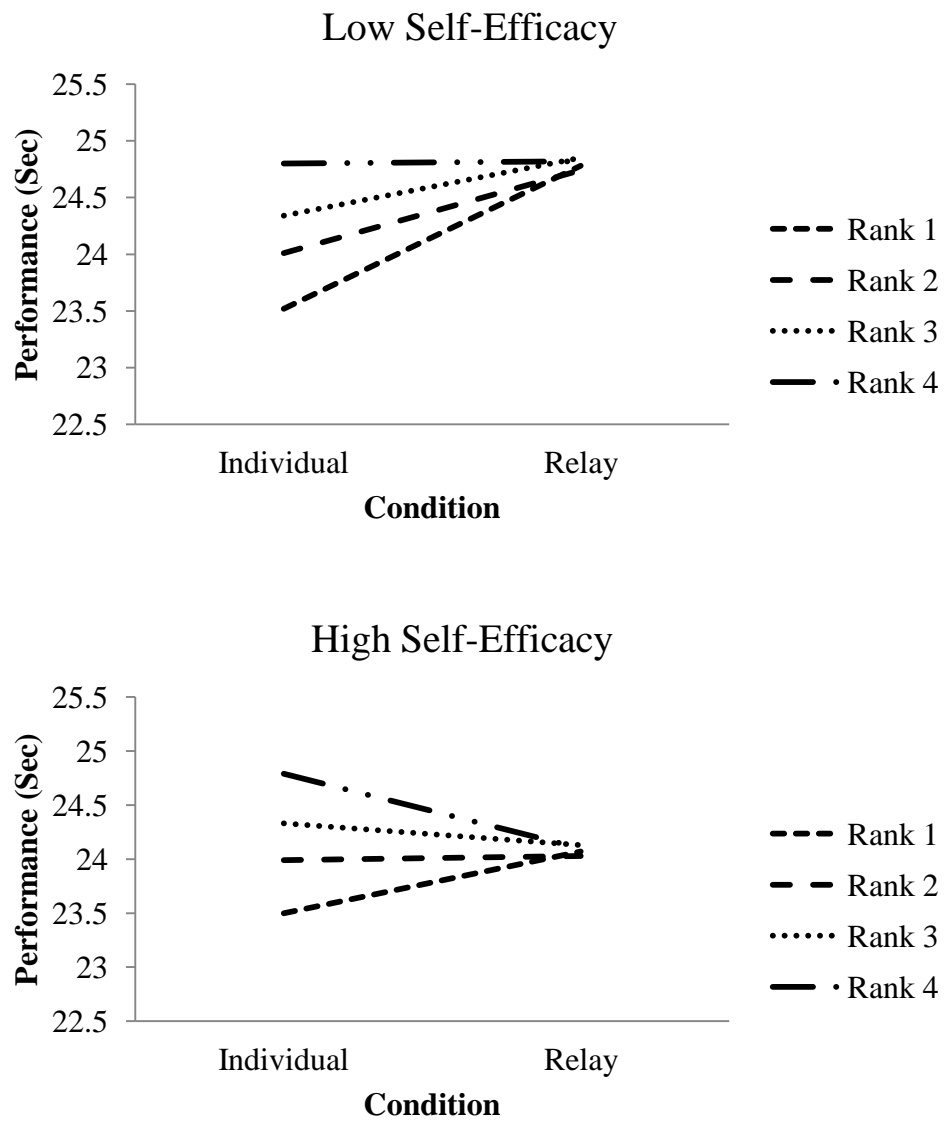


Figure 4. Individual and relay performance by rank with low and high self-efficacy beliefs at the 200 distance.

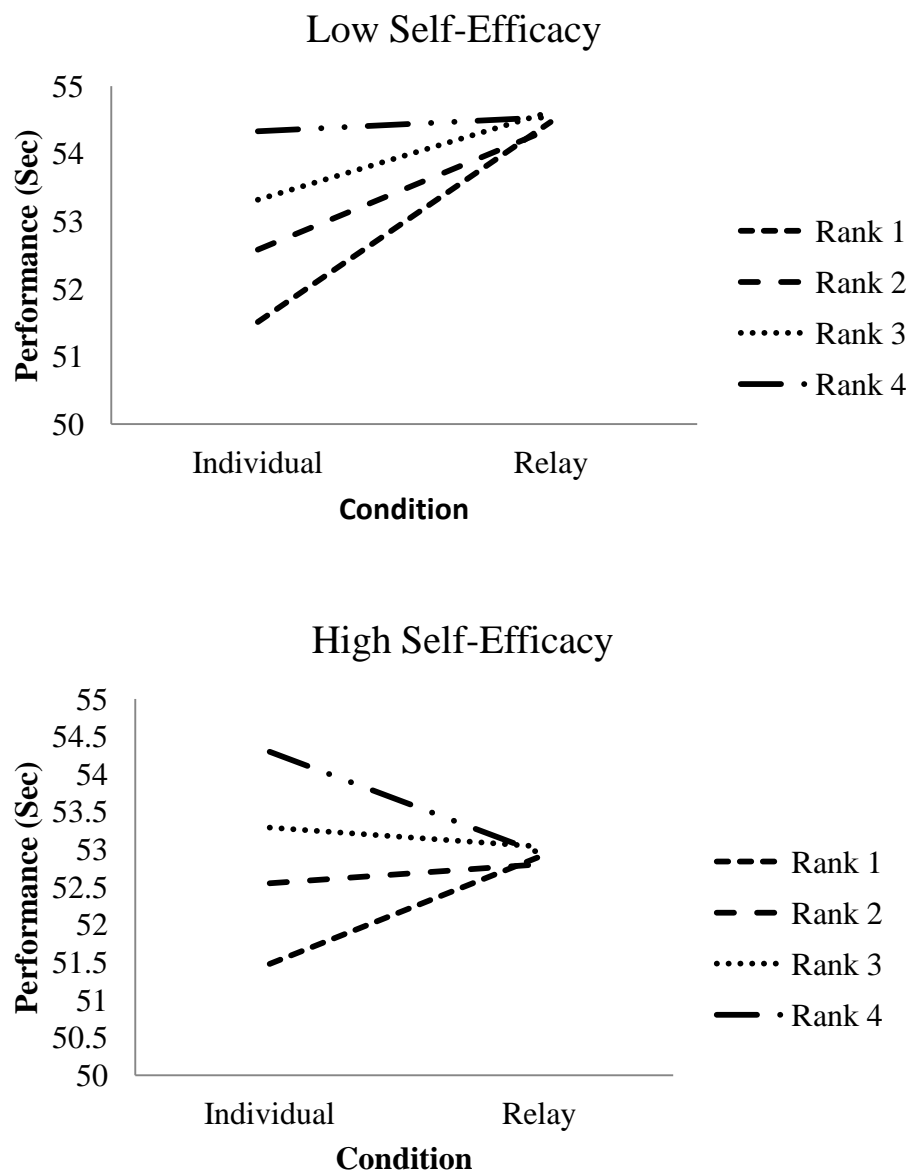


Figure 5. Individual and relay performance by rank with low and high self-efficacy beliefs at the 400 distance

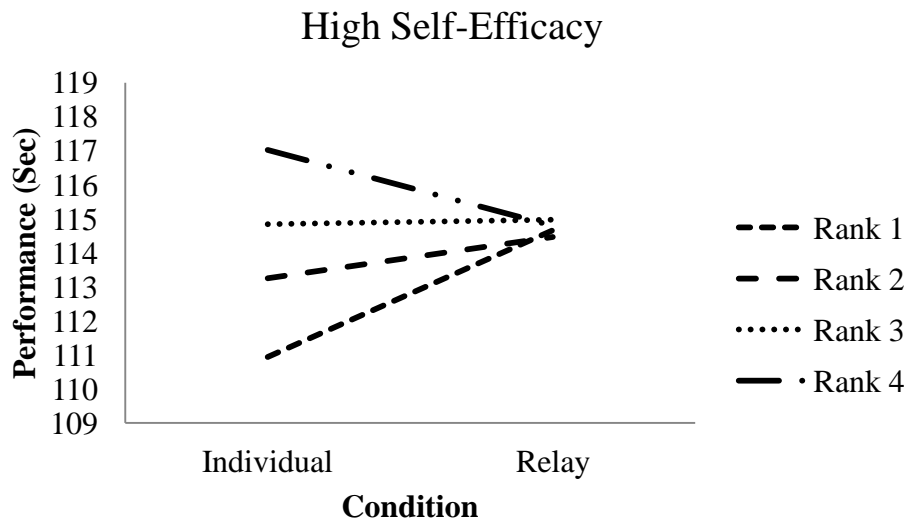
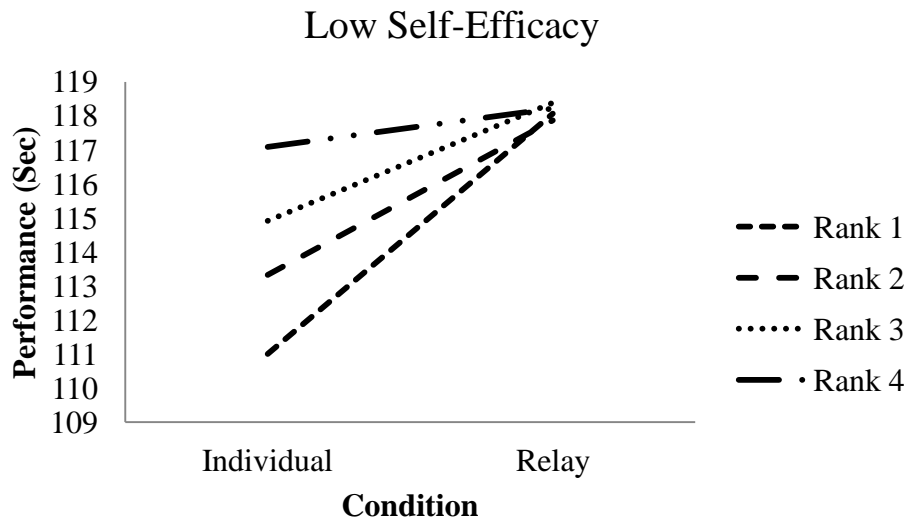


Figure 6. Individual and relay performance by rank with low and high self-efficacy beliefs at the 800 distance

between Relay by both High and Low Efficacy were added. The completed Model 3 is as follows:

$$\begin{aligned}
Y_{ijk} = & \pi_{0jk} + \pi_{1jk}*(TEAM_{ijk}) + \pi_{2jk}*(D400_{ijk}) + \pi_{3jk}*(D800_{ijk}) + \pi_{4jk}*(RANK2_{ijk}) \\
& + \pi_{5jk}*(RANK3_{ijk}) + \pi_{6jk}*(RANK4_{ijk}) + \pi_{7jk}*(TEAMD400_{ijk}) + \pi_{8jk}*(TEAMD800_{ijk}) \\
& + \pi_{9jk}*(TEAMR2_{ijk}) + \pi_{10jk}*(TEAMR3_{ijk}) + \pi_{11jk}*(TEAMR4_{ijk}) + \pi_{12jk}*(LOWOE_{ijk}) \\
& + \pi_{13jk}*(HIGHOE_{ijk}) + \pi_{14jk}*(TEAMLOE_{ijk}) + \pi_{15jk}*(TEAMHOE_{ijk}) + e_{ijk}
\end{aligned}$$

In Model 3, Y_{ijk} is the performance time of swimmer j in relay k , π_{0jk} is the Level 1 intercept, π_{1jk} is the effect of performing individually or in the relay, π_{2jk} is the effect of the 400 distance individually, π_{3jk} is the effect of the 800 distance individually, π_{4jk} is the effect of the second ranked individual, π_{5jk} is the effect of the third ranked individual, π_{6jk} is the effect of the fourth ranked individual, π_{7jk} is the interaction effect of the relay performance at the 400 relay distance, π_{8jk} is the interaction effect of the relay performance at the 800 distance, π_{9jk} is the interaction effect of the second ranked individual on the relay, π_{10jk} is the interaction effect of the third ranked individual on the relay, π_{11jk} is the interaction effect of the fourth ranked person on the relay, π_{12jk} is the effect of low other efficacy individually, π_{13jk} is the effect of high other efficacy individually, π_{14jk} is the interaction effect between relay and low other

efficacy, π_{15jk} is the interaction effect between relay and high other efficacy, and e_{ijk} is the error associated with each swimmer j in relay k .

Significant predictors were the same as found in Model 1, with the addition of High Other Efficacy, $t(279) = 2.44, p < .05$. However this was superseded by a Relay x High Other Efficacy interaction, $t(279) = -5.10, p < .001$ indicating that those with high other efficacy in the relay decreased their time from individual to relay performance. Model 3 was also used to answer research Question 3, which asked if low other efficacy would lead to a social compensation effect, however, the Relay x Low Other Efficacy interaction was not significant, $t(279) = 1.06, p = .29$. The Relay x Rank 2, $t(279) = -4.30, p < .001$, Relay x Rank 3, $t(279) = -6.21, p < .001$, and Relay x Rank 4, $t(279) = -9.85, p < .001$, interactions were also significant.

To investigate Model 3 further, estimated means were calculated and contrasts were run to determine the effects of High and Low Other Efficacy on differences in performance from the individual to the relay condition as it pertained to specific ranks. In general, individuals with low other efficacy performed worse in the relay condition compared to the individuals with high other efficacy, $\chi^2(1) = 11.05, p < .01$. The results of the contrasts were very similar to the results of Self-Efficacy in that second ranked individuals with high other efficacy had no difference in their performance from the individual to the relay condition in the 200, $\chi^2(1) = .27, p > .5$, and 400 distance, $\chi^2(1) = .86, p > .5$. While the third ranked member with high other efficacy also showed no performance change from the individual to relay performance in the 200, $\chi^2(1) = 1.73, p = .18$, 400, $\chi^2(1) = .86, p > .5$, and 800, $\chi^2(1) = .51, p > .5$. The fourth ranked member

with high other efficacy increased performance from the individual to relay swim in the 200, $\chi^2(1) = 24.70, p < .001$, 400, $\chi^2(1) = 23.33, p < .001$, and 800, $\chi^2(1) = 10.13, p < .01$.

With respect to variance, Time varied significantly between relays, $\chi^2(84, N = 85) = 5668.57, p < .001$. The ICC for relays was calculated, relays ($\rho_{c00k} = .91$), demonstrating that 91% of the variance in Time was explained between relays. Deviance in this model was compared against Model 1 indicating that the models are significantly different, $\chi^2(4) = 42.80, p < .001$, and against Model 2, $\chi^2(0) = 23.48, p > .5$, indicating there was no significant difference between the models with Self-Efficacy or Other Efficacy as moderators. Hypothesis 6 was supported only for the fourth ranked member. Full Model 3 results can be found in Table 12. Estimated mean times and percent changes between individual and relay performance can be found in Table 13. Mean times are also displayed in Figure 7-9. Model comparisons for all hypothesis tested models can be found in Table 14 while ICC calculations for hypotheses models can be found in Table 15.

