

EXAMINING THE RELATIONSHIPS BETWEEN ABILITY CONCEPTIONS, INTRINSIC
MOTIVATION, PERSISTENCE, AND PERFORMANCE

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ABSTRACT

The purpose of this study was to examine the relationships between ability conceptions, intrinsic motivation, persistence, and performance using an interaction approach. The phase-one study revealed that participants who were more oriented toward incremental ability beliefs were likely to be more intrinsically motivated. For those who were more intrinsically motivated, they displayed more persistence and obtained better performance scores. Participants who were highly intrinsically motivated had lower performance scores as they were more oriented toward incremental ability beliefs. The phase-two study showed that participants who were more oriented toward incremental views were more intrinsically motivated, which provided evidence supporting the important role of dispositional ability conceptions in mediating intrinsic motivation. Participants who were more intrinsically motivated had better performance scores. Participants with high levels of intrinsic motivation in the incremental condition persisted longer than those in the entity condition. The results suggest that when studying the effects of situational ability conceptions on motivational patterns dispositional ability conceptions should be considered. It is also suggested that if physical education teachers want to improve students' learning outcomes a positive environment should be created, whereby their perceptions of competency and intrinsic motivation will be enhanced. Finally, an interaction approach promises to provide a deeper understanding of how motivational constructs interact to affect students' motivational patterns.

INTRODUCTION

Previous research in motivation has demonstrated that individuals' achievement strivings are complex processes involving many factors that interact to affect behavior. Numerous theoretical frameworks have been established to understand achievement strivings, and it is unlikely that a single theory or set of related constructs can completely explain individuals' motivation and cognition in achievement contexts (Pintrich, 2003). Multiple perspectives from two or more theories with different sets of defining characteristics can be combined to better understand a person's achievement strivings. Today, Americans are at risk of being physically inactive. It is imperative for physical education researchers to understand how motivational factors such as ability belief systems, intrinsic motivation, and competence beliefs relate to one another and interact to impact individuals' achievement behaviors. Drawing from multiple models has the potential to guide researchers and teachers in identifying ways to create positive motivational environments that will encourage students to actively engage in physical activities and adopt physically active lifestyles.

ABILITY CONCEPTIONS

Among the modern motivational theories, conceptions of ability and intrinsic motivation have been identified as important constructs directly or indirectly affecting individuals' achievement strivings and outcomes. Conceptions of ability or implicit theories of ability have been used to describe students' personal belief systems about the relationships among ability, effort/practice, and performance. Dweck (1999, 2002) proposed that students' theories about their ability will lead them to view ability as being largely fixed and unchangeable, or malleable through their own efforts.

Dweck's (1999) implicit theories of ability focus mainly on the relationship between ability and effort/practice, and determine beliefs about whether or not ability can be changed. In a similar way, Nicholls (1984a, 1984b, 1989) has defined conceptions of ability as being differentiated or undifferentiated, and suggests the undifferentiated view is consistent with the belief that ability can be improved through effort and learning. The most important thing is that both Nicholls and Dweck have reported that individual conceptions of ability or implicit theories of ability affect their achievement strivings and learning outcomes in significant ways.

In this paper, an entity conception of ability will represent the view that ability is fixed and cannot be changed through effort. In contrast to this view, an incremental conception of ability is a belief that ability is malleable and can be changed through effort.

Research has shown that individuals differ in dispositions for the development of ability as being a stable trait or a process that can be changed by effort and practice (Dweck, 1999; Dweck & Leggett, 1988; Nicholls, 1989), but more important for teachers is the work indicating that situational factors emphasizing either an entity or incremental ability conception can also exert a powerful influence on students' ability beliefs over time. There is evidence (e. g. Taberero & Wood, 1999) that the environment and the features of a situation can influence these basic beliefs and assumptions. Teachers can promote an entity conception by creating a condition that emphasizes outperforming others and normative comparisons. If task mastery is endorsed, however, students can be influenced to organize their thinking toward an incremental orientation and an adaptive view of achievement (Jagacinski & Nicholls, 1984; Thill & Brunel, 1995).