Research Questions

There were seven additional research questions that were investigated in this dissertation. The first research question asked if there would be a performance-change difference from individual to relay performance depending on the serial position of the relay. This research question was also tested using an HLM model. In this model, Rank was replaced with Position (2, 3, 4) as well as a Relay/Position interaction effect. The model used for this research question (Model 4) is below:

Table 12

Model 3 for performance time, including the moderating effects of other efficacy

Fixed Effect	Parameter	Coefficient	<i>SE</i>	<i>df</i>	<i>t</i>
Intercept	B ₀₀	3.15	.013	279	226.70**
Relay	B ₁₀	.045	.005	279	9.05**
Distance 400	B ₂₀	.784	.017	279	44.10**
Distance 800	B ₃₀	1.55	.018	279	83.02**
Rank 2	B ₄₀	.020	.003	279	5.78**
Rank 3	B ₅₀	.034	.003	279	9.86**
Rank 4	B ₆₀	.054	.003	279	14.65**
Relay*Distance 400	B ₇₀	.001	.004	279	.40
Relay*Distance 800	B ₈₀	.010	.004	279	2.30*
Relay*Rank 2	B ₉₀	-.020	.004	279	-4.30**
Relay*Rank 3	B ₁₀₀	-.030	.004	279	-6.21**
Relay*Rank 4	B ₁₁₀	-.049	.005	279	-9.85**
Low Other Efficacy	B ₁₂₀	-.002	.003	279	-.66
High Other Efficacy	B ₁₃₀	.009	.003	279	2.44*
Relay*Low Other Efficacy	B ₁₄₀	.004	.004	279	1.06
Relay*High Other Efficacy	B ₁₅₀	-.021	.004	279	-5.10**

Random Effect	Parameter	Variance Component	<i>SD</i>	<i>df</i>	χ^2
Individual	<i>b_{00j}</i>	.000	.001	155	116.62
Relay	<i>c_{00k}</i>	.004	.065	84	5668.57**
Error	<i>E</i>	.000	.019		

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

Table 13

Model 3 Estimated mean times and percent changes between relay and individual performance

			200 Yard Relay	% Change	400 Yard Relay	% Change	800 Yard Relay	% Change
Low Other Efficacy	Rank 1	Individual	23.37		51.22		110.30	
		Relay	24.57	5.11**	53.93	5.20**	117.13	6.19**
	Rank 2	Individual	23.86		52.28		112.58	
		Relay	24.56	2.96**	53.92	3.14**	117.10	4.01**
	Rank 3	Individual	24.20		53.03		114.20	
		Relay	24.69	2.00**	54.19	2.18**	117.68	3.04**
	Rank 4	Individual	24.68		54.07		116.44	
		Relay	24.69	.06	54.20	.23	117.71	1.08*
High Other Efficacy	Rank 1	Individual	23.66		51.85		111.66	
		Relay	24.22	2.36**	53.17	2.54**	115.47	3.41**
	Rank 2	Individual	24.15		52.92		113.97	
		Relay	24.22	.26	53.16	.44	115.44	1.29*
	Rank 3	Individual	24.50		53.68		115.61	
		Relay	24.33	-.66	53.42	-.49	116.01	.34
	Rank 4	Individual	24.98		54.74		117.88	
		Relay	24.34	-2.55**	53.43	-2.38**	116.04	-1.55*

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

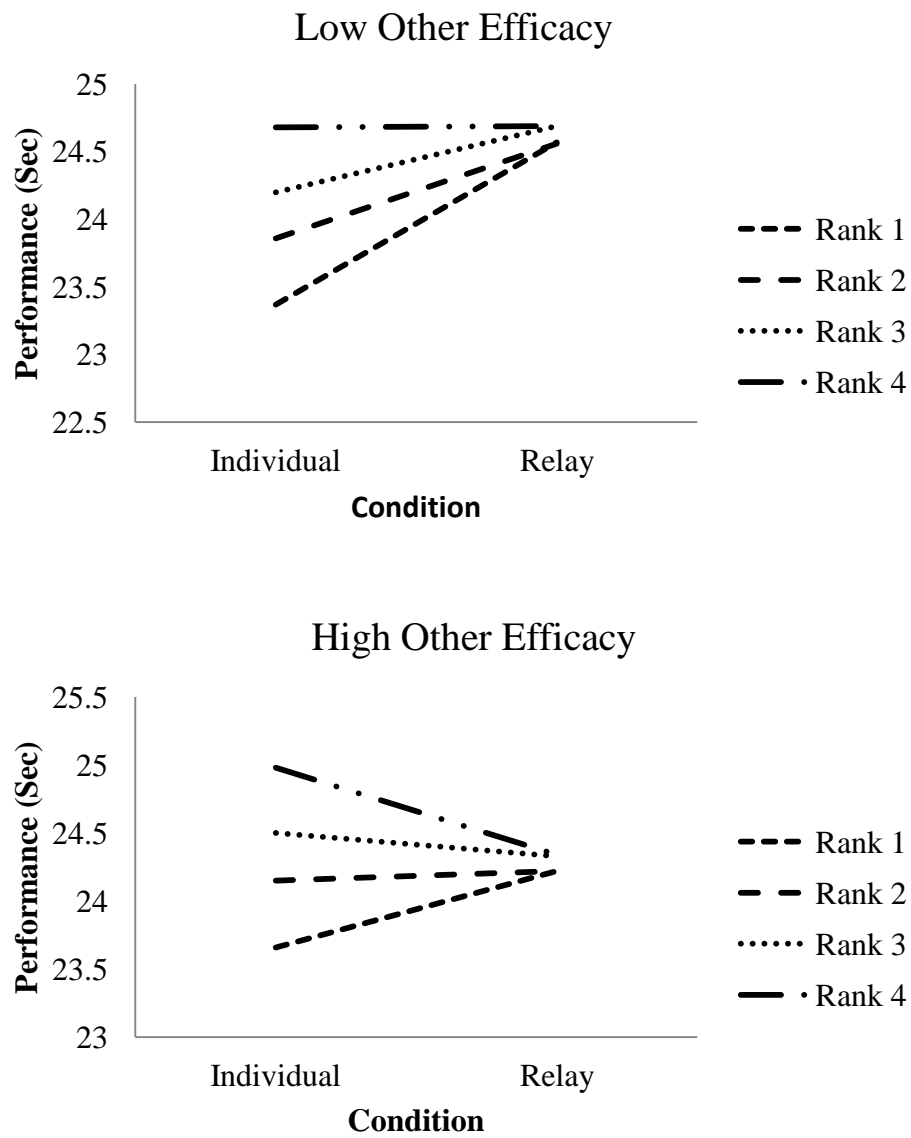


Figure 7. Individual and relay performance by rank with low and high other efficacy beliefs at the 200 distance

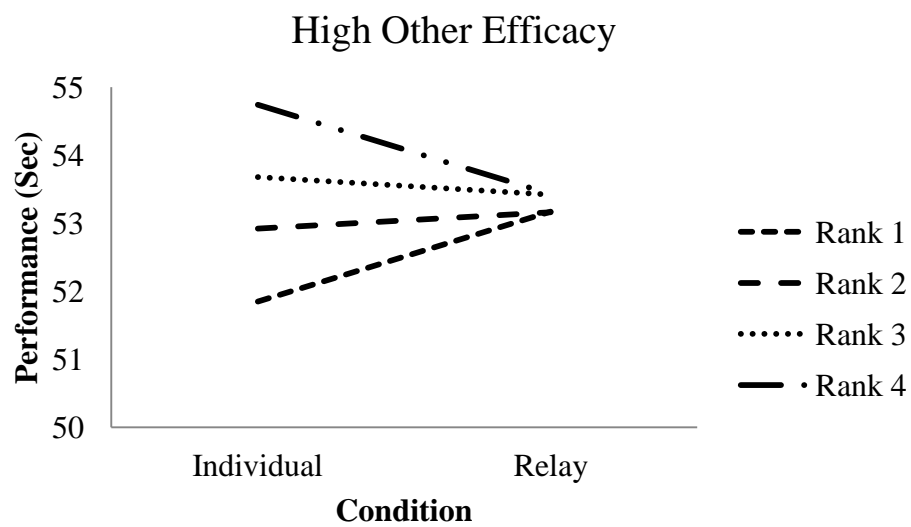
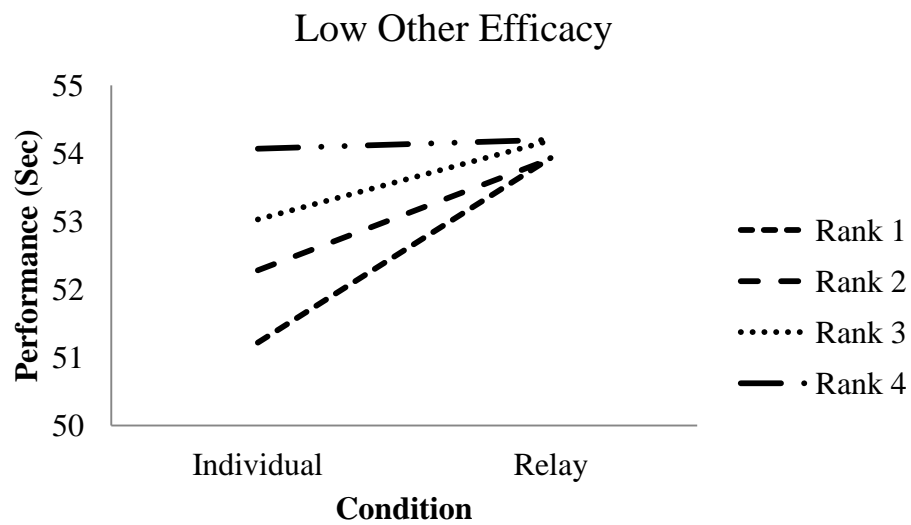


Figure 8. Individual and relay performance by rank with low and high other efficacy beliefs at the 400 distance

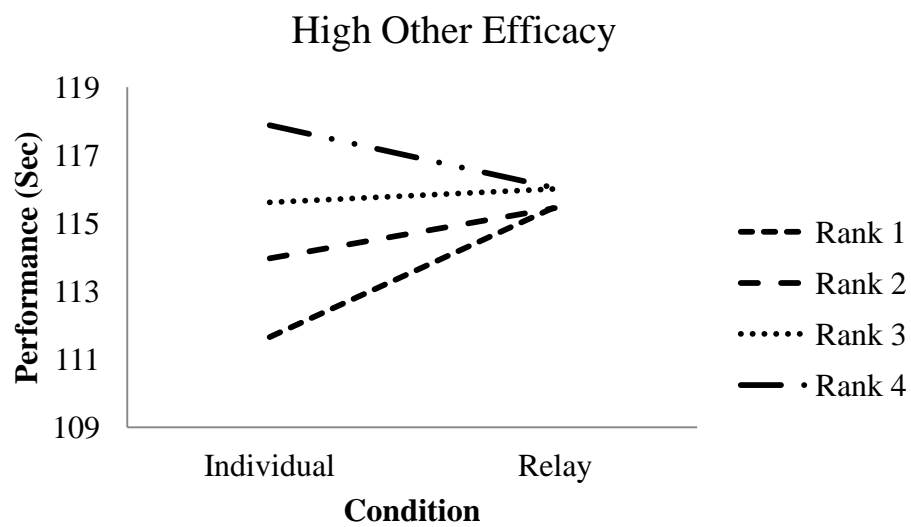
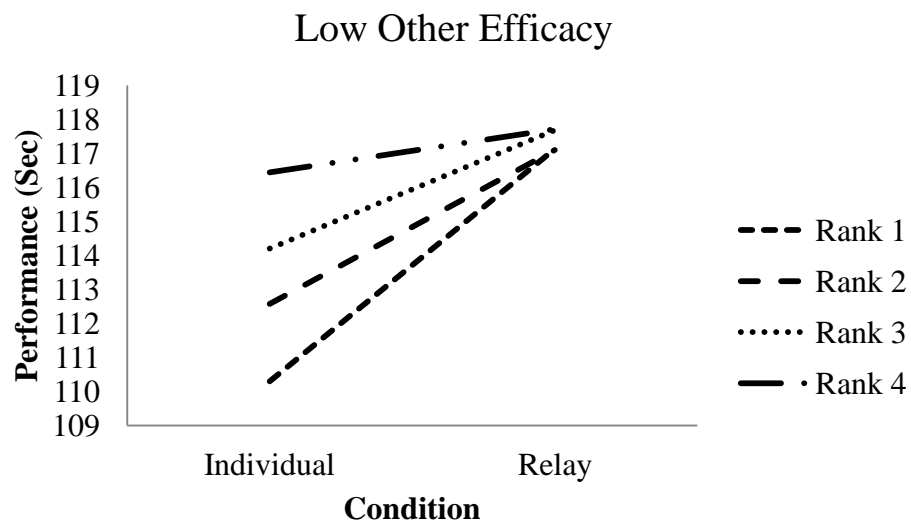


Figure 9. Individual and relay performance by rank with low and high other efficacy beliefs at the 800 distance

Table 14

Deviance comparisons between hypotheses models

Comparison	χ^2	<i>df</i>	<i>p</i>
Unconditional vs. 1	621.32	11	< .001
1 vs. 2	66.29	4	< .001
1 vs. 3	42.80	4	< .001
2 vs. 3	23.48	0	> .5

Table 15

ICCs of random effects pertaining to hypotheses models

Model	Swimmer	Relay	Error
Unconditional	.000	.997	.002
1	.000	.907	.092
2	.000	.912	.087
3	.000	.914	.085

$$\begin{aligned}
Y_{ijk} = & \pi_{0jk} + \pi_{1jk}*(TEAM_{ijk}) + \pi_{2jk}*(D400_{ijk}) + \pi_{3jk}*(D800_{ijk}) + \pi_{4jk}*(TEAMD400_{ijk}) \\
& + \pi_{5jk}*(TEAMD800_{ijk}) + \pi_{6jk}*(TEAMP2_{ijk}) + \pi_{7jk}*(TEAMP3_{ijk}) + \pi_{8jk}*(TEAMP4_{ijk}) \\
& + \pi_{9jk}*(POS2_{ijk}) + \pi_{10jk}*(POS3_{ijk}) + \pi_{11jk}*(POS4_{ijk}) + e_{ijk}
\end{aligned}$$

In Model 4, Y_{ijk} is the performance time of swimmer j in relay k , π_{0jk} is the Level 1 intercept, π_{1jk} is the effect of performing individually or in the relay, π_{2jk} is the effect of the 400 distance individually, π_{3jk} is the effect of the 800 distance individually, π_{4jk} is the interaction effect of swimming on the relay at the 400 distance, π_{5jk} is the interaction of swimming on the relay at the 800 distance, π_{6jk} is the interaction effect of the second positioned individual on the relay, π_{7jk} is the interaction effect of the third positioned individual on the relay, π_{8jk} is the interaction effect of the fourth positioned individual on the relay, π_{9jk} is the effect of the second positioned individual, π_{10jk} is the effect of the third position individual, π_{11jk} is the effect of the fourth position individual, and e_{ijk} is the error associated with each swimmer j in relay k .

In Model 4, the only significant predictors were the Relay effect, $t(279) = 3.68, p < .001$, in which the relay time was slower in the 200 than the individual time for the individual in the first position. Unsurprisingly, the 400, $t(279) = 44.03, p < .001$, and 800 distance, $t(279) = 83.05, p < .001$, were significantly slower than the 200 distance. There were no significant interactions between relay performance and position.

For Model 4, Time varied significantly between relays, $\chi^2(84, N = 85) = 2713.23, p < .001$ and within relays, $\chi^2(155, N = 156) = 206.63, p < .01$. The ICCs were calculated for relays

($\rho_{c00k} = .86$), and individuals, ($\rho_{b00j} = .01$), demonstrating that 86% of the variance in Time in this Model 4 was explained between relays while 1% of the variance was explained within relays, between individuals. The full model details can be found in Table 16 and means and percent changes between individual and relay condition can be found in Table 17. Mean times are also displayed in Figure 10-12.

The second research question asked if there are differences with respect to gender and the moderating effects of self- and other efficacy. HLM was used to test this research question by creating two additional models. For self-efficacy, Model 2 was used as a start and the variable Gender, an interaction between Relay x Gender, an interaction between Gender x High/Low Self-Efficacy, an interaction between Rank x Gender, and an interaction effect between Relay x Gender x High/Low Self-Efficacy were added. The model used for gender and self-efficacy is below (Model 5):

$$\begin{aligned}
Y_{ijk} = & \pi_{0jk} + \pi_{1jk}*(TEAM_{ijk}) + \pi_{2jk}*(D400_{ijk}) + \pi_{3jk}*(D800_{ijk}) + \pi_{4jk}*(RANK2_{ijk}) \\
& + \pi_{5jk}*(RANK3_{ijk}) + \pi_{6jk}*(RANK4_{ijk}) + \pi_{7jk}*(GENDER_{ijk}) + \pi_{8jk}*(LOWSE_{ijk}) \\
& + \pi_{9jk}*(HIGHSE_{ijk}) + \pi_{10jk}*(TEAMD400_{ijk}) + \pi_{11jk}*(TEAMD800_{ijk}) + \\
& \pi_{12jk}*(TEAMR2_{ijk}) + \pi_{13jk}*(TEAMR3_{ijk}) + \pi_{14jk}*(TEAMR4_{ijk}) + \\
& \pi_{15jk}*(TEAMLSE_{ijk}) + \pi_{16jk}*(TEAMHSE_{ijk}) + \pi_{17jk}*(TGENDER_{ijk}) + \\
& \pi_{18jk}*(GENLSE_{ijk}) + \pi_{19jk}*(GENHSE_{ijk}) + \pi_{20jk}*(R2GEN_{ijk}) + \pi_{21jk}*(R3GEN_{ijk}) + \\
& \pi_{22jk}*(R4GEN_{ijk}) + \pi_{23jk}*(TGENLSE_{ijk}) + \pi_{24jk}*(TGENHSE_{ijk}) + e_{ijk}
\end{aligned}$$

Table 16

Model 4 for performance time according to position

Fixed Effect	Parameter	Coefficient	<i>SE</i>	<i>df</i>	<i>t</i>
Intercept	B ₀₀	3.17	.013	279	229.27**
Relay	B ₁₀	.005	.005	279	2.68**
Distance 400	B ₂₀	.78	.017	279	44.03**
Distance 800	B ₃₀	1.55	.018	279	83.05**
Position 2	B ₄₀	.009	.004	279	2.09*
Position 3	B ₅₀	.005	.004	279	1.25
Position 4	B ₆₀	.001	.004	279	.35
Relay*Distance 400	B ₇₀	.005	.005	279	.41
Relay*Distance 800	B ₈₀	.005	.005	279	1.61
Relay*Position 2	B ₉₀	-.005	.006	279	-.94
Relay*Position 3	B ₁₀₀	-.002	.006	279	-.41
Relay*Position 4	B ₁₁₀	-.008	.006	279	-1.36

Random Effect	Parameter	Variance Component	<i>SD</i>	<i>df</i>	χ^2
Individual	<i>b_{00j}</i>	.006	.000	155	206.63*
Relay	<i>c_{00k}</i>	.064	.064	84	2713.23**
Error	<i>e</i>	.024	.024		

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

Table 17

Model 4 Estimated mean times and percent changes between relay and individual performance

		200 Yard Relay	% Change	400 Yard Relay	% Change	800 Yard Relay	% Change
Position 1	Individual	24.10		52.58		113.38	
	Relay	24.49	1.98**	53.74	2.21**	116.64	2.88*
Position 2	Individual	24.24		53.08		114.45	
	Relay	24.58	1.40*	53.94	1.63**	117.08	2.30*
Position 3	Individual	24.15		52.67		114.02	
	Relay	24.57	1.72*	53.92	1.95**	117.02	2.62**
Position 4	Individual	24.05		52.67		113.56	
	Relay	24.32	1.13*	53.38	1.36*	115.87	2.03**

* $p < .01$, ** $p < .001$

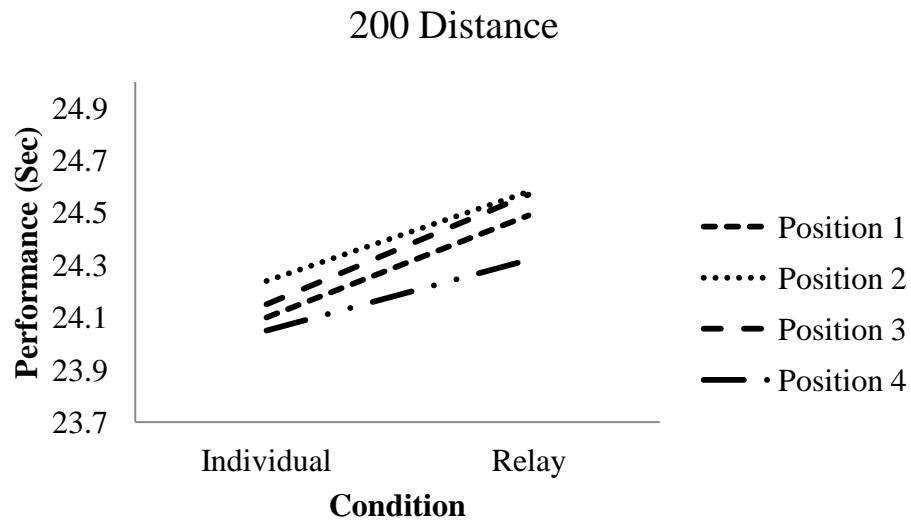


Figure 10. Individual and relay performance by position at the 200 distance

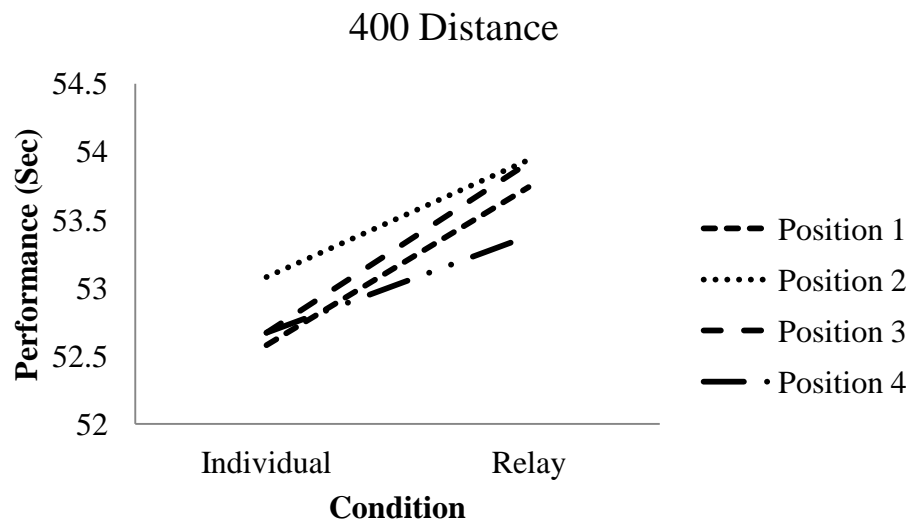


Figure 11. Individual and relay performance by position at the 400 distance

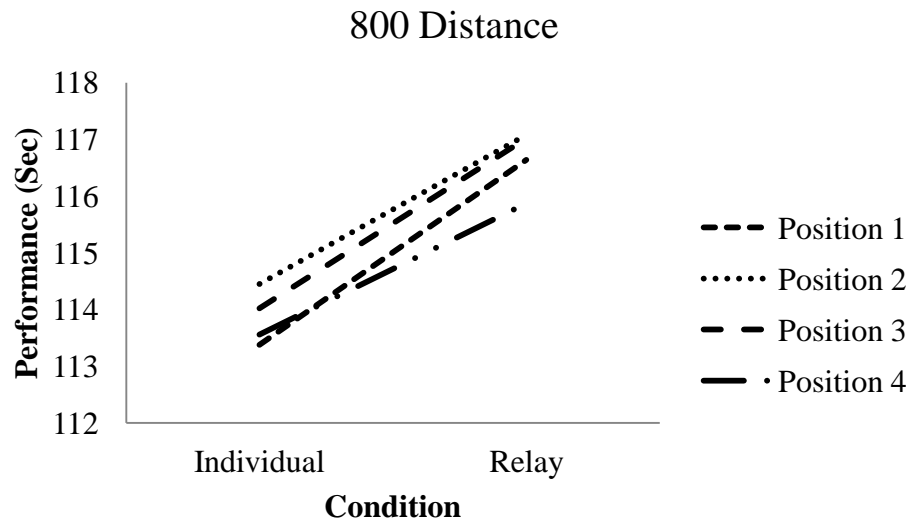


Figure 12. Individual and relay performance by position at the 800 distance

In Model 5, Y_{ijk} is the performance time of swimmer j in relay k , π_{0jk} is the Level 1 intercept, π_{1jk} is the effect of relay performance at the 200 distance, π_{2jk} is the effect of the 400 distance individually, π_{3jk} is the effect of the 800 distance individually, π_{4jk} is the effect for second ranked females, π_{5jk} is the effect for third ranked females, π_{6jk} is the effect for fourth ranked females, π_{7jk} is the effect for males individually, π_{8jk} is the effect of low self-efficacy for females individually, π_{9jk} is the effect of high self-efficacy for females individually, π_{10jk} is the interaction effect of the relay performance at the 400 relay distance, π_{11jk} is the interaction effect of the relay performance at the 800 distance, π_{12jk} is the interaction effect of the second ranked individual on the relay, π_{13jk} is the interaction effect of the third ranked individual on the relay, π_{14jk} is the interaction effect of the fourth ranked individual on the relay, π_{15jk} is the interaction effect between relay and low self-efficacy beliefs for females, π_{16jk} is the interaction effect between relay and high self-efficacy beliefs for females, π_{17jk} is the interaction effect of relay performance for males, π_{18jk} is the interaction effect of low self-efficacy beliefs for males, π_{19jk} is the interaction effect of high self-efficacy beliefs for males, π_{20jk} is the interaction effect of second ranked males individually, π_{21jk} is the interaction effect of third ranked males individually, π_{22jk} is the interaction effect of fourth ranked males individually, π_{23jk} is the interaction effect of low self-efficacy beliefs and being on the relay for males, π_{24jk}

is the interaction effect of high self-efficacy beliefs and being on the relay for females, and e_{ijk} is the error associated with each swimmer j in relay k .

Results demonstrated that there were significant interaction effects between Relay x High Self-Efficacy, $t(279) = -2.03, p < .05$ and Relay x Low Self-Efficacy, $t(279) = 2.02, p < .05$ indicating that individuals performed differently in the relay condition. There were also significant interaction effects for Relay x Gender, $t(279) = 2.73, p < .01$ indicating that males performed differently in the relay condition, and Gender x Low Self-Efficacy, $t(279) = 2.78, p < .01$, indicating that males performed differently with low self-efficacy beliefs. Further there were significant Rank x Gender interactions between the second ranked individual x gender, $t(279) = -2.06, p < .05$, and the third ranked individual x gender, $t(279) = -3.50, p < .05$. Finally, there was a significant interaction between Relay x Gender x High Self-Efficacy, $t(279) = -3.71, p < .001$.

Contrast and mean times were calculated to demonstrate the differences between specific Rank according to Gender and High or Low Self-Efficacy. The results indicated that for females, the fourth ranked member demonstrated a motivation gain from the individual to relay performance with high self-efficacy in the 200, $\chi^2(1) = 15.94, p < .001$, 400, $\chi^2(1) = 13.02, p < .001$, and 800, $\chi^2(1) = 5.05, p < .05$. For males with high self-efficacy, the third ranked member performed better from the individual to relay condition in the 200, $\chi^2(1) = 7.88, p < .01$, and 400, $\chi^2(1) = 5.19, p < .05$. For males with high self-efficacy, the fourth ranked member also showed a motivation gain from the individual to relay performance in the 200, $\chi^2(1) = 40.30, p < .001$, 400, $\chi^2(1) = 35.09, p < .001$, and 800, $\chi^2(1) = 23.71, p < .001$.

For Model 5, Time varied significantly between relays, $\chi^2(84, N = 85) = 693.38, p < .001$. The ICC was calculated for relays, ($\rho_{c00k} = .59$), demonstrating that 59% of the variance in Time in this model is explained between relays. The full model details can be found in Table 18 and means and percent changes between individual and relay condition can be found in Table 19 and Table 20. Mean times are also displayed in Figure 13 through 15.

The second research question also asked about the relationship between other efficacy and gender. Model 3 was used as a base. Gender, an interaction between Relay x Gender, an interaction between Gender x High/Low Other Efficacy, and an interaction effect between Relay x Gender x High/Low Other Efficacy were added. Below is the model used (Model 6):

$$\begin{aligned}
Y_{ijk} = & \pi_{0jk} + \pi_{1jk}*(TEAM_{ijk}) + \pi_{2jk}*(D400_{ijk}) + \pi_{3jk}*(D800_{ijk}) + \pi_{4jk}*(RANK2_{ijk}) \\
& + \pi_{5jk}*(RANK3_{ijk}) + \pi_{6jk}*(RANK4_{ijk}) + \pi_{7jk}*(GENDER_{ijk}) + \pi_{8jk}*(LOWOE_{ijk}) \\
& + \pi_{9jk}*(HIGHOE_{ijk}) + \pi_{10jk}*(TEAMD400_{ijk}) + \pi_{11jk}*(TEAMD800_{ijk} + \\
& \pi_{12jk}*(TEAMR2_{ijk}) + \pi_{13jk}*(TEAMR3_{ijk}) + \pi_{14jk}*(TEAMR4_{ijk}) + \pi_{15jk}*(TEAMLOE_{ijk}) + \\
& \pi_{16jk}*(TEAMHOE_{ijk}) + \pi_{17jk}*(TGENDER_{ijk}) + \pi_{18jk}*(GENLSE_{ijk}) + \pi_{19jk}*(GENHSE_{ijk}) + \\
& \pi_{20jk}*(R2GEN_{ijk}) + \pi_{21jk}*(R3GEN_{ijk}) + \pi_{22jk}*(R4GEN_{ijk}) + \pi_{23jk}*(TGENLOE_{ijk}) + \\
& \pi_{24jk}*(TGENHOE_{ijk}) + e_{ijk}
\end{aligned}$$

In Model 6, Y_{ijk} is the performance time of swimmer j in relay k , π_{0jk} is the Level 1 intercept, π_{1jk} is the effect of relay performance at the 200 distance, π_{2jk} is the effect of the 400 distance individually, π_{3jk} is the effect of the 800 distance individually, π_{4jk} is the effect for

Table 18

Model 5 for performance, including the moderating effects of self-efficacy and gender

Fixed Effect	Parameter	Coefficient	<i>SE</i>	<i>df</i>	<i>t</i>
Intercept	B ₀₀	3.20	.006	279	458.40**
Relay	B ₁₀	.040	.005	279	7.46**
Distance 400	B ₂₀	.784	.077	279	111.11**
Distance 800	B ₃₀	1.55	.007	279	210.61**
Rank 2	B ₄₀	.023	.003	279	5.84**
Rank 3	B ₅₀	.039	.003	279	9.99**
Rank 4	B ₆₀	.051	.004	279	12.02**
Gender	B ₇₀	-.111	.008	279	-12.87**
Low Self-Efficacy	B ₈₀	.001	.004	279	.31
High Self-Efficacy	B ₉₀	-.007	.005	279	-1.53
Relay*Distance 400	B ₁₀₀	.003	.004	279	.82
Relay*Distance 800	B ₁₁₀	.009	.004	279	2.35*
Relay*Rank 2	B ₁₂₀	-.020	.004	279	-4.54**
Relay*Rank 3	B ₁₃₀	-.032	.004	279	-7.01**
Relay*Rank 4	B ₁₄₀	-.052	.004	279	-10.95**
Relay*Low Self-Efficacy	B ₁₅₀	-.010	.005	279	-2.02*
Relay*High Self-Efficacy	B ₁₆₀	-.011	.005	279	-2.03*
Relay*Gender	B ₁₇₀	.018	.006	279	2.74*
Gender*Low Self-Efficacy	B ₁₈₀	.022	.008	279	2.74*
Gender*High Self-Efficacy	B ₁₉₀	-.000	.008	279	-.10
Rank 2*Gender	B ₂₀₀	-.011	.005	279	-2.11*
Rank 3*Gender	B ₂₁₀	-.019	.005	279	-3.46**
Rank 4*Gender	B ₂₂₀	-0.00	.005	279	-.12
Relay*Gender*Low Self-Efficacy	B ₂₃₀	-.016	.009	279	-1.80
Relay*Gender*High Self-Efficacy	B ₂₄₀	-.032	.008	279	-3.71**

Table 18 (cont'd)

Random Effect	Parameter	Variance Component	<i>SD</i>	<i>df</i>	χ^2
Individual	b_{00j}	.000	.004	155	138.69
Relay	c_{00k}	.000	.023	84	773.29**
Error	e	.000	.018		

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

Table 19

Model 5 Estimated mean times and percent changes between relay and individual performance for females

			200 Yard Relay	% Change	400 Yard Relay	% Change	800 Yard Relay	% Change
Low Self- Efficacy	Rank 1	Individual	24.64		54.02		116.48	
		Relay	25.94	5.28**	57.07	5.64**	123.86	6.33**
	Rank 2	Individual	25.23		55.30		119.24	
		Relay	26.01	3.10**	57.21	3.45**	124.17	4.13**
	Rank 3	Individual	25.63		56.18		121.14	
		Relay	26.12	1.92**	57.46	2.27**	124.71	2.94**
	Rank 4	Individual	25.93		56.85		122.58	
		Relay	25.91	-.08	56.99	.25	123.70	.90
High Self- Efficacy	Rank 1	Individual	24.42		53.52		115.41	
		Relay	25.15	3.01**	55.33	3.37**	120.08	4.04**
	Rank 2	Individual	24.99		54.79		118.14	
		Relay	25.22	.88	55.47	1.23*	120.38	1.89**
	Rank 3	Individual	25.39		55.66		120.03	
		Relay	25.33	-.26	55.71	.07	120.91	.73
	Rank 4	Individual	25.69		56.33		121.45	
		Relay	25.12	-2.23**	55.26	-1.90**	119.92	-1.26*

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

Table 20

Model 5 Estimated mean times and percent changes between relay and individual performance for males

			200 Yard Relay	% Change	400 Yard Relay	% Change	800 Yard Relay	% Change
Low Self- Efficacy	Rank 1	Individual	22.54		49.40		106.52	
		Relay	23.77	5.49**	52.30	5.86**	113.50	6.55**
	Rank 2	Individual	22.80		49.99		107.80	
		Relay	23.56	3.31**	51.83	3.67**	112.48	4.34**
	Rank 3	Individual	23.00		50.41		108.70	
		Relay	23.49	2.13**	51.66	2.48**	112.13	3.15**
	Rank 4	Individual	23.70		51.95		112.02	
		Relay	23.73	.11	52.19	.46	113.27	1.11
High Self- Efficacy	Rank 1	Individual	21.82		47.83		103.13	
		Relay	22.17	1.61*	48.77	1.96**	105.84	2.63**
	Rank 2	Individual	22.08		48.40		104.36	
		Relay	21.97	-.48	48.33	-.14	104.89	.51*
	Rank 3	Individual	22.26		49.80		105.23	
		Relay	21.90	-1.61*	48.18	-1.28*	104.56	-.63
	Rank 4	Individual	22.94		50.30		108.45	
		Relay	22.13	-3.56**	48.67	-3.23**	105.63	-2.60**