Classroom research from both dispositional and situational perspectives has demonstrated that individuals with dispositions oriented toward entity conceptions or who are placed in entity

conditions will tend to focus more on documenting their performance (Butler, 2000), be less intrinsically motivated, display less persistence and effort, and would avoid showing deficient performance of any kind in the face of difficulty. They generally believe that effort is a measure of ability and hard work translates to lower ability. These motivational patterns should result in performance decrements, especially when perceived ability is low (Dweck & Sorich, 1999). In contrast, students oriented toward incremental dispositions or those placed in incremental conditions believe that competence can be developed and an involvement in effort will increase their ability. When faced with failure, they tend to be more determined and intrinsically motivated, and look for ways to become more mastery oriented, which should produce positive achievement outcomes (Hong, Chiu, Dweck, Lin, & Wan, 1999; Martocchio, 1994; Nicholls & Miller, 1984; Wood & Bandura, 1989).

Recently, Taberero and Wood (1999) employed an interaction approach to investigate how situational and dispositional ability conceptions interact to influence motivational and behavioral responses in achievement contexts. Using the person-environment fit theory, these researchers proposed that when studying the effect of situational cues on motivational and behavioral patterns, dispositional ability conceptions must be taken into consideration. This approach promises to provide a deeper and more complete understanding of how ability beliefs affect motivational and behavioral consequences.

In the physical domains, limited research has been done to investigate the relationships between ability conceptions and motivational patterns and outcomes. Several researchers have investigated how ability conceptions influence self-efficacy, affect, motivation, and performance from a situational perspective (Jagacinski & Nicholls, 1984; Jourden, Bandura, & Banfield, 1991; Kasimatis, Miller, & Marcussen, 1996; Lirgg, George, Chase, & Ferguson, 1996). The

findings were consistent with theoretical predictions and classroom research, indicating that individuals in incremental conditions were more likely to show interest/enjoyment and positive affect, develop stronger self-efficacy, persist longer, and obtain better performance than those in entity conditions. This line of research has provided evidence about how students, regardless of their dispositional ability conceptions, respond and act with regard to different learning situations.

From a dispositional perspective, Belcher, Lee, Solmon, and Harrison (2003) investigated the effects of gender-related beliefs and dispositional ability conceptions on students' competency beliefs, effort and persistence, and actual performance. The merit of this study is that participants were selected from a large pool based on their beliefs about whether ability is innate or acquired, and these ability beliefs were reinforced through teachers' comments during the instructional session. The results indicated that ability beliefs did not produce a significant difference, which was inconsistent with the classroom literature. These researchers, however, did not provide any explanation for the inconsistency. One question that remains to be answered in physical activity settings is whether or not dispositional ability conceptions make a difference in individuals' motivational consequences. If these initial beliefs do make a difference, then a further question is how dispositional and situational ability conceptions interact to affect these responses.

ABILITY CONCEPTIONS AND INTRINSIC MOTIVATION

The distinct feature of ability conceptions is how ability is defined by students and whether it is changeable or unchangeable. The conception of ability an individual adopts has a great impact on his or her perceived competence, which in turn mediates the effects of ability conceptions on motivational patterns and achievement outcomes (Dweck, 2002; Jourden, et al.,

1991; Wood & Bandura, 1989).

Perceived competence also plays a central role in intrinsic motivation (Bandura, 1986; Deci & Ryan, 1985; Harachiewicz & Elliot, 1993). Intrinsic motivation generally leads to engagement in an activity for pleasure and enjoyment, or as an end itself (Deci, 1975; Deci & Ryan, 1985). There is clear evidence that intrinsic motivation leads to adaptive cognitive, affective, and behavioral consequences (Vallerand, 2001). The growth of a student's intrinsic interest and enjoyment in an activity is fostered through his or her competence or efficacy beliefs (Bandura, 1997). Given these interrelationships between ability conceptions, perceived competence, and intrinsic motivation, researchers have recently attempted to bridge the ability conceptions and intrinsic motivation literatures (Aronson, Fried, & Good, 2003; Jourden, et al., 1991; Kasimatis, et al., 1996).