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

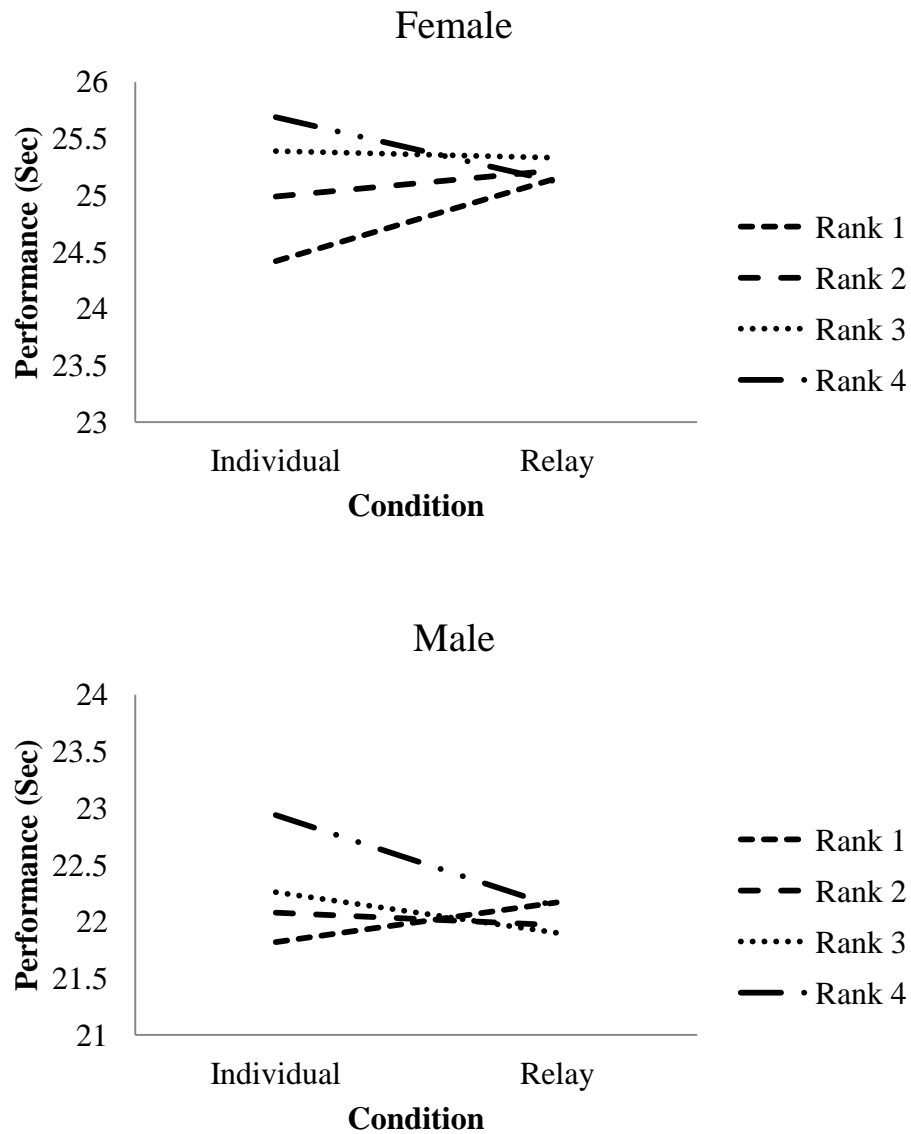


Figure 13. Individual and relay performance by rank and gender with high self-efficacy beliefs at the 200 distance

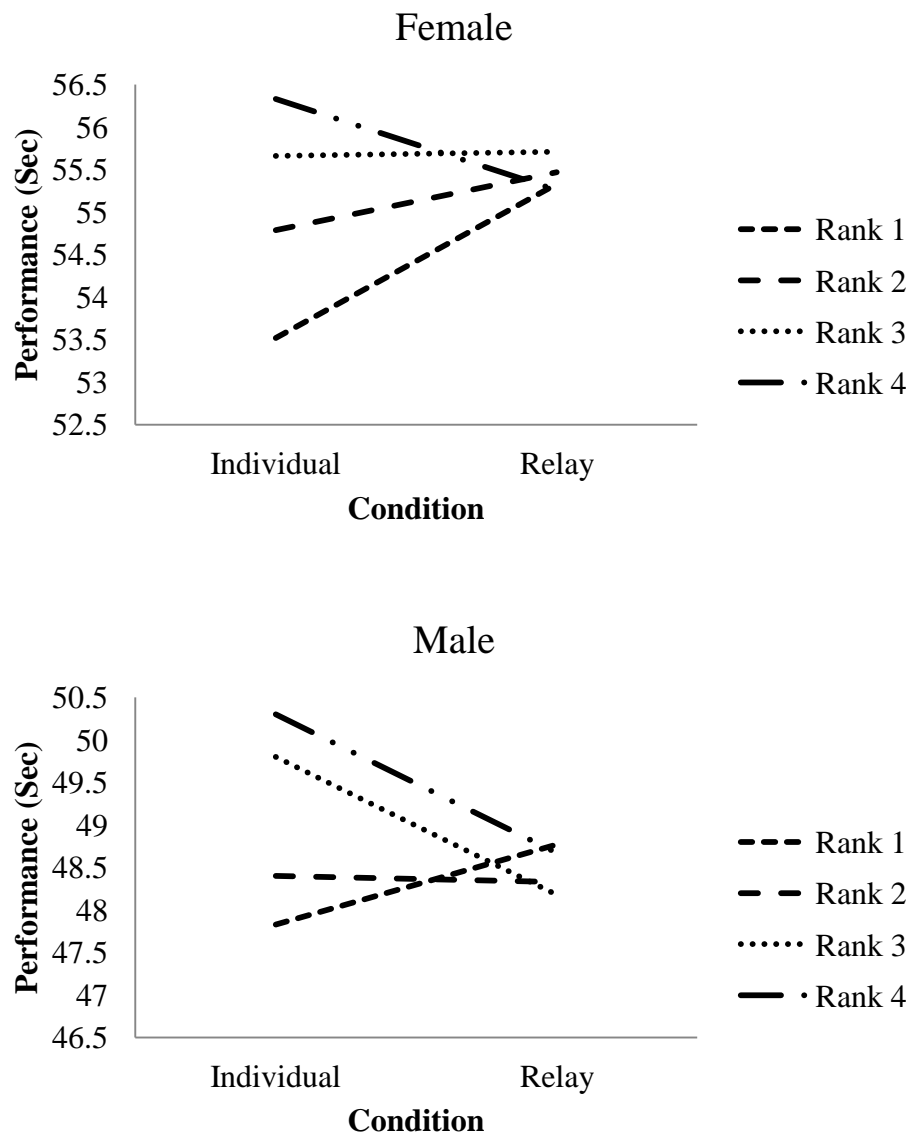


Figure 14. Individual and relay performance by rank and gender with high self-efficacy beliefs at the 400 distance

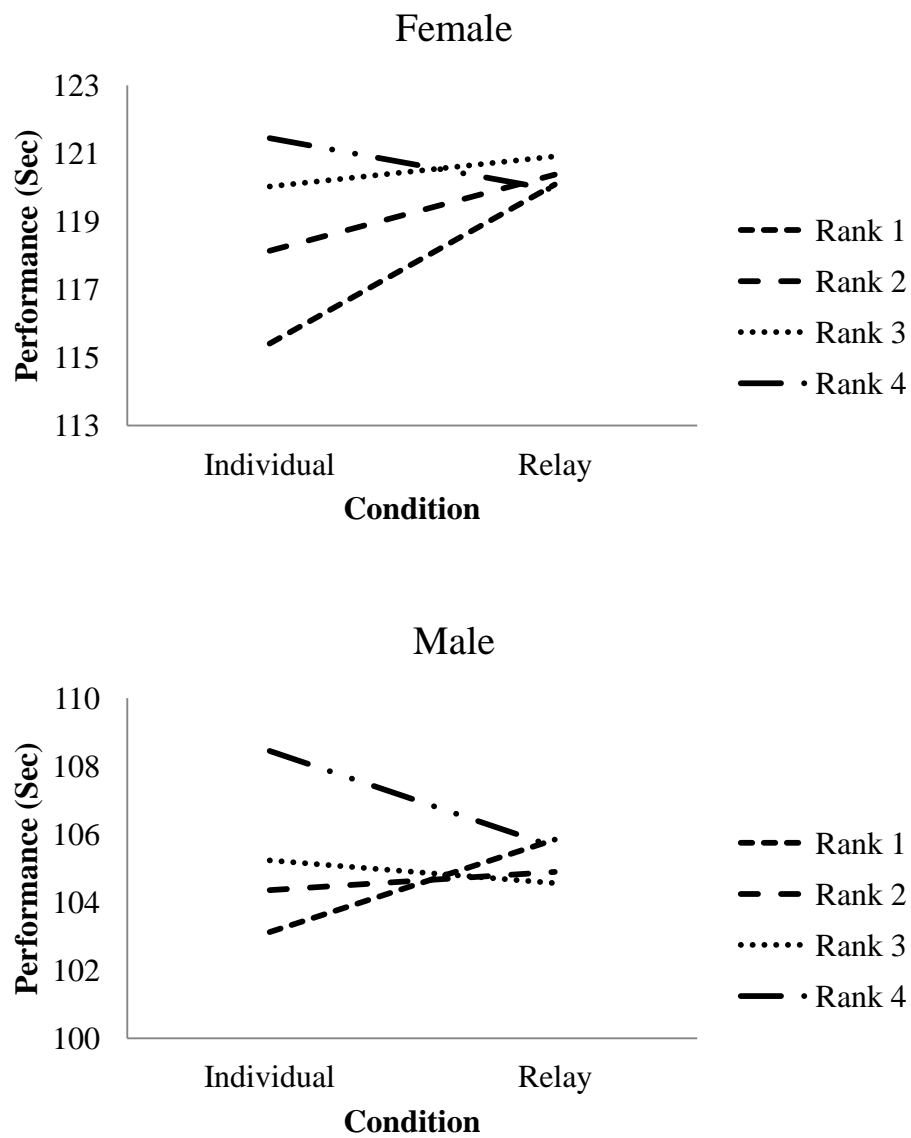


Figure 15. Individual and relay performance by rank and gender with high self-efficacy beliefs at the 800 distance

second ranked females, π_{5jk} is the effect for third ranked females, π_{6jk} is the effect for fourth ranked females, π_{7jk} is the effect for males individually, π_{8jk} is the effect of low other efficacy for females individually, π_{9jk} is the effect of high other efficacy for females individually, π_{10jk} is the interaction effect of the relay performance at the 400 relay distance, π_{11jk} is the interaction effect of the relay performance at the 800 distance, π_{12jk} is the interaction effect of the second ranked individual on the relay, π_{13jk} is the interaction effect of the third ranked individual on the relay, π_{14jk} is the interaction effect of the fourth ranked individual on the relay, π_{15jk} is the interaction effect between relay and low other efficacy beliefs for females, π_{16jk} is the interaction effect between relay and high other efficacy beliefs for females, π_{17jk} is the interaction effect of relay performance for males, π_{18jk} is the interaction effect of low other efficacy beliefs for males, π_{19jk} is the interaction effect of high other efficacy beliefs for males, π_{20jk} is the interaction effect of second ranked males individually, π_{21jk} is the interaction effect of third ranked males individually, π_{22jk} is the interaction effect of fourth ranked males individually, π_{23jk} is the interaction effect of low other efficacy beliefs and being on the relay for males, π_{24jk} is the interaction effect of high other efficacy beliefs and being on the relay for females, and e_{ijk} is the error associated with each swimmer j in relay k .

Results of Model 6 indicated that there was a significant Gender main effect, $t(279) = -11.86, p < .001$. Further, a Relay x Rank 2 interaction, $t(279) = -4.38, p < .001$, a Relay x Rank 3

interaction, $t(279) = -6.46, p < .001$, and a Relay x Rank 4 interaction, $t(279) = -9.91, p < .001$, indicated that these ranks perform differently at the relay level. Further, there were significant Rank 2 x Gender, $t(279) = -2.08, p < .001$, and Rank 3 x Gender, $t(279) = -2.21, p < .001$, interactions indicating that males at rank 2 and 3 performed differently than females. There was also a Relay x High Other Efficacy interaction, $t(279) = -2.37, p < .05$, however this was superseded by a Relay x Gender x High Other Efficacy interaction, $t(279) = -2.54, p < .05$.

Contrasts and means were calculated to determine the relationship between Gender and Other Efficacy within the different ranks. Females ranked fourth with high other efficacy performed better in the relay condition compared to the individual condition in the 200, $\chi^2(1) = 9.96, p < .01$, and 400, $\chi^2(1) = 9.81, p < .01$. For males with high other efficacy, performance in the relay was also better than the individual condition for the third ranked member in the 200, $\chi^2(1) = 7.39, p < .01$, and 400, $\chi^2(1) = 6.24, p < .05$, as well as the fourth ranked member in the 200, $\chi^2(1) = 35.11, p < .001$, 400, $\chi^2(1) = 33.00, p < .001$, and 800, $\chi^2(1) = 18.39, p < .001$.

Time varied significantly between relays, $\chi^2(84, N = 85) = 1078.42, p < .001$. The ICC was calculated for relays, ($\rho_{c00k} = .68$), demonstrating that 68% of the variance in Time in Model 6 was explained between relays. The full model details can be found in Table 21 and means and percent changes between individual and relay condition according to rank and gender can be found in Table 22 and Table 23. Mean times are also displayed in Figure 16 through 18.

The third research question pertaining to a social compensation effect was addressed above with Hypothesis 6. The fourth research question asked if there would be a relationship between RISE beliefs and performance. HLM was also used to test this question and the model

Table 21

Model 6 for performance, including the moderating effects of other efficacy and gender

Fixed Effect	Parameter	Coefficient	<i>SE</i>	<i>df</i>	<i>t</i>
Intercept	B ₀₀	3.19	.007	279	408.13**
Relay	B ₁₀	.043	.005	279	8.17**
Distance 400	B ₂₀	.783	.008	279	92.37**
Distance 800	B ₃₀	1.55	.009	279	175.06**
Rank 2	B ₄₀	.023	.003	279	5.96**
Rank 3	B ₅₀	.038	.004	279	9.66**
Rank 4	B ₆₀	.051	.004	279	12.05**
Gender	B ₇₀	-.109	.009	279	-11.86**
Low Other Efficacy	B ₈₀	.001	.004	279	.39
High Other Efficacy	B ₉₀	.004	.004	279	.87
Relay*Distance 400	B ₁₀₀	.001	.004	279	.26
Relay*Distance 800	B ₁₁₀	.010	.004	279	2.38*
Relay*Rank 2	B ₁₂₀	-.020	.004	279	-4.38**
Relay*Rank 3	B ₁₃₀	-.030	.004	279	-6.46**
Relay*Rank 4	B ₁₄₀	-.048	.004	279	-9.91**
Relay*Low Other Efficacy	B ₁₅₀	.003	.005	279	.60
Relay*High Other Efficacy	B ₁₆₀	-.012	.005	279	-2.37*
Relay*Gender	B ₁₇₀	.004	.006	279	.76
Gender*Low Other Efficacy	B ₁₈₀	.004	.008	279	.49
Gender*High Other Efficacy	B ₁₉₀	-.002	.008	279	-.26
Rank 2*Gender	B ₂₀₀	-.011	.005	279	-2.08*
Rank 3*Gender	B ₂₁₀	-.012	.005	279	-2.21*
Rank 4*Gender	B ₂₂₀	.003	.005	279	.64
Relay*Gender*Low Other Efficacy	B ₂₃₀	.004	.009	279	.50

Table 21 (cont'd)

Relay*Gender* High Other Efficacy	B ₂₄₀	-.021	.008	279	-2.54*
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Random Effect	Parameter	Variance Component	<i>SD</i>	<i>df</i>	χ^2
Individual	<i>b_{00j}</i>	.000	.004	155	137.71
Relay	<i>c_{00k}</i>	.000	.029	84	1082.50**
Error	<i>E</i>	.000	.019		

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

Table 22

Model 6 Estimated mean times and percent changes between relay and individual performance for females

			200 Yard Relay	% Change	400 Yard Relay	% Change	800 Yard Relay	% Change
Low Other Efficacy	Rank 1	Individual	24.57		53.78		116.03	
		Relay	25.75	4.79**	56.43	4.91**	122.85	5.88**
	Rank 2	Individual	25.16		55.08		118.83	
		Relay	25.83	2.66**	56.61	2.78**	123.26	3.72**
	Rank 3	Individual	25.54		55.91		120.61	
		Relay	25.96	1.64*	56.89	1.76*	123.87	2.69**
	Rank 4	Individual	25.87		56.64		122.19	
		Relay	25.83	-.15	56.62	-.03	123.26	.87
High Other Efficacy	Rank 1	Individual	24.63		53.91		116.31	
		Relay	25.40	3.14**	55.67	3.32**	121.21	4.21**
	Rank 2	Individual	25.22		55.21		119.12	
		Relay	25.48	1.04	55.86	1.61*	121.61	2.09**
	Rank 3	Individual	25.60		56.04		120.90	
		Relay	25.61	.04	56.13	.16	122.21	1.08
	Rank 4	Individual	25.93		56.77		122.48	
		Relay	25.48	-1.72*	55.86	-1.61*	122.61	-.70

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

Table 23

Model 6 Estimated mean times and percent changes between relay and individual performance for males

			200 Yard Relay	% Change	400 Yard Relay	% Change	800 Yard Relay	% Change
Low Other Efficacy	Rank 1	Individual	22.11		48.40		104.42	
		Relay	23.39	5.79**	51.27	5.91**	111.62	6.88**
	Rank 2	Individual	22.38		49.00		105.71	
		Relay	23.20	3.63**	50.84	3.75**	110.69	4.71**
	Rank 3	Individual	22.70		49.71		107.23	
		Relay	23.30	2.61**	51.06	2.73**	111.17	3.67**
	Rank 4	Individual	23.37		51.16		110.36	
		Relay	23.55	.79	51.62	.91	112.39	1.83*
High Other Efficacy	Rank 1	Individual	22.02		48.20		103.99	
		Relay	22.33	1.40*	48.94	1.52*	106.55	2.45**
	Rank 2	Individual	22.29		48.80		105.27	
		Relay	22.14	-.65	48.53	-.54	105.66	.37
	Rank 3	Individual	22.61		49.50		106.79	
		Relay	22.24	-1.63*	48.74	-1.52*	106.12	-.62
	Rank 4	Individual	23.27		50.95		109.91	
		Relay	22.48	-3.38**	49.28	-3.27**	107.29	-2.38**