The classroom literature has shown that students with incremental dispositions are more intrinsically motivated as compared to those with entity dispositions, and situations where incremental ability conceptions are emphasized can foster intrinsic motivation (Dweck, 1999, 2002). In the physical domain, two studies from a situational perspective have investigated how ability conceptions affect intrinsic motivation (Jourden, et al., 1991; Kasimatis, et al., 1996). The findings from these two studies were consistent with the classroom research, indicating that individuals in the incremental condition were more intrinsically motivated as compared to those in the entity condition. Though these studies are consistent with the classroom literature, there are some limitations in these two studies.

First, in the studies by Jourden, et al. (1991) and Kasimatis, et al. (1996), participants were tested individually and could not interact with others being tested. They only had access to their own performance, and could not view the performance of other participants. In physical

education classes, the activities are public and students can easily view the performance of other students. The availability of normative information makes it easy for even young students to make social comparisons. Therefore, there is a need to investigate the effects of situational ability conceptions on students' motivational and behavioral consequences in a setting that allows opportunities for social comparisons and interactions. Addressing issues of student motivation and performance within a conceptual framework may provide information that will guide researchers and educators in their planning of interventions to promote more adaptive behaviors.

Second, the reliability of a one-item question used to measure participants' intrinsic motivation is questionable. In both the Jourden, et al. (1991) and Kasimatis, et al. (1996) studies, the researchers attempted to measure intrinsic motivation by simply asking participants if they were interested in continuing the task during the 5-minute independent practice time and how motivated they were to keep up with the instructional video. Although the findings of those two studies were consistent, the reliability of the measurements used to assess participants' intrinsic motivation is questionable. Additionally, dispositional ability conceptions were not accounted for in the two studies. Classroom research literature has demonstrated that dispositional ability conceptions play an important role in mediating individuals' motivational patterns and achievement outcomes (Dweck, 1999, 2002) and in the early stages of practice, these responses to a novel task are largely determined by dispositional ability conceptions (Taberner & Wood, 1999; Wood & Bandura, 1989); therefore, researchers must take dispositional ability conceptions into consideration when studying the effect of situational cues. Otherwise, the findings may be misleading because it is not clear whether it is the learning environment, the dispositional ability

conceptions, or the interaction of learning situations and dispositional ability conceptions that actually affect individuals' motivation and behavior.

Given the fact that perceived competence moderates the effect of ability conceptions on motivational patterns and outcome, and is at the heart of intrinsic motivation, it is possible that the effects of ability conceptions on motivational patterns and performance may be moderated by intrinsic motivation. Research to date, however, has dealt with ability conceptions and intrinsic motivation in isolation, or merely comparisons of these two constructs. Therefore, an approach that examines how the two variables interact to affect motivational patterns and performance promises to provide a more complete understanding of achievement behaviors in the physical domains.

This study expanded this line of research by addressing the limitations of the previous research. First, both phases were conducted in a setting using small learning groups, where participants could interact with each other during practice and their performance was visible to classmates. Further, explicit instructions about what students should do to be successful in the learning task were provided using written materials. This direct approach to instructions provided supplemental content information that could facilitate participants' learning. Second, the Intrinsic Motivation Inventory questionnaire (IMI) was used to assess participants' levels of intrinsic motivation. The IMI, developed by Ryan (1982) and his colleagues (Plant & Ryan, 1985), has been used to determine individuals' levels of intrinsic motivation as an additive function of the four sub-dimensions: interest/enjoyment, perceived competence, effort/importance, and pressure/tension. This measure is very flexible because it can assess both four specific sub-dimensions of intrinsic motivation and the overall level of intrinsic motivation that an individual experiences from engaging in a task. McAuley, Duncan, and Tammen (1989)

designed a study to assess selected psychometric properties of the IMI using a basketball jump shooting skill. The results of this study demonstrated the IMI is a reliable measurement that can be used to assess individuals' levels of intrinsic motivation in physical education settings. Third, an interaction approach was employed to study the relationships between dispositional ability conceptions, situational ability conceptions, intrinsic motivation, persistence, and performance. Finally, participants' engaged time during the independent practice session was recorded to assess their persistence during practice of the task.