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

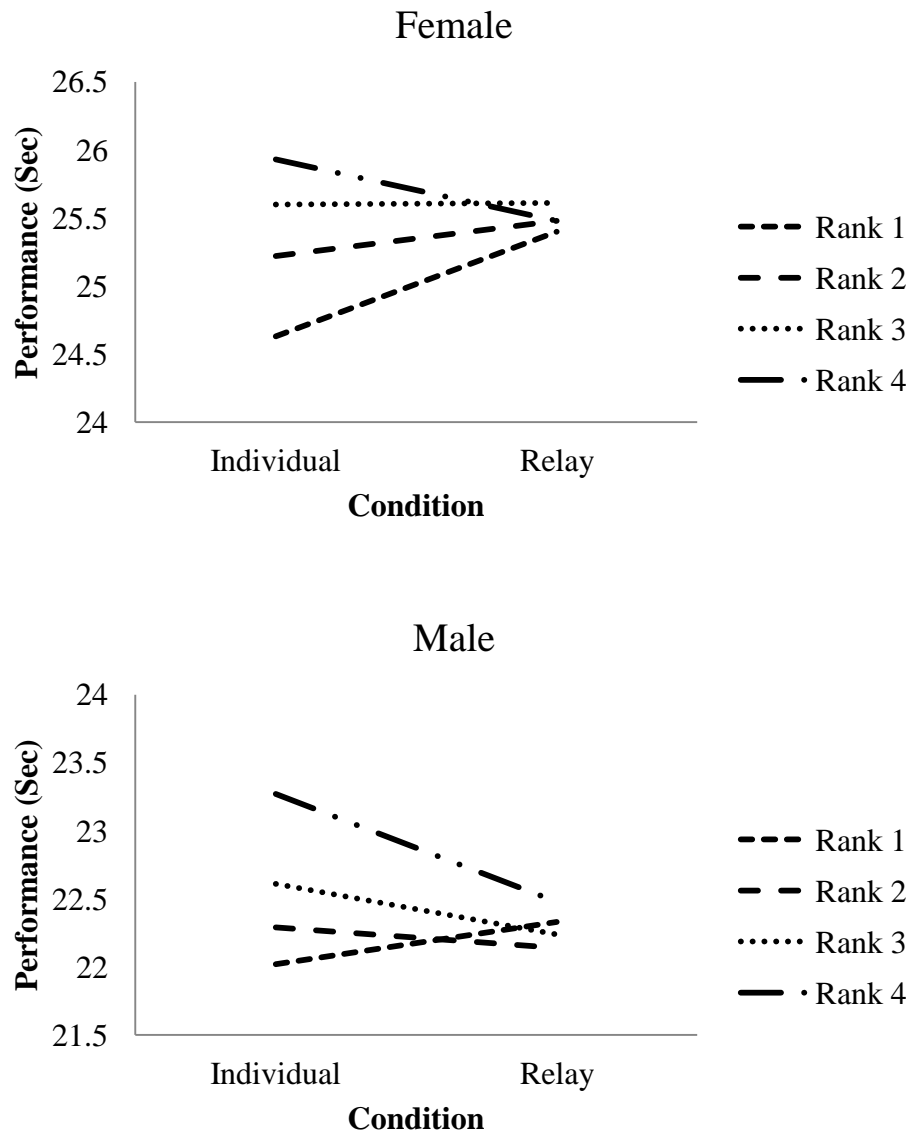


Figure 16. Individual and relay performance by rank and gender with high other efficacy beliefs at the 200 distance

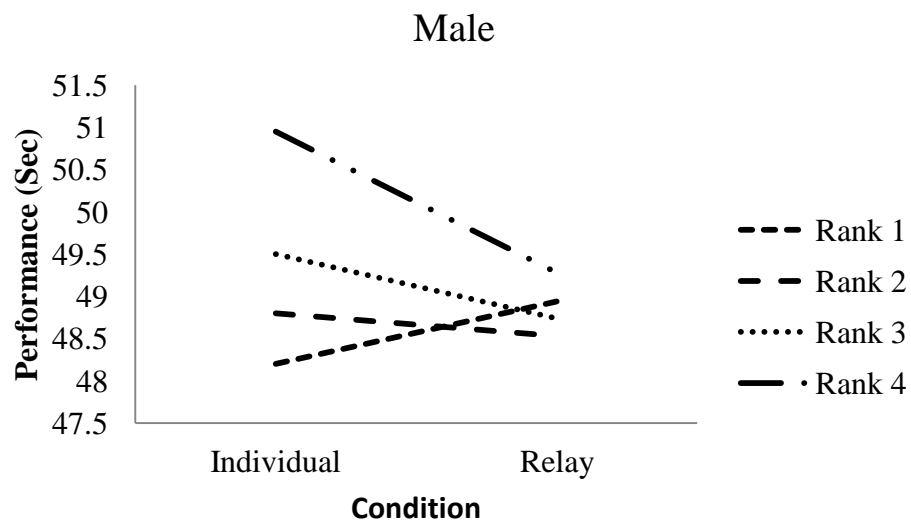
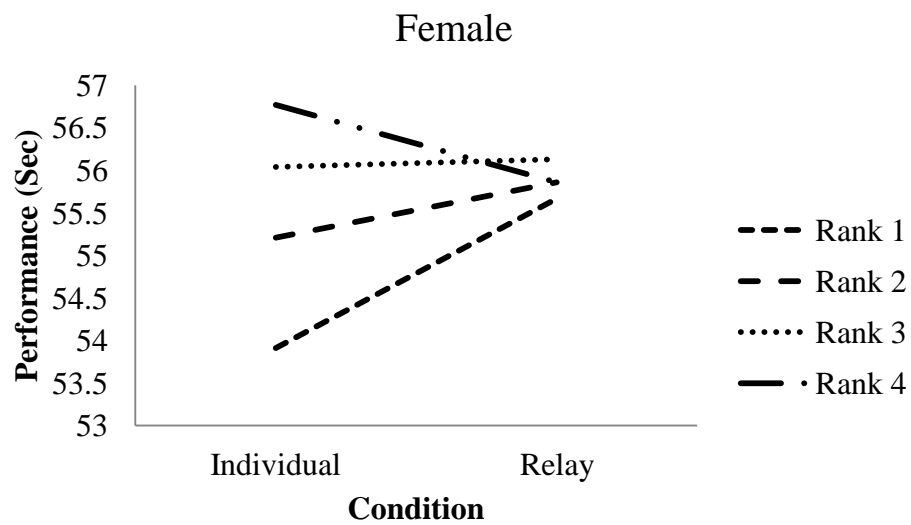


Figure 17. Individual and relay performance by rank and gender with high other efficacy beliefs at the 400 distance

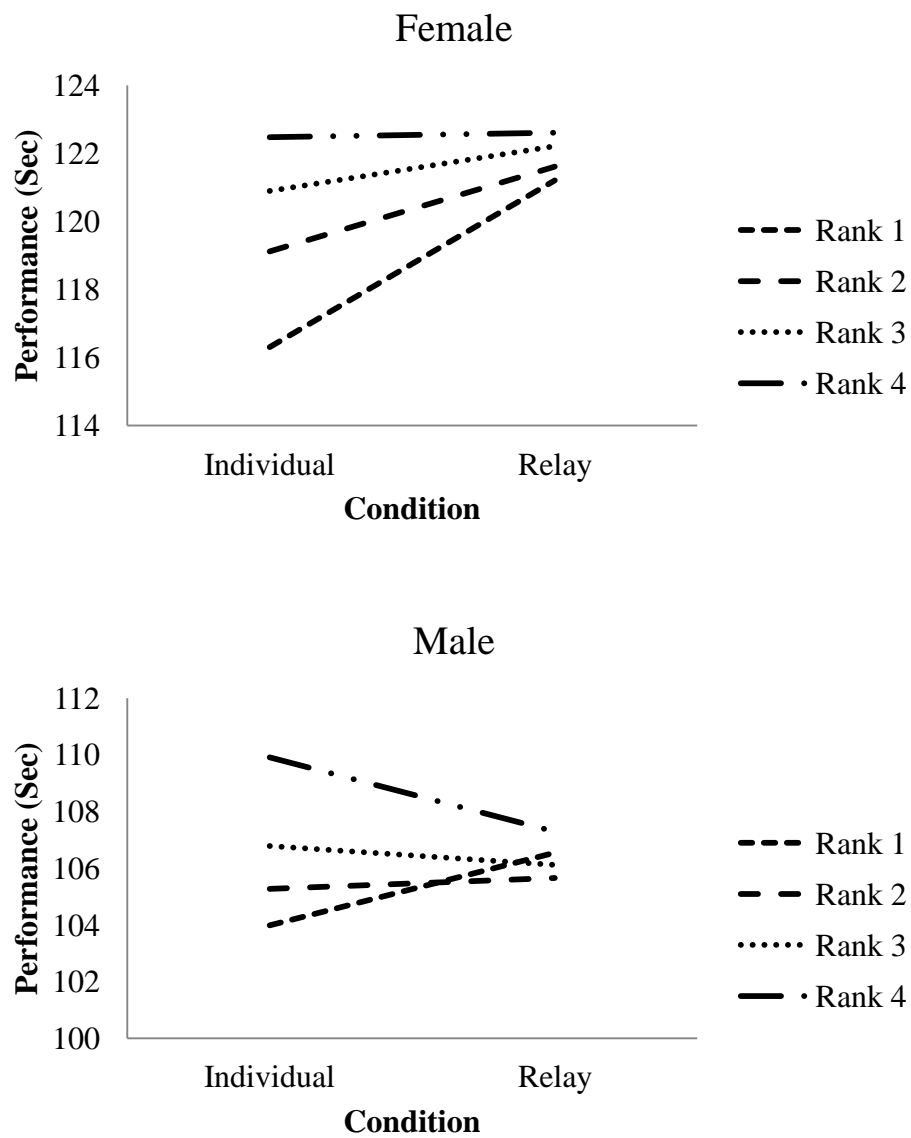


Figure 18. Individual and relay performance by rank and gender with high other efficacy beliefs at the 800 distance

consisted of Model 1, with the addition of Low and High RISE beliefs and interaction terms between RISE beliefs x Relay. The model used (Model 7) is below:

$$\begin{aligned}
Y_{ijk} = & \pi_{0jk} + \pi_{1jk}*(TEAM_{ijk}) + \pi_{2jk}*(D400_{ijk}) + \pi_{3jk}*(D800_{ijk}) + \pi_{4jk}*(RANK2_{ijk}) \\
& + \pi_{5jk}*(RANK3_{ijk}) + \pi_{6jk}*(RANK4_{ijk}) + \pi_{7jk}*(TEAMD400_{ijk}) + \pi_{8jk}*(TEAMD800_{ijk}) \\
& + \pi_{9jk}*(TEAMR2_{ijk}) + \pi_{10jk}*(TEAMR3_{ijk}) + \pi_{11jk}*(TEAMR4_{ijk}) + \pi_{12jk}*(LOWRISE_{ijk}) \\
& + \pi_{13jk}*(HIGHRISE_{ijk}) + \pi_{14jk}*(TLRISE_{ijk}) + \pi_{15jk}*(THRISE_{ijk}) + e_{ijk}
\end{aligned}$$

In Model 7, Y_{ijk} is the performance time of swimmer j in relay k , π_{0jk} is the Level 1 intercept, π_{1jk} is the effect of performing individually or in the relay, π_{2jk} is the effect of the 400 distance individually, π_{3jk} is the effect of the 800 distance individually, π_{4jk} is the effect of the second ranked individual, π_{5jk} is the effect of the third ranked individual, π_{6jk} is the effect of the fourth ranked individual, π_{7jk} is the interaction effect of the relay performance at the 400 relay distance, π_{8jk} is the interaction effect of the relay performance at the 800 distance, π_{9jk} is the interaction effect of the second ranked individual on the relay, π_{10jk} is the interaction effect of the third ranked individual on the relay, π_{11jk} is the interaction effect of the fourth ranked person on the relay, π_{12jk} is the effect of low RISE individually, π_{13jk} is the effect of high RISE individually, π_{14jk} is the interaction effect between relay and high RISE, π_{15jk} is the interaction effect between relay and low RISE, and e_{ijk} is the error associated with each swimmer j in relay k .

All predictors were significant in Model 7 similar to Model 2. In addition, the interaction between relay x high RISE was a significant predictor of Time, $t(279) = -5.59, p < .001$. Means and contrasts were once again performed and followed a similar trend to both Self- and Other Efficacy. In general, swimmers with low RISE beliefs performed worse from the individual to relay condition than individuals with high RISE beliefs, $\chi^2(1) = 41.00, p < .001$. Further the only individuals who performed better in the relay condition compared to the individual condition were the fourth ranked members with high RISE beliefs, 200, $\chi^2(1) = 28.86, p < .001$, 400, $\chi^2(1) = 139.78, p < .001$, and 800, $\chi^2(1) = 13.18, p < .001$. Time varied significantly between relays, $\chi^2(84, N = 85) = 5443.61, p < .001$. The ICC was calculated for relays, ($\rho_{C00k} = .91$), demonstrating that 91% of the variance in time in this model was explained between relays. Full model results are presented in Table 24, while estimated means and percent changes between individual and relay performance are presented in Table 25. Mean times are also displayed in Figure 19 through 21.

The fifth research question asked if individuals socially compare themselves to others within their relay team. Means for each relay distance (200: $M = 7.73, SD = 2.39$; 400: $M = 7.68, SD = 2.27$; 800: $M = 7.79, SD = 2.19$) indicated that relay members compared their own swim time to others within the relay. In swimming, it is common for coaches to record split times in one place during the relay event and then swimmers can immediately see their time after the event. If this was the case, looking or “comparing” ones’ time may not have been intentional but rather the result of looking at the relay’s split times as a whole.

The sixth research question addressed whether relay members think they make a contribution to the relay team and if this differs according to whether the assessment is before or

Table 24

Model 7 for performance, including the moderating effects of RISE beliefs

Fixed Effect	Parameter	Coefficient	<i>SE</i>	<i>df</i>	<i>t</i>
Intercept	B ₀₀	3.15	.013	279	236.44**
Relay	B ₁₀	.046	.004	279	9.57**
Distance 400	B ₂₀	.784	.017	279	45.93**
Distance 800	B ₃₀	1.55	.017	279	86.50**
Rank 2	B ₄₀	.020	.003	279	5.79**
Rank 3	B ₅₀	.034	.003	279	9.88**
Rank 4	B ₆₀	.053	.003	279	14.47**
Relay*Distance 400	B ₇₀	.002	.004	279	.68
Relay*Distance 800	B ₈₀	.009	.004	279	2.28*
Relay*Rank 2	B ₉₀	-.021	.004	279	-4.62**
Relay*Rank 3	B ₁₀₀	-.031	.004	279	-6.53**
Relay*Rank 4	B ₁₁₀	-.050	.004	279	-10.23**
Low RISE	B ₁₂₀	.002	.003	279	.67
High RISE	B ₁₃₀	.002	.003	279	.59
Relay*Low RISE	B ₁₄₀	.005	.004	279	1.24
Relay*High RISE	B ₁₅₀	-.023	.004	279	-5.59**

Random Effect	Parameter	Variance Component	<i>SD</i>	<i>df</i>	χ^2
Individual	<i>b_{00j}</i>	.000	.001	155	5443.61**
Relay	<i>c_{00k}</i>	.003	.062	84	112.58
Error	<i>E</i>	.000	.019		

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

Table 25

Model 7 Estimated mean times and percent changes between relay and individual performance

			200 Yard Relay	% Change	400 Yard Relay	% Change	800 Yard Relay	% Change
Low RISE	Rank 1	Individual	23.52		51.54		111.03	
		Relay	24.77	5.29**	54.43	5.60**	118.03	6.35**
	Rank 2	Individual	24.00		52.59		113.30	
		Relay	24.73	3.00**	54.33	3.31**	117.88	4.04**
	Rank 3	Individual	24.35		53.34		114.92	
		Relay	24.85	2.05**	54.60	2.35**	118.46	3.07**
	Rank 4	Individual	24.81		54.36		117.11	
		Relay	24.83	.07	54.56	.36	118.38	1.07*
High RISE	Rank 1	Individual	23.52		51.52		110.99	
		Relay	24.06	2.31**	52.87	2.62**	114.70	3.34**
	Rank 2	Individual	24.00		52.57		113.26	
		Relay	24.02	.09	52.78	.38	114.50	1.09*
	Rank 3	Individual	24.34		53.32		114.88	
		Relay	24.14	-.83	53.04	-.53	115.07	.16
	Rank 4	Individual	24.80		54.34		117.07	
		Relay	24.12	-2.75**	53.00	-2.46**	114.99	-1.77*

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

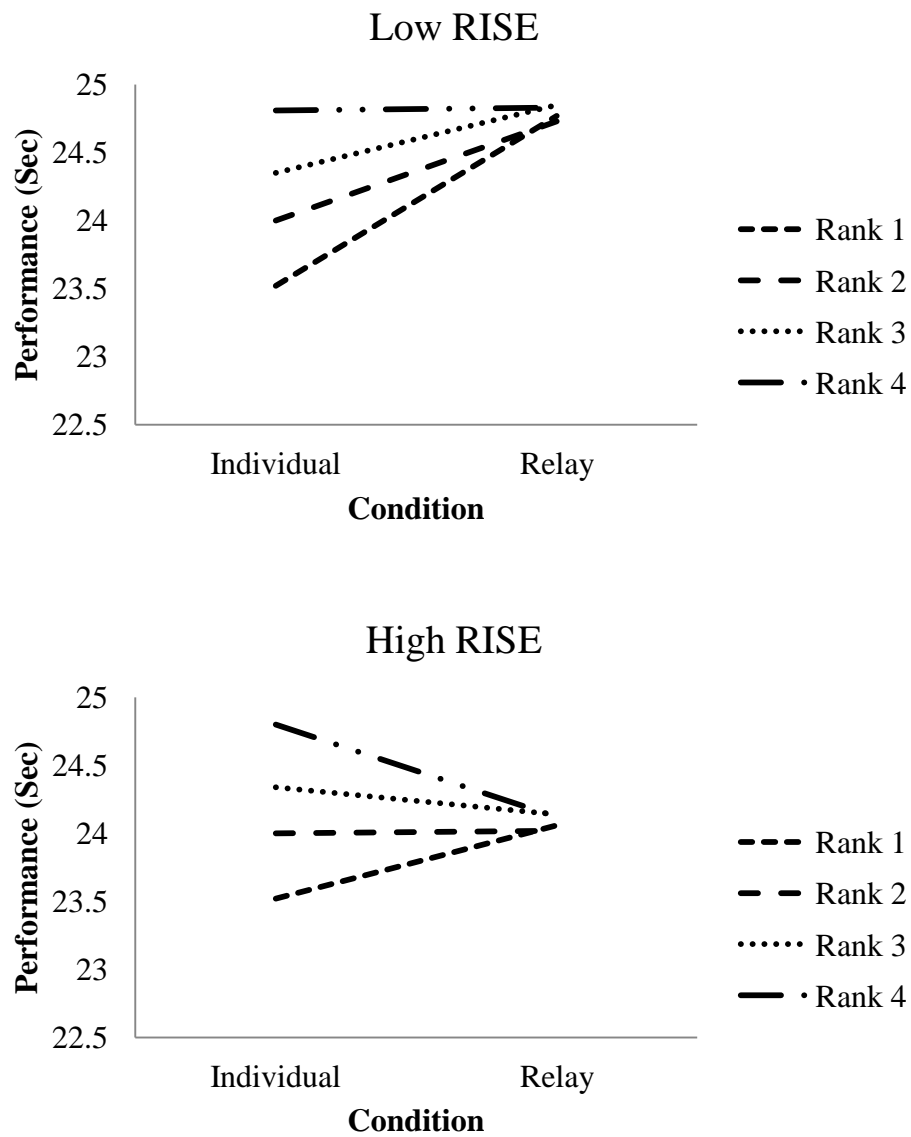


Figure 19. Individual and relay performance by rank with low and high RISE beliefs at the 200 distance

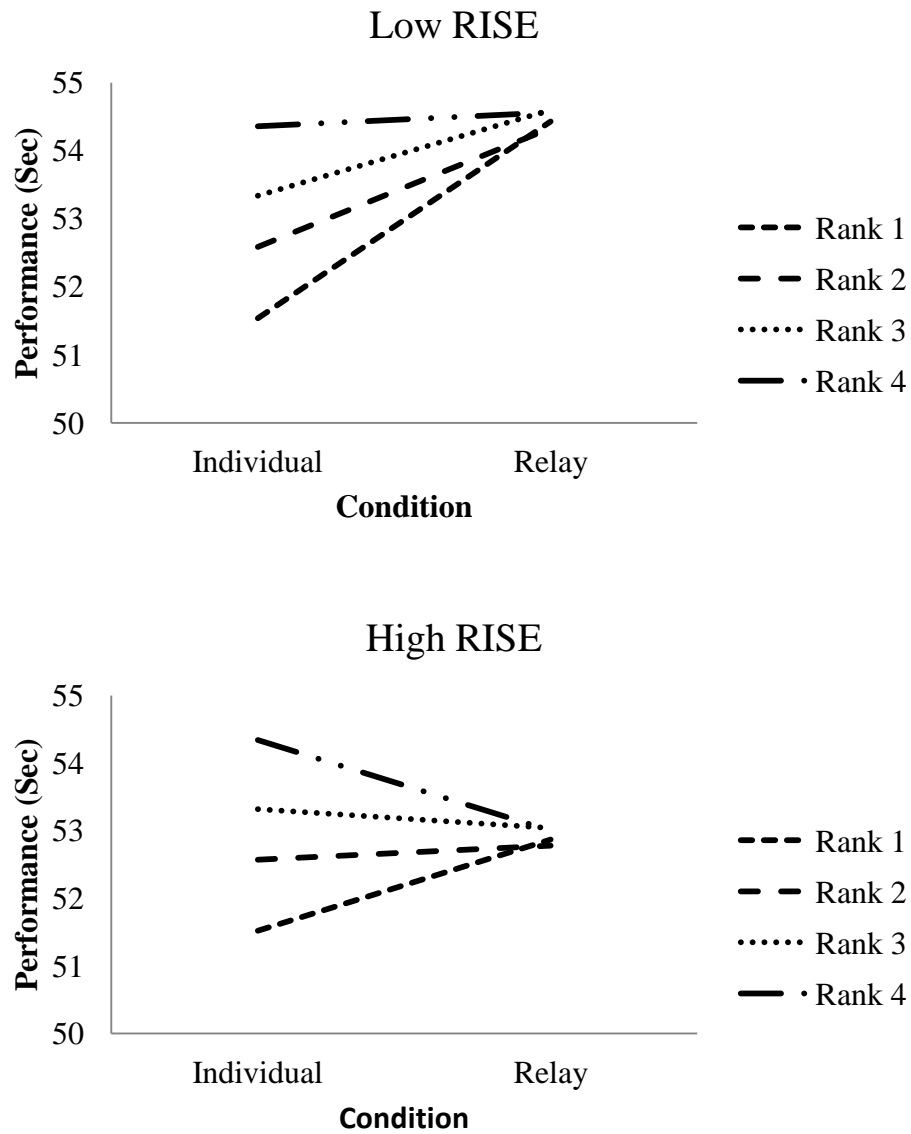


Figure 20. Individual and relay performance by rank with low and high RISE beliefs at the 400 distance

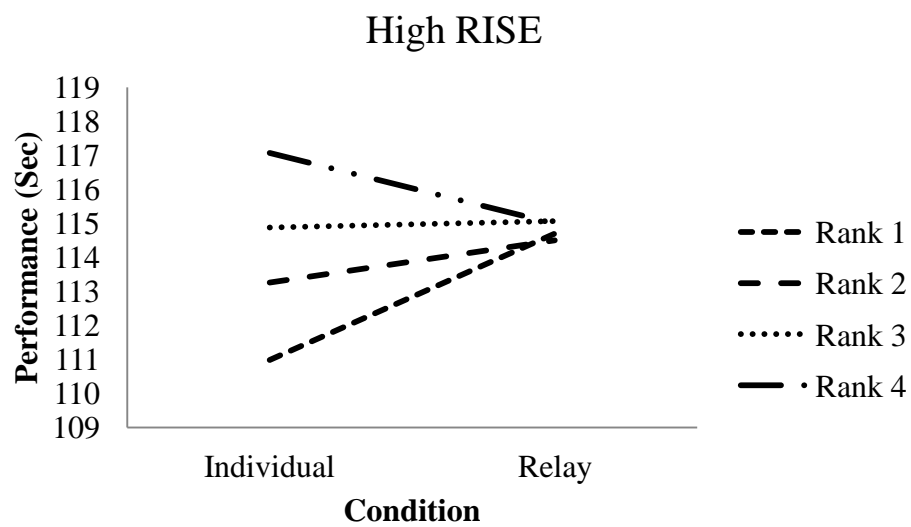
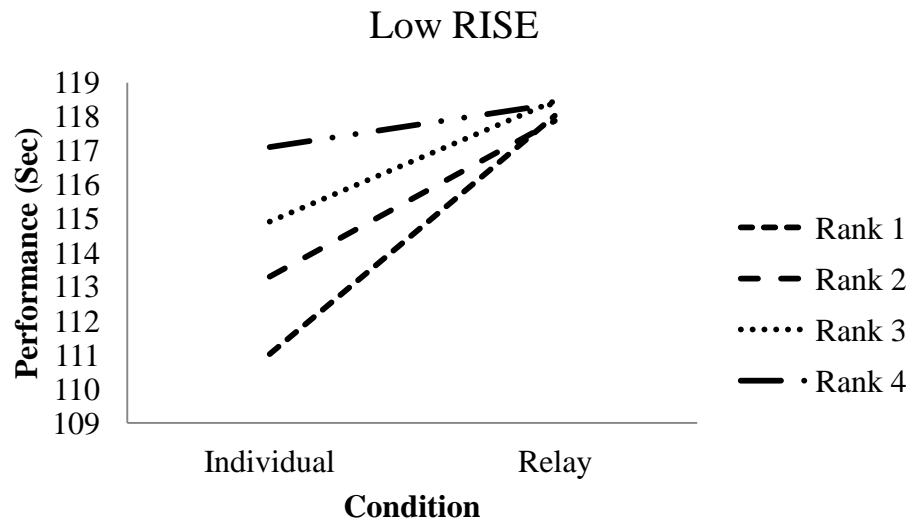


Figure 21. Individual and relay performance by rank with low and high RISE beliefs at the 800 distance

after the actual performance. Means of member's feelings of their contribution before the relay (200: $M = 7.78$, $SD = 2.15$; 400: $M = 8.25$, $SD = 1.60$; 800: $M = 7.91$, $SD = 1.70$) were slightly lower than means after the relay (200: $M = 8.37$, $SD = 1.60$; 400: $M = 8.46$, $SD = 1.41$) with the exception of the 800 distance, which was slightly lower compared to the before measure ($M = 7.59$, $SD = 1.92$). A series of paired sample t tests were conducted and there were no significant differences at any of the distances between the pre and post measures.

The last research question asked how much effort relay members believed they gave on their performance. Means for all relay distances (200: $M = 18.29$, $SD = 2.05$; 400: $M = 18.08$, $SD = 1.77$; 800: $M = 17.80$, $SD = 1.98$) indicated swimmers perceived their effort as between "very hard" and "extremely hard."

In Summary, Hypothesis 1 was supported in which self- and other efficacy beliefs were negatively related to performance. Hypothesis 2 was not supported; swimmers did not swim faster in the relay condition compared to the individual condition. Hypothesis 3 and 4 were both supported in that the weakest member demonstrated a motivation gain in the relay while the strongest member demonstrated a motivation loss. Hypothesis 5 was not supported with respect to self-efficacy while Hypothesis 6 was supported but only for the fourth ranked member.

CHAPTER 5

DISCUSSION

Motivation losses between individual and group performance have been frequently studied within a sport context. However, motivation gains within a group setting have been less frequently studied. Swimming is a sport in which researchers can easily compare the differences between individual and group performance. Swimmers in a competitive setting should hold beliefs about their own capabilities to perform and beliefs about the capabilities of their teammates in a relay task. These beliefs should also influence the performance motivation of a swimmer in a competitive performance environment. This dissertation aimed to replicate the Köhler motivation gain effect in real-time swimming relays rather than through the use of archival data. Further this dissertation investigated the moderating effects of self- and other efficacy on relay performance. This chapter discusses the findings of this dissertation, discusses strengths and limitations of the study, identifies implications of the study, and presents future research directions.

Performance Results

The major findings in this dissertation demonstrated that overall, swimmers' performances from best individual times to the relay performance times were dependent on their rank within the relay. In general, across distances, the first, second, and third ranked individuals swam significantly slower in the relay condition compared to their individual condition. The fourth ranked individual swam faster in the relay condition compared to their individual condition. These findings show support for the Kohler effect (Hypothesis 3).

Previous Köhler effect literature has demonstrated that within dyads, the weakest individual performs better when paired with a moderately more capable partner compared to how

they perform on an individual task (Gockel et al., 2008; Hertel et al., 2000; Kerr et al., 2005). This performance increase from the weakest member is emphasized under conjunctive task demands rather than additive task demands (Weber & Hertel, 2007). However, Kerr et al. (2005) indicated that relays have certain characteristics that allow them to function as quasi-conjunctive task demands. First, relays are divisible in that each member of the relay must adequately complete his or her leg of the relay for the team to be successful overall. Similarly, relays are sequential in that each member of the relay must adequately complete his or her leg of the relay before the next leg can be started. These characteristics support the finding that within an additive relay task, performance gains may be more likely to occur.

These findings support other motivation gain literature within swimming relays specifically, Osborn et al. (2012). Osborn et al. was one of the first studies to demonstrate that these motivation gains occur from the weakest group member in groups larger than dyads indicating a performance gain from the fourth ranked or slowest relay members. Within this dissertation study, the fourth ranked member also demonstrated a performance gain in the relay condition compared to the individual condition. This finding supported Hypothesis 3. This is an even more impressive finding practically, as these fourth ranked swimmers were swimming faster than their lifetime best performances in the relays in order to see these motivation gain effects. Further, these motivation gains, in both Osborn et al. (2012) and this dissertation study occurred under a relay task demand which is usually thought of as an additive task demand.

Additional findings of Osborn et al. (2012) indicated that the first ranked member performed slower in the relay condition compared to the individual condition, however, this was non-significant. In this dissertation study, the first ranked individual swam significantly slower in the relay compared to the individual condition demonstrating a motivation loss or a social loafing

effect. This result supported Hypothesis 4. Additionally, this is the first time within a sport context where both motivation gains and social loafing effects occur in a group task simultaneously. This finding supports the idea that within groups larger than dyads, motivation processes may be more complex and researchers may need to focus on more than just the weakest or strongest member. Further, this finding may indicate that the other members within the relay may show similar trends in performance compared to the weakest or strongest members. Although Hypothesis 2, that predicted that swimmers would swim faster in the relay condition compared to the individual condition, was found in a previous study (Osborn et al., 2012), this main effect hypothesis was not supported in the present study. Only the fourth ranked relay swimmer swam faster in the relay condition. This may be explained by the measure for individual performance used in the study, which was the swimmers' lifetime best performance. While swimmers were "rested" for these fall invitational meets in which relay time was measured, the swimmers may not have been as "rested" as they would be for a championship meet at the end of the season in which most lifetime best performances are swum.

Research Question 1 asked about the position effects of the relay members. Prior research has found that indispensability increases as a result of one's position within the relay (Huffmeier & Hertel, 2011; Huffmeier et al., 2012). However this dissertation model (Model 4) did not indicate any significant motivation gains for anyone on the relay due to their position. Instead only motivation losses were found to occur. This finding lends support for the stronger effects of rank within a relay compared to position (Osborn et al., 2012).

Moderating Effects of Efficacy Beliefs

In terms of efficacy beliefs, both high self-efficacy and high other efficacy significantly moderated the performance relationships between individual and relay times, specifically for the

fourth ranked individual. Hypothesis 5 predicted that self-efficacy would moderate the performance from the individual to relay condition in that those individuals with low self-efficacy would show a motivation gain and individuals with high self-efficacy would demonstrate a motivation loss. This hypothesis was not supported. Individuals with low self-efficacy, specifically those ranked first through third actually performed significantly slower on the relay compared to the individual condition. For fourth ranked individuals with low self-efficacy, there was not a significant increase in time; however, their performances were still slower. When the effect of self-efficacy was separated by gender (Research Question 2), the effect became much more interesting.

For both males and females with low self-efficacy, the effects were similar to those described above. However, when examining the effects of high self-efficacy, performance was dependent on both rank and gender. For both males and females with high self-efficacy, the first ranked member swam significantly slower in the relay condition compared to the individual condition; although this performance loss was less than individuals with low self-efficacy (i.e., percent changes from individual to relay performance were less for individuals with high self-efficacy). For the second through fourth-ranked swimmers within the relay, the effects of high self-efficacy varied according to gender. For females with high self-efficacy beliefs, only the fourth ranked individuals displayed a motivation gain in the relay performance, while the second ranked females were significantly slower, displaying a motivation loss. However, for males, both the third and fourth ranked individuals demonstrated a motivation gain, while the second ranked member showed no significant difference from individual to relay performance.

Previous research on the moderating effects of self-efficacy and motivation gains demonstrated that females who are given false feedback about low self-efficacy, increased their

performance in a group task compared to high self-efficacy participants (Seok, 2004). That is, participants who were led to believe that their individual performance was very good compared to others, did not increase their efforts as much in the group setting as those who thought their individual performance was sub par. However, in this dissertation low self-efficacy beliefs were not manipulated and did not result in a significant motivation gain. The only individuals who did not have a performance difference in the relay with low self-efficacy were the fourth ranked individuals. The results indicated that they did not swim statistically slower and their performance may be regarded as at least an increase in effort to swim the same performance time in both the individual and relay conditions. However, in practical terms, even adding a few tenths of a second during a relay event can dramatically change where a team finishes overall.

One reason the findings in this dissertation may differ from those found in Seok (2004), is in the validity of efficacy beliefs. In Seok's study, participants were given false feedback about their abilities no matter how well their performance was overall. For example, individuals who personally thought they did well, and received low self-efficacy feedback, may have still felt confident in their abilities but just needed to try harder, resulting in a motivation gain on the next trial. However, in this dissertation, swimmers reported their own efficacy to swim under certain times. Their confidence may have been based on a greater history of past performances and, thus, a more accurate assessment of their future performance. Therefore, these lower efficacy swimmers may not have felt that their contribution was instrumental enough to make a difference in the relay condition (Hertel et al., 2000). One additional difference could also be that the swimmers used in this dissertation did not all specialize in freestyle or the distances measured. The swimmers with low self-efficacy beliefs may not have swum these freestyle events on a

regular basis and, therefore, may not have been confident in their abilities to swim fast on a relay, possibly making these swimmers feel even less instrumental to the relay performance.