This study was conducted in two phases. The phase-one study was designed to investigate the relationship between dispositional ability conceptions and intrinsic motivation and how these two variables interact to affect persistence and performance on a novel task in a small group physical education class setting. The purpose of the phase-two study was to examine how dispositional and situational ability conceptions interact to affect intrinsic motivation, and how dispositional ability conceptions, situational ability conceptions, and intrinsic motivation interact to affect persistence and performance on a more difficult novel task.

PHASE 1: DISPOSTIONAL ABILITY CONCEPTIONS, INTRINSIC MOTIVATION, PERSISTENCE, AND PERFORMANCE

Duda (2001) proposed that there are various dispositional factors that serve to govern human behavior in different achievement domains, including exercise and movement-related situations. At the dispositional level, individuals' personal beliefs and assumptions about themselves and others are constructs that have important implications for their achievement motivation. Self-beliefs about the nature of ability are one of several common threads that run through major motivational theories. Despite evidence that entity and incremental beliefs exist, there has been little attention given to these dispositional ability beliefs in the physical activity domain.

The present study was an initial attempt to understand the relationship between dispositional ability conceptions and intrinsic motivation, and how the two variables interact to affect persistence and performance in a physical activity setting. Participants' dispositional ability conceptions were assessed by their initial beliefs about whether ability in object manipulation is fixed or changeable. Specifically, two questions were addressed: (a) What is the relationship between dispositional ability conceptions and intrinsic motivation? (b) How do individuals' dispositional ability conceptions and intrinsic motivation affect their persistence and performance of a physical skill? It was hypothesized that students' levels of incremental ability conceptions would be positively associated with their levels of intrinsic motivation. It was also hypothesized that both dispositional ability conceptions and intrinsic motivation would predict persistence and performance, and that the effect of dispositional ability conceptions on persistence and performance would be moderated by intrinsic motivation.

METHOD

Participants

Participants for this study were 97 college female student volunteers enrolled in the Kinesiology classes at a southeastern university. They ranged in age from 18 to 44 years ($M = 22.2$, $SD = 4.29$). Consent forms were obtained from all the participants in accordance with the university's Institutional Review Board.

Research Personnel

Four research assistants were recruited and trained to monitor student practice during the instructional session and administer the final skill test. Research assistants attended a detailed training session three days prior to the experiment. They were introduced to the experimental task, and study procedures were explained to them. Researchers were provided with complete instructions for administering the skill test and were allowed opportunities to practice until an acceptable level of consistency was evident between the researchers in their test procedures. A female model was video taped while performing ten trials of the skill. The research assistants were asked to independently record the total number of successful counts for the first two trials on a score sheet. The counts from these two trials were discussed among the research assistants. Then the research assistants independently scored the remaining eight trials. The scores from the eight trials were used to assess the inter-rater reliability. The intraclass correlation coefficient from a two-way analysis of variance yielded a coefficient of 0.96.

Experimental Task

Lunastix was the novel task selected as the learning activity for the study. An object manipulation task, Lunastix required participants to lift a baton off the ground, and then catch and release it between two control handles in a back and forth manner.

Video-Taped Instructions and Demonstrations

A skilled female was video-taped as she introduced the concepts of fundamental motor skills, provided the learning instructions for the task, and demonstrated the skill. This instructor was selected because she is well skilled in the delivery of the instructions and can successfully execute the skill. The video tape was used in all instructional sessions to assure that information provided to participants was consistent across groups.

Instructional Cues

Additional skill-related instructions were provided to participants during practice using written materials. The cues were taken from the learning instructions provided on the video and included points in techniques: (a) lock your wrists; (b) leave your elbows flexible; (c) do not rush and feel the rhythm; (d) pull upward, releasing the baton from one handle stick, and catching it with the other in a back and forth manner; (e) bend your knees and absorb the force as you catch the baton; (f) keep your eyes on the baton and catch it on the top 1/3 of both the handle stick and the baton.

Instrumentation

Self-reported data were collected at different times throughout the study. The modified Conceptions of Natural Athletic Ability Questionnaire (CNAAQ-2; Wang & Biddle, 2001) was distributed after introducing the concepts of object manipulation skill, locomotor skills, and nonlocomotor skills. At the end of the independent practice session, participants were asked to complete the Intrinsic Motivation Index questionnaire and one item assessing the difficulty level of the task.

Conceptions of Ability. The Conceptions of Natural Athletic Ability Questionnaire (CNAAQ-2) has been employed to assess students' conceptions of ability in sports by Biddle and

his colleagues (Wang, Chatzisarantis, Spray, & Biddle, 2002; Wang & Biddle, 2001). The 12-item measure consists of four first order factors with three items for each factor (learning, improvement, stable, and gift) and two higher-order factors (Incremental and Entity). The incremental scale was assessed through two subscales reflecting learning (e. g., “to reach a high level of performance in sports, you must go through periods of learning and training”) and improvement (e. g., “in sports, if you work hard at it, you will always get better”). The entity scale was assessed through two subscales reflecting stable (e. g., “you have a certain level of ability in sports and you can not really do much to change that level”) and gift (e. g., “you need to have a certain ‘gift’ to be good at sports”). To be specific for this study, “sports” was replaced by “activities that involve object manipulation.” The response scales range from “strongly agree” to “strongly disagree.”

The author had also used this measure to assess conceptions of ability in sports in several studies (Li, Harrison, & Solmon, in press; Li, Lee, & Solmon, 2003). However, the reliability coefficient for the entity scale was inconsistent, sometimes as low as 0.65. To attain a high reliability coefficient for the entity scale, two modifications were made on the original questionnaire. First, the word “gifted” was changed to “talented.” For example, “you need to have a certain amount of natural talent to be good at activities that involve object manipulation.” Second, the item “it is difficult to change how good you are at sports” was replaced by “even if you work hard, making a big change (improvement) in how good you are at activities that involve object manipulation is very difficult.” The modified questionnaire was administered to 45 students enrolled in the kinesiology classes. The reliability alpha for both the entity and incremental ability conceptions were 0.79 and 0.85, respectively.

Intrinsic Motivation. The Intrinsic Motivation Index (IMI) (McAuley, et al., 1989), which consists of 16 Likert-type items, was used to assess students' intrinsic motivation with regard to the Lunastix activity. The seven-point response scale ranges from "very strongly agree" to "very strongly disagree." The 16-item measure includes four subscales: interest-enjoyment (4 items), perceived competence (4 items), effort-importance (4 items), and tension-pressure (4 items). The item "I enjoyed playing the activity very much" represents the interest-enjoyment dimension; the item "I think that I am pretty good at the activity" reflects the perceived competence dimension; the item "I tried very hard while practicing" assesses the effort-importance dimension; and the item "I was very relaxed while practicing" measures the tension-pressure subscale. The subscales can be analyzed individually, and can also be summed to derive a composite score for intrinsic motivation.

Task Difficulty. One item was designed to assess the difficulty level of the Lunastix skill: "Please indicate the difficulty level of this Lunastix skill by circling the number that corresponds to your perceptions." The seven-point response scale ranged from "very easy" to "very difficult."