Overall, the performance changes for swimmers with high self-efficacy indicated that they either swam better in the relay condition, indicating a motivation gain (e.g. third and fourth ranked individuals). Or, these swimmers did not swim as poorly on the relay as swimmers with low self-efficacy as indicated by lower positive percent changes from individual to relay performance. Meaning, high self-efficacy swimmers who were ranked first and second still swam slower in the relay condition compared to swimmers with low-self-efficacy, those with high self-efficacy added less time resulting in lower percent changes.

Previous research on the Köhler effect has indicated that females are more motivated by feelings of indispensability while males are more motivated by socially comparing themselves to others (Weber & Hertel, 2007). Within this dissertation study, there were no significant differences between self-reports of these measures according to gender. This may indicate that both of these processes occur simultaneously for both males and females. Swimmers may feel indispensable to their relay team and, as well as, feel confident in their ability to contribute, resulting in motivation gains. Further, these swimmers also may have been more confident in their abilities and therefore felt more confident successfully comparing their performance with the other faster members.

Hypothesis 6 predicted that other efficacy should also moderate the motivation gain relationship in that those individuals with higher other efficacy would demonstrate a motivation gain in the relay condition. This hypothesis was supported once again by the fourth ranked position for females and both the third and fourth ranked position for males. For the most part, the moderating effects of other-efficacy were the same with regards to gender and rank as the

effects of self-efficacy. However, one additional finding was for the third ranked member of female relays. These individuals did not swim statistically differently in the relay, however they did show a decrease in their times.

The results of other efficacy on performance can also be explained through the same underlying processes of the Köhler effect; social comparison and indispensability. Relay members indicated that they compared their split times to others within their relay (Research question 5). Further they also believed that they significantly contributed to the relay and this feeling of contribution increased slightly after the relay (Research question 6). Correlations between other efficacy, indispensability, and social comparison measures, indicate that swimmers with high other efficacy also have both high pre and post relay feelings of indispensability. However, these individuals did not indicate that they socially compared themselves to others within the relay. This indicates that individuals with high other efficacy were more attuned to feelings of indispensability rather than social comparison.

Relay members also indicated that they gave a “hard” or “very hard” effort according to the Borg scale. This finding makes sense within the context of the study where swimmers were evaluated within a competitive racing environment. Further, correlations between pre-relay indispensability and RPE indicates that those individuals who thought they were indispensable to the relay, also perceived they worked harder on the relay.

One explanation for these findings may have to do with impression management. Swimmers may have wanted to present a favorable impression of themselves to their other relay members (Kerr et al., 2005). Impression management may actually complement feelings of indispensability, in that weaker relay members may feel indispensable to their relay team and they may try to avoid forming an unfavorable impression of themselves if their performance is

poor. This may encourage weaker members to increase their performance in order to appear favorable to their relay members especially under conditions of high indispensability. However, the fastest members of the relay may not have felt indispensable to the relay team as their performance would still be faster than those of the weaker individuals. They may not have felt an increased need to appear favorable to their relay members and therefore did not increase their performance. This may explain how there was not a social compensation effect from the fastest member with feelings of low other efficacy (Research Question 3), but rather a social loafing effect.

Hypothesis 1 predicted that both self-efficacy and other efficacy would be negatively related to performance times. This hypothesis was supported as demonstrated by negative and moderate correlations between these variables. This finding also supports other research on the moderate relationship between efficacy beliefs and performance (Moritz et al., 2000). However, research on efficacy beliefs has been mixed in that there is support for both efficacy beliefs being negatively related to performance (Vancouver et al., 2002) as well as being positively related to performance (Gilson et al., 2012) at within-subjects levels. In this dissertation, the correlation was negative; however in the context of swimming relays, better performances were actually represented as lower times. So in this case, if efficacy beliefs were high at the between-subjects level, performance was also better as indicated by a lower performance time. The fact that Vancouver et al.'s within-subjects studies have found a slight negative relationship between self-efficacy and performance does not mean that high self-efficacy is detrimental to performance. For self-efficacy to be detrimental to performance, researchers would have to show that individuals with high self-efficacy are consistently outperformed by individuals with low self-efficacy. This is not what has been observed in the extant research (Moritz et al., 2000). For

example, the individual regression slopes found in Beattie et al., 2011, clearly show that individuals with high-efficacy outperform individuals with low self-efficacy regardless of whether individual optimal putting occurred. The results in the present dissertation support the research on self-efficacy in sport, in which efficacy beliefs are positively related to performance (i.e., higher efficacy beliefs are correlated with better performance).

Research question 4 asked about the effects of RISE beliefs on performance. The results indicated that these were similar to the results for both self-efficacy and other efficacy. Once again these may be explained through the high correlations between these three variables indicating that those individuals with high self-efficacy and other efficacy often had high RISE beliefs as well. The same explanations for impression management may also have an effect here (Kerr et al., 2005). Those individuals with high RISE beliefs (e.g., an individual was confident that their other relay members were confident in that individual's ability to swim fast), may have felt like their relay members expected them to swim well and if they did not perform well, this might leave a unfavorable impression.

Despite the fact that both self-efficacy and other efficacy demonstrate the same pattern with respect to motivation gains within relays, these relays are the first time in which self- and other efficacy have been studied in regards to the Köhler effect. Further, by using the tripartite model of efficacy beliefs (Lent & Lopez, 2002), this study allows a better understanding of how efficacy beliefs are impacted both by group member's perceptions, and in turn, how these efficacy beliefs influence performance. This study also helps to clarify how performance changes in groups larger than dyads, in that both social loafing and motivation gains occur simultaneously. Further this study can provide researchers with a better understanding of how different ranks perform with regard to both self and other efficacy.

Strengths and Limitations

A strength of this dissertation is that it was conducted in the field with competitive swimming relay teams in which swimmers should have been already motivated to perform. This gives the phenomenon of the Kohler effect some ecological validity. Further, prior research on motivation gains in swimming relays has used archival data rather than live relays (Huffmeier & Hertel, 2011; Huffmeier et al, 2012; Osborn et al., 2012). Using live relays allowed the collection of subjective measures with regards to efficacy beliefs and the underlying processes of social comparison and indispensability.

Additionally, prior research of the Kohler effect, conducted with laboratory tasks, has used mostly conjunctive tasks (e.g., Gockel, et al., 2008; Hertel et al., 2000; Kerr et al., 2005). In Steiner's (1972) taxonomy of group tasks, swimming relays are considered an additive task but function in a quasi-conjunctive manner (Kerr et al., 2005). Although, some motivation gains have been found using coactive and additive tasks (e.g., Feltz et al., 2012; Hertel et al., 2003), the present dissertation found motivation gain effects for inferior group members in a team task that is divisible and sequential. Thus, the present study's finding adds to the applicability of group tasks that are not purely conjunctive.

Another advantage of this dissertation is that it used groups larger than dyads, which allows for better understanding of how multiple individuals perform in a group task. Further, it organized these groups by ability into ranks. This allowed the analysis to demonstrate how performance changes as a result of ability within the relay and how other variables like efficacy beliefs, distance of race, and gender moderate this relationship.

Lastly, the use of HLM for the data analysis is also a strength of the study. Within meets, swimmers can swim in multiple relays. Depending on their abilities in certain events, swimmers

might have different levels of confidence for each race distance. By using HLM to model the data, and therefore take into account these dependencies, it allows the researcher to get a more accurate picture of how self-efficacy, other efficacy, distance of the race, and swimmer's rank within the relay impacts overall performance time. Without the use of HLM, the data analysis would split each relay distance up and treat both the race itself as well as efficacy as an independent event when in reality swimmers are connected to their other performances and efficacy beliefs.

Of course there were also some limitations in this dissertation. While the sample size was large enough to produce 86 separate relays, in regards to the HLM analysis, there were not enough relays to allow self- and other efficacy to act as random effects. This limited the ability to generalize the effects of efficacy beliefs beyond this population (Raudenbush & Bryk, 2002).

Another limitation was the high correlations between self-efficacy, other efficacy, and RISE beliefs. While instructions for the swimmers were presented both orally before they took the surveys as well as written on the surveys, swimmers may not have been aware of the subtle differences between efficacy scales which may be one reason why the scores were very similar. Because of the similarity between scores, it was difficult to see direct relationships between changes in performance and changes in efficacy beliefs. This may be modified in future studies by further clarifying the differences in each scale.

Further, because of the use of three distinctly different relay distances, the variance between the relays was much greater than the variance between the swimmers (i.e., within the relays). This was problematic in the explanations of variance from a HLM standpoint as the results demonstrated that most of the variance was between relays and there was no significant variation explained between swimmers. While the use of multiple relay distances may have

given a more accurate picture of how swimmers swim at a meet overall, it may have also limited the explanations of the statistical analysis.

One other limitation was the amount of tapering among teams for each meet in which the study was conducted. While the study did not assess the state of rest of each team directly, coaches may use different definitions of “rest” and this can cause validity issues within self-report data. While each team “rested” for each meet, some teams were more rested than others, based upon conversations with coaches, which also can impact performance. The teams that were more rested were most likely more confident in their abilities to swim fast as well as more confident in their teammates’ abilities to swim fast, which may have enhanced both self- and other efficacy beliefs.

Similarly, the individual performance times used were the lifetime best performance from different meets. These lifetime best times were used because not each individual swimmer swam the individual condition of each event. These individual performance times may have been swum last year or even further back which also may change how likely it is that swimmers were going to swim near, close to, or faster than these times. A more accurate measure would be to use individual times swum at that specific meet even if it limits the sample. This would be a more accurate and comparable time to relay performance.

Implications

This study has shown that both motivation gains as well as losses occur within swimming relays. Further, high self- and other efficacy moderate these performance differences for different ranked members. Specifically the fourth ranked members demonstrate motivation gains with high self-efficacy or high other efficacy. Third ranked relay members also demonstrate motivation gains for males and perform faster albeit not significantly faster for females. This

may demonstrate that both these lower ranked individuals within the relay have similar views about their abilities within the relay and through either feelings of indispensability or social comparison, increase their performance in the relay condition. Within groups larger than dyads, the third and fourth ranked members may function similarly while the first and second ranked members may function similarly. Coaches should promote both self-efficacy as well as other efficacy among their slowest relay members to try to enhance these motivation gain effects. Further, coaches should try to emphasize the importance of the strongest two members' contributions as this may reduce the effects of social loafing (Baron & Kerr, 2003). Coaches can also emphasize feelings of indispensability for every member as well as the importance of leaving favorable impressions for one's other relay members. This may be especially true in teams where performance has occurred before and swimmers have a concrete knowledge of how other members perform (Karau & Williams, 1993).

Future Directions

There are a few directions for future research that can be conducted with respect to motivation gains and the moderating effects of self- and other efficacy. First, due to the nature of the study and how relay data were collected in the field, it was not possible to make an individualized assessment of other efficacy for each swimmer within each relay. One follow-up would be to use an aggregated measure of other efficacy for individual's other relay members. This might be a better measure of other efficacy within this context as it gives a direct measure of how confident an individual is in each one of his or her teammates instead of generalizing about the group.

Further, using individual performance and relay performance measured from the same meet should allow a more accurate comparison. This would allow for researchers to generalize

how the swimmer is swimming in one point in time and then how that performance changes as a result of the either the individual or relay context.

Another area to expand on this research is to ask more in-depth follow up questions concerning the underlying processes of the Köhler effect. The questions asked in this dissertation were limited in the amount of information they provided and also might have been confounded given the context in which they were asked. Formal and more in-depth questioning might give researchers a better understanding of how the processes work and whether swimmers are aware of these processes during their performance.

While motivation gains have been demonstrated in multiple relay situations (Huffmeier & Hertel, 2011; Huffmeier et al., 2012; Osborn et al., 2012), this dissertation research provides an understanding of how each relay member performs based upon their rank. This research indicates that performance in a group larger than dyads is different according to rank. This research could be expanded by looking at these motivation gains in other sports besides swimming. While similar results have been found in field relays (Osborn et al., 2012), expanding the research into more group sport tasks in which performance can be directly measured would allow for these findings to be generalized to sports beyond swimming. Some of these sports may include track relays, team golf scores, and bowling.

Conclusion

Overall, this dissertation provides insight into motivation within groups. The majority of motivation theories define motivation based upon a cognitive antecedent. An individual's thoughts determine an individual's motivational intensity and direction (Roberts, 1992). Due to the cognitive nature of motivation, it is difficult to measure motivation directly. However the literature commonly infers that performance is an accurate measure of motivation. These

performance differences are inferred from effort, which is then inferred to be a result of motivation.

This dissertation supports the cognitive nature of motivation and infers that motivation occurs as a result of performance differences between individual and relay performance. Further, self- and other efficacy beliefs modify this performance relationship and can be viewed as moderators to performance and subsequently motivation.

The Köhler effect has been studied primarily in regards to dyads; however, often groups are larger than dyads, and having a better understanding of how individuals function within a group performance is important. Specifically, this is the first time in which both social loafing effects and motivation gains were demonstrated within the same group within a sport context. These findings allow for a better understanding of both motivation and how rank and ability within a group task, specifically, may contribute to performance. With regards to self efficacy, this dissertation adds to the literature supporting a positive relationship between self-efficacy and performance. This dissertation also allows for a better understanding about how both high self- and other efficacy enhance performance at the group level for weaker members within the group.

APPENDICES

APPENDIX A

Demographic Questionnaire

Name:

Age:

Year in School: Freshman Sophomore Junior Senior Fifth Year

Years of Competitive Swimming:

Top 3 Events:

Personal best times for those top 3 events (SCY)

Personal best time in the 50, 100, and 200 freestyle (SCY):

Personal Goals for this season:

Team goals for this season:

On the following questions answer the questions as they relate to the scale

1. Do you like swimming on relays?

<i>Do not Like</i>								<i>Absolutely Like</i>	
1	2	3	4	5	6	7	8	9	10
Why do you feel that way?									

2. How important is it to you to be on a championship relay this season?

<i>Not important</i>								<i>Very Important</i>	
1	2	3	4	5	6	7	8	9	10
Why do you feel this way?									

3. Have you been on a freestyle championship relay team before?

YES NO

If yes, which one:

What is your favorite position?

First Second Third Fourth

Why?

APPENDIX B

Self-Efficacy Scale, Individual, Female 50 Freestyle

Please rate how confident you are that YOU can attain the different levels of performance when swimming the 50 yard freestyle today.

Rate your degree of confidence that YOU can attain the different levels of performance by circling a number from:

0 (cannot do at all) to 100 (positive you can do) using the scale given below

1. Swim the 50 free in under :28.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. Swim the 50 free in under :27.5 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. Swim the 50 free in under :27.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. Swim the 50 free in under :26.5 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. Swim the 50 free in under :26.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. Swim the 50 free in under :25.5 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

7. Swim the 50 free in under :25.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. Swim the 50 free in under :24.5 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

9. Swim the 50 free in under :24.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix C

Self-Efficacy Scale, Individual, Male 50 Freestyle

Please rate how confident you are that YOU can attain the different levels of performance when swimming the 50 yard freestyle today.

Rate your degree of confidence that YOU can attain the different levels of performance by circling a number from:

0 (cannot do at all) to 100 (positive you can do) using the scale given below

1. Swim the 50 free in under :25.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. Swim the 50 free in under :24.5 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. Swim the 50 free in under :24.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. Swim the 50 free in under :23.5 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. Swim the 50 free in under :23.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. Swim the 50 free in under :22.5 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

7. Swim the 50 free in under :22.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. Swim the 50 free in under :21.5 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

9. Swim the 50 free in under :21.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix D

Self-Efficacy Scale, Individual, Female 100 Freestyle

Please rate how confident you are that YOU can attain the different levels of performance when swimming the 100 yard freestyle today.

Rate your degree of confidence that YOU can attain the different levels of performance by circling a number from:

0 (cannot do at all) to 100 (positive you can do) using the scale given below

1. Swim the 100 free in under 1:06 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. Swim the 100 free in under 1:04 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. Swim the 100 free in under 1:02 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. Swim the 100 free in under 1:00 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. Swim the 100 free in under :58 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. Swim the 100 free in under :56 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

7. Swim the 100 free in under :54 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. Swim the 100 free in under :52 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

9. Swim the 100 free in under :50 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix E

Self-Efficacy Scale, Individual, Male 100 Freestyle

Please rate how confident you are that YOU can attain the different levels of performance when swimming the 100 yard freestyle today.

Rate your degree of confidence that YOU can attain the different levels of performance by circling a number from:

0 (cannot do at all) to 100 (positive you can do) using the scale given below

1. Swim the 100 free in under :59 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. Swim the 100 free in under :57 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. Swim the 100 free in under :55 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. Swim the 100 free in under :53 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. Swim the 100 free in under :51 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. Swim the 100 free in under :49 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

7. Swim the 100 free in under :47 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. Swim the 100 free in under :45 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

9. Swim the 100 free in under :43 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix F

Self-Efficacy Scale, Individual, Female 200 Freestyle

Please rate how confident you are that YOU can attain the different levels of performance when swimming the 200 yard freestyle today.

Rate your degree of confidence that YOU can attain the different levels of performance by circling a number from:
0 (cannot do at all) to 100 (positive you can do) using the scale given below

1. Swim the 200 free in under 2:06 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. Swim the 200 free in under 2:04 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. Swim the 200 free in under 2:02 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. Swim the 200 free in under 2:00 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. Swim the 200 free in under 1:58 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. Swim the 200 free in under 1:56 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

7. Swim the 200 free in under 1:54 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. Swim the 200 free in under 1:52 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

9. Swim the 200 free in under 1:50 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix G

Self-Efficacy Scale, Individual, Male 200 Freestyle

Please rate how confident you are that YOU can attain the different levels of performance when swimming the 200 yard freestyle today.

Rate your degree of confidence that YOU can attain the different levels of performance by circling a number from:

0 (cannot do at all) to 100 (positive you can do) using the scale given below

1. Swim the 200 free in under 1:57 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. Swim the 200 free in under 1:55 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. Swim the 200 free in under 1:53 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. Swim the 200 free in under 1:51 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. Swim the 200 free in under 1:49 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. Swim the 200 free in under 1:47 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

7. Swim the 200 free in under 1:45 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. Swim the 200 free in under 1:43 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

9. Swim the 200 free in under 1:41 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix H

Self-Efficacy Scale, Relay, Female 50 Freestyle

Please rate how confident you are that YOU can attain the different levels of performance when swimming the 50 yard freestyle today on the RELAY.

Rate your degree of confidence that YOU can attain the different levels of performance on your RELAY SWIM by circling a number from:

0 (cannot do at all) to 100 (positive you can do) using the scale given below

1. Swim the 50 free in under :28.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. Swim the 50 free in under :27.5 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. Swim the 50 free in under :27.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. Swim the 50 free in under :26.5 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. Swim the 50 free in under :26.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. Swim the 50 free in under :25.5 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

7. Swim the 50 free in under :25.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. Swim the 50 free in under :24.5 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

9. Swim the 50 free in under :24.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix I

Self-Efficacy Scale, Relay, Male 50 Freestyle

Please rate how confident you are that YOU can attain the different levels of performance when swimming the 50 yard freestyle today on the RELAY.

Rate your degree of confidence that YOU can attain the different levels of performance on your RELAY SWIM by circling a number from:

0 (cannot do at all) to 100 (positive you can do) using the scale given below

1. Swim the 50 free in under :25.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. Swim the 50 free in under :24.5 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. Swim the 50 free in under :24.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. Swim the 50 free in under :23.5 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. Swim the 50 free in under :23.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. Swim the 50 free in under :22.5 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

7. Swim the 50 free in under :22.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. Swim the 50 free in under :21.5 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

9. Swim the 50 free in under :21.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix J

Self-Efficacy Scale, Relay, Female 100 Freestyle

Please rate how confident you are that YOU can attain the different levels of performance when swimming the 100 yard freestyle today on the RELAY.

Rate your degree of confidence that YOU can attain the different levels of performance on your RELAY SWIM by circling a number from:

0 (cannot do at all) to 100 (positive you can do) using the scale given below

1. Swim the 100 free in under 1:06 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. Swim the 100 free in under 1:04 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. Swim the 100 free in under 1:02 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. Swim the 100 free in under 1:00 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. Swim the 100 free in under :58 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. Swim the 100 free in under :56 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

7. Swim the 100 free in under :54 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. Swim the 100 free in under :52 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

9. Swim the 100 free in under :50 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix K

Self-Efficacy Scale, Relay, Male 100 Freestyle

Please rate how confident you are that YOU can attain the different levels of performance when swimming the 100 yard freestyle today on the RELAY.

Rate your degree of confidence that YOU can attain the different levels of performance on your RELAY SWIM by circling a number from:

0 (cannot do at all) to 100 (positive you can do) using the scale given below

1. Swim the 100 free in under :59 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. Swim the 100 free in under :57 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. Swim the 100 free in under :55 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. Swim the 100 free in under :53 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. Swim the 100 free in under :51 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. Swim the 100 free in under :49 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

7. Swim the 100 free in under :47 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. Swim the 100 free in under :45 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

9. Swim the 100 free in under :43 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix L

Self-Efficacy Scale, Relay, Female 200 Freestyle

Please rate how confident you are that YOU can attain the different levels of performance when swimming the 200 yard freestyle today on the RELAY.

Rate your degree of confidence that YOU can attain the different levels of performance on your RELAY SWIM by circling a number from:

0 (cannot do at all) to 100 (positive you can do) using the scale given below

1. Swim the 200 free in under 2:06 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. Swim the 200 free in under 2:04 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. Swim the 200 free in under 2:02 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. Swim the 200 free in under 2:00 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. Swim the 200 free in under 1:58 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. Swim the 200 free in under 1:56 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

7. Swim the 200 free in under 1:54 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. Swim the 200 free in under 1:52 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

9. Swim the 200 free in under 1:50 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix M

Self-Efficacy Scale, Relay, Male 200 Freestyle

Please rate how confident you are that YOU can attain the different levels of performance when swimming the 200 yard freestyle today in the RELAY.

Rate your degree of confidence that YOU can attain the different levels of performance on your RELAY SWIM by circling a number from:

0 (cannot do at all) to 100 (positive you can do) using the scale given below

1. Swim the 200 free in under 1:57 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. Swim the 200 free in under 1:55 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. Swim the 200 free in under 1:53 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. Swim the 200 free in under 1:51 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. Swim the 200 free in under 1:49 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. Swim the 200 free in under 1:47 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

7. Swim the 200 free in under 1:45 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. Swim the 200 free in under 1:43 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

9. Swim the 200 free in under 1:41 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix N

Other Efficacy Scale, Female 200 Freestyle Relay

Today you will swim in the 200 yard freestyle relay
Please rate how confident you are in the OTHER MEMBERS of your relay team in attaining the different levels of performance.

Rate your degree of confidence that the OTHER MEMBERS of your relay team can attain the different levels of average split times by circling a number from:
0 (cannot do at all) to 100 (positive you can do) using the scale given below

1. Swim the 200 free relay average split time under :28.0 sec
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
2. Swim the 200 free relay average split time under :27.5 sec
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
3. Swim the 200 free relay average split time under :27.0 sec
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
4. Swim the 200 free relay average split time under :26.5 sec
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
5. Swim the 200 free relay average split time under :26.0 sec
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
6. Swim the 200 free relay average split time under :25.5 sec
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
7. Swim the 200 free relay average split time under :25.0 sec
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
8. Swim the 200 free relay average split time under :24.5 sec
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
9. Swim the 200 free relay average split time under :24.0 sec
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix O

Other Efficacy Scale, Male 200 Freestyle Relay

Today you will swim in the 200 yard freestyle relay
Please rate how confident you are in the OTHER MEMBERS of your relay team in attaining the different levels of performance.

Rate your degree of confidence that the OTHER MEMBERS of your relay team can attain the different levels of average split times by circling a number from:
0 (cannot do at all) to 100 (positive you can do) using the scale given below

1. Swim the 200 free relay average split time under :25.0 sec
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
2. Swim the 200 free relay average split time under :24.5 sec
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
3. Swim the 200 free relay average split time under :24.0 sec
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
4. Swim the 200 free relay average split time under :23.5 sec
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
5. Swim the 200 free relay average split time under :23.0 sec
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
6. Swim the 200 free relay average split time under :22.5 sec
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
7. Swim the 200 free relay average split time under :22.0 sec
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
8. Swim the 200 free relay average split time under :21.5 sec
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
9. Swim the 200 free relay average split time under :21.0 sec
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix P

Other Efficacy Scale, Female 400 Freestyle Relay

Today you will swim in the 400 yard freestyle relay
Please rate how confident you are in the OTHER MEMBERS of your relay team in attaining the different levels of performance.

Rate your degree of confidence that the OTHER MEMBERS of your relay team can attain the different levels of average split times by circling a number from:
0 (cannot do at all) to 100 (positive you can do) using the scale given below

1. Swim the 400 free relay average split time under 1:06 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. Swim the 400 free relay average split time under 1:04 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. Swim the 400 free relay average split time under 1:02 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. Swim the 400 free relay average split time under 1:00 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. Swim the 400 free relay average split time under :58 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. Swim the 400 free relay average split time under :56 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

7. Swim the 400 free relay average split time under :54 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. Swim the 400 free relay average split time under :52 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

9. Swim the 400 free relay average split time under :50 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix Q

Other Efficacy Scale, Male 400 Freestyle Relay

Today you will swim in the 400 yard freestyle relay
Please rate how confident you are in the OTHER MEMBERS of your relay team in attaining the different levels of performance.

Rate your degree of confidence that the OTHER MEMBERS of your relay team can attain the different levels of average split times by circling a number from:
0 (cannot do at all) to 100 (positive you can do) using the scale given below

1. Swim the 400 free relay average split time under :59 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. Swim the 400 free relay average split time under :57 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. Swim the 400 free relay average split time under :55 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. Swim the 400 free relay average split time under :53 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. Swim the 400 free relay average split time under :51 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. Swim the 400 free relay average split time under :49 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

7. Swim the 400 free relay average split time under :47 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. Swim the 400 free relay average split time under :45 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

9. Swim the 400 free relay average split time under :43 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix R

Other Efficacy Scale, Female 800 Freestyle Relay

Today you will swim in the 800 yard freestyle relay
Please rate how confident you are in the OTHER MEMBERS of your relay team in attaining the different levels of performance.

Rate your degree of confidence that the OTHER MEMBERS of your relay team can attain the different levels of average split times by circling a number from:
0 (cannot do at all) to 100 (positive you can do) using the scale given below

1. Swim the 800 free relay average split time under 2:06 min
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
2. Swim the 800 free relay average split time under 2:04 min
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
3. Swim the 800 free relay average split time under 2:02 min
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
4. Swim the 800 free relay average split time under 2:00 min
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
5. Swim the 800 free relay average split time under 1:58 min
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
6. Swim the 800 free relay average split time under 1:56 min
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
7. Swim the 800 free relay average split time under 1:54 min
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
8. Swim the 800 free relay average split time under 1:52 min
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
9. Swim the 800 free relay average split time under 1:50 min
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix S

Other Efficacy Scale, Male 800 Freestyle Relay

Today you will swim in the 800 yard freestyle relay
Please rate how confident you are in the OTHER MEMBERS of your relay team in attaining the different levels of performance.

Rate your degree of confidence that the OTHER MEMBERS of your relay team can attain the different levels of average split times by circling a number from:
0 (cannot do at all) to 100 (positive you can do) using the scale given below

1. Swim the 800 free relay average split time under 1:57 min
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
2. Swim the 800 free relay average split time under 1:55 min
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
3. Swim the 800 free relay average split time under 1:53 min
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
4. Swim the 800 free relay average split time under 1:51 min
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
5. Swim the 800 free relay average split time under 1:49 min
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
6. Swim the 800 free relay average split time under 1:47 min
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
7. Swim the 800 free relay average split time under 1:45 min
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
8. Swim the 800 free relay average split time under 1:43 min
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
9. Swim the 800 free relay average split time under 1:41 min
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix T

Relation-Inferred Self-Efficacy Scale, Female 200 Freestyle Relay

Today you will swim in the 200 yard freestyle relay
Please rate how confident your OTHER RELAY MEMBERS are in YOUR ability in attaining
the different levels of performance.

Rate your relay members' degree of confidence that YOU can attain the different levels of average split
times by circling a number from:
0 (cannot do at all) to 100 (positive you can do) using the scale given below

1. Swim the 200 free relay average split time under :28.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. Swim the 200 free relay average split time under :27.5 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. Swim the 200 free relay average split time under :27.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. Swim the 200 free relay average split time under :26.5 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. Swim the 200 free relay average split time under :26.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. Swim the 200 free relay average split time under :25.5 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

7. Swim the 200 free relay average split time under :25.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. Swim the 200 free relay average split time under :24.5 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

9. Swim the 200 free relay average split time under :24.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix U

Relation-Inferred Self-Efficacy Scale, Female 400 Freestyle Relay

Today you will swim in the 400 yard freestyle relay
Please rate how confident your OTHER RELAY MEMBERS are in YOUR ability in attaining
the different levels of performance.

Rate your relay members' degree of confidence that YOU can attain the different levels of average split
times by circling a number from:
0 (cannot do at all) to 100 (positive you can do) using the scale given below

1. Swim the 400 free relay average split time under 1:06 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. Swim the 400 free relay average split time under 1:04 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. Swim the 400 free relay average split time under 1:02 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. Swim the 400 free relay average split time under 1:00 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. Swim the 400 free relay average split time under :58 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. Swim the 400 free relay average split time under :56 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

7. Swim the 400 free relay average split time under :54 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. Swim the 400 free relay average split time under :52 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

9. Swim the 400 free relay average split time under :50 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix V

Relation-Inferred Self-Efficacy Scale, Female 800 Freestyle Relay

Today you will swim in the 800 yard freestyle relay
Please rate how confident your OTHER RELAY MEMBERS are in YOUR ability in attaining
the different levels of performance.

Rate your relay members' degree of confidence that YOU can attain the different levels of average split
times by circling a number from:
0 (cannot do at all) to 100 (positive you can do) using the scale given below

1. Swim the 800 free relay average split time under 2:06 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. Swim the 800 free relay average split time under 2:04 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. Swim the 800 free relay average split time under 2:02 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. Swim the 800 free relay average split time under 2:00 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. Swim the 800 free relay average split time under 1:58 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. Swim the 800 free relay average split time under 1:56 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

7. Swim the 800 free relay average split time under 1:54 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. Swim the 800 free relay average split time under 1:52 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

9. Swim the 800 free relay average split time under 1:50 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix W

Relation-Inferred Self-Efficacy Scale, Male 200 Freestyle Relay

Today you will swim in the 200 yard freestyle relay
Please rate how confident your OTHER RELAY MEMBERS are in YOUR ability in attaining
the different levels of performance.

Rate your relay members' degree of confidence that YOU can attain the different levels of average split
times by circling a number from:
0 (cannot do at all) to 100 (positive you can do) using the scale given below

1. Swim the 200 free relay average split time under :25.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. Swim the 200 free relay average split time under :24.5 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. Swim the 200 free relay average split time under :24.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. Swim the 200 free relay average split time under :23.5 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. Swim the 200 free relay average split time under :23.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. Swim the 200 free relay average split time under :22.5 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

7. Swim the 200 free relay average split time under :22.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. Swim the 200 free relay average split time under :21.5 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

9. Swim the 200 free relay average split time under :21.0 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix X

Relation-Inferred Self-Efficacy Scale, Male 400 Freestyle Relay

Today you will swim in the 400 yard freestyle relay
Please rate how confident your OTHER RELAY MEMBERS are in YOUR ability in attaining
the different levels of performance.

Rate your relay members' degree of confidence that YOU can attain the different levels of average split
times by circling a number from:
0 (cannot do at all) to 100 (positive you can do) using the scale given below

1. Swim the 400 free relay average split time under :59 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. Swim the 400 free relay average split time under :57 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. Swim the 400 free relay average split time under :55 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. Swim the 400 free relay average split time under :53 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. Swim the 400 free relay average split time under :51 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. Swim the 400 free relay average split time under :49 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

7. Swim the 400 free relay average split time under :47 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. Swim the 400 free relay average split time under :45 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

9. Swim the 400 free relay average split time under :43 sec

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix Y

Relation-Inferred Self-Efficacy Scale, Male 800 Freestyle Relay

Today you will swim in the 800 yard freestyle relay
Please rate how confident your OTHER RELAY MEMBERS are in YOUR ability in attaining
the different levels of performance.

Rate your relay members' degree of confidence that YOU can attain the different levels of average split
times by circling a number from:
0 (cannot do at all) to 100 (positive you can do) using the scale given below

1. Swim the 800 free relay average split time under 1:57 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. Swim the 800 free relay average split time under 1:55 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. Swim the 800 free relay average split time under 1:53 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. Swim the 800 free relay average split time under 1:51 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. Swim the 800 free relay average split time under 1:49 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. Swim the 800 free relay average split time under 1:47 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

7. Swim the 800 free relay average split time under 1:45 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. Swim the 800 free relay average split time under 1:43 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

9. Swim the 800 free relay average split time under 1:41 min

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix Z

Pre Relay Questionnaire

1. How indispensable is your upcoming swim to the outcome of the relay?
- | <i>No Contribution</i> | | | | | | | | | | <i>Maximum Contribution</i> | |
|------------------------|---|---|---|---|---|---|---|---|----|-----------------------------|--|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |

Appendix AA

Post Relay Questionnaire

1. Did you compare your split time to others' split times in the relay?

No Comparison

Maximum Comparison

1 2 3 4 5 6 7 8 9 10

2. As you were preparing to start, how much did you think you would contribute to the relay?

No Contribution

Maximum Contribution

1 2 3 4 5 6 7 8 9 10

3. Please describe your exertion on the previous swim on the relay:

6 No Exertion At All

7

8 Extremely Light

9

10

11 Light

12

13 Somewhat Hard

14

15 Hard

16

17 Very Hard

18

19 Extremely Hard

20 Maximal Exertion

Appendix AB

Confidentiality Assurance

While the nature of this research contains sensitive information regarding yourself and other teammates, it is of absolute importance that you are completely honest about how you feel. Your answers will help to determine very important information with respect to confidence and motivation.

Your answers will be kept strictly confidential and will only be seen by the researcher conducting the study. Your coach, parents, and other teammates will not have access to any part of your survey. When the researchers are done with your survey, your name will be removed from all parts of the survey and your answers will no longer be identifiable.

When you are finished with the survey, please return it to the researcher and place it directly into the provided envelope.

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