Persistence. The engaged time during the independent 10-minute practice session was used to assess participants' persistence. It was recorded by systematically coding the videotaped learning session using a stopwatch. Participants were considered to be engaged in learning the task if they were involved in preparation, actually practicing, observing others, reading instructions, or retrieving the Lunastix. Other behaviors such as holding the sticks, sitting, or visiting with other students were considered off task. The amount of time participants spent on task was expressed as a percentage of the 10-minute independent practice time utilized.

A research assistant was recruited and trained on how to code the engaged time. A tape recording six subjects was randomly selected for the training session. Both the researcher and the research assistant coded the tape at the same time. The disagreements were discussed. After the training, both the researcher and the assistant independently coded 18 subjects on the two separate TV stations, and no discussions were allowed during the coding. The inter-rater reliability was assessed using the intra-class correlation coefficient, and it yielded a coefficient of 0.97.

Final Skill Test. A final skill test was administered to all participants, allowing each student three trials to perform the task. The research assistants recorded the total number of successful counts from each trial on a score sheet. A successful count was defined as every hit that participants executed. If participants continuously caught and released the baton between the two handle sticks 50 times, then they were asked to stop to begin the next trial. If participants dropped the baton or held the baton and two handle sticks together, they were stopped and asked to start the next trial. Each trial, therefore, could yield scores ranging from zero to 50 points. The average score from the three trials was used to assess the skill performance.

Procedures

Two television stations with two practice areas for each station were set up for this experiment. The two stations were located in two different practice rooms of a large activity area. Upon arrival, participants were randomly assigned to two groups. One group was directed to TV Station One, and the other one was directed to TV Station Two. The sticks were distributed to the participants. Before the instructional phase of the study students were introduced to object manipulation skills so they would have a basic knowledge of motor skill terminology used in this study. The video taped introduction explained that fundamental motor

skills are usually categorized as object manipulation skills, locomotor skills, and nonlocomotor skills. Object manipulation skills were described as a category of physical activity that includes throwing, catching, kicking, and striking, and these are used in many team and individual sport activities. It was explained that object manipulation or hand-eye coordination is important for success in activities such as frisbee, baton twirling, and juggling. Locomotor skills were described as running, jumping, skipping, and hopping that are necessary ingredients for success in team sport activities and individual sports such as tennis and track and field. Nonlocomotor and rhythmic skills were defined as body movements dependent on balance, body control, creativity, and expressive responses needed for activities such as gymnastics and dance. This information was provided to insure that students understood the concept of object manipulation.

Following the introduction, the Conceptions of Ability in Object Manipulation questionnaire was distributed. Participants were told that they were going to learn a skill called Lunastix and the purpose of the session was to validate the activity as a measure of object manipulation ability. The video-taped instructions and demonstration of Lunastix were shown to all participants. Participants were allowed to perform the skill while watching the instructions and demonstration of the skill.

After watching the video, participants were randomly assigned to four practice areas with five or six participants in each practice area, and were given a 10-minute independent time period to practice the task. They were allowed to practice as much or as little as they desired during the session. No individualized feedback was provided by research assistants, but students had the printed instructional cues available.

After the 10-minute independent practice session, the Intrinsic Motivation Index questionnaire and one-item assessing the difficulty level of the Lunastix skill were administered

to participants. Finally, the skill test was given to all participants. A video camera was situated to record participants' actions during the independent practice session so that engaged time could be coded at a later time.

RESULTS

Internal consistency reliability for all subscales from the Conceptions of Ability in Object Manipulation and the Intrinsic Motivation Index questionnaires was assessed using Cronbach's (Cronbach, 1951) coefficient alpha. All subscales demonstrated acceptable levels of internal consistency ranging from 0.76-0.92. The aggregate scores were calculated by summing all responses for each item and dividing by the relevant number of items per subscale. All negatively worded items in the IMI were reversed before the data analysis. The aggregate score for intrinsic motivation was derived by summing all four sub-scales and dividing by four. For the tension and pressure sub-scale of IMI, the higher number participants assigned, the more relaxed they felt during the practice session. The score for Ability Conceptions in Object Manipulation was calculated by summing the incremental scale and the reversed entity scale and dividing by two (Dweck, 1999). The derived mean was used as an index of conceptions of object manipulation ability as changeable through effort, with higher numbers representing greater endorsement of the incremental perspective. Means, standard deviations, and Cronbach's coefficient alphas (where appropriate) for entity and incremental conceptions of ability, dispositional ability conceptions, intrinsic motivation, perceived competence, interest/enjoyment, tension/pressure, effort/importance, task difficulty, persistence, and performance are presented in Table 1.

Inspection of the mean of task difficulty indicated that participants in this study overall did not perceive this Lunastix skill as an easy task. The level of task difficulty is an important

motivational variable to understand when a given ability belief might mediate students' motivational patterns (Dweck, 2002). The ability conceptions research literature has clearly demonstrated that when entity theorists fail on a task perceived as difficult or challenging, they begin to question their ability and think of failure as a threat to their ability. As a result, they tend to display maladaptive motivational patterns such as avoiding the task, negative affect, low effort and persistence (Dweck, 1999, 2002; Nicholls, 1984a, 1984b, 1989). The results of this study suggest that the Lunastix skill presented a challenge to participants' ability, which provided a theoretical basis for studying the effects of ability beliefs on intrinsic motivation, and how these two variables affect persistence and performance.

Several studies (Li, Harrison, & Solmon, in press; Li, Lee, & Solmon, 2003) in physical domains have indicated that participants at college levels are more likely to be oriented toward being incremental views rather than entity views. Consistent with these results, the means of entity and incremental ability conceptions in this study indicated that participants were more likely to embrace incremental views that ability is changeable through effort and practice than entity views.

Correlational Analysis

To examine the relationships among dispositional ability conceptions (ABI), entity ability conceptions (ENT), incremental ability conceptions (INC), intrinsic motivation (IM), perceived competence (PC), interest/enjoyment (IE), tension/pressure (TP), effort/importance (EI), performance (PER), and persistence(PS), the spearman rank-order correlations were conducted. The correlation matrix is reported in Table 2.

The correlation analyses indicated a negative correlation between scores from the entity scale and the incremental scale, which was consistent with the theoretical prediction and

Table 1. Means, Standard Deviations, and Cronbach's Coefficient Alphas for Dispositional Ability Conceptions, Entity and Incremental Conceptions of Ability, Intrinsic Motivation, Perceived competence, Interest/Enjoyment, Tension/Pressure, Effort/Importance, Performance, Persistence, and Task Difficulty

Variable	Mean	Standard Deviation	Alpha (where appropriate)
Dispositional Ability Conceptions	3.74	0.44	--
Entity Ability Conceptions	2.51	0.59	0.79
Incremental Ability Conceptions	3.99	0.45	0.76
Intrinsic Motivation	4.54	0.68	--
Perceived competence	3.75	1.21	0.92
Interest/Enjoyment	4.98	1.10	0.91
Tension/Pressure	4.33	1.04	0.81
Effort/Importance	5.12	0.81	0.85
Performance	30.5 (hits/trial)	15.62	--
Persistence	0.96 (96%)	0.05	--
Task Difficulty	4.26	1.22	--

classroom findings. This finding suggests that participants who disagreed with the entity statements showed a moderate degree of support for the incremental statements. Theoretical predictions suggest that students who are more oriented toward incremental ability beliefs are likely to display more adaptive motivational patterns in the face of difficulty. The data in this study indicated ability conceptions were positively associated with effort/importance, intrinsic motivation, and interest/enjoyment. Participants who were more oriented toward incremental views of ability were likely to display more interest and enjoyment, exert more effort, and be

more intrinsically motivated. However, participants' ability conceptions were not significantly correlated with perceived competence, tension/pressure, performance, or persistence. There was no significant relationship between the incremental subscale and interest/enjoyment.

Table 2. Correlation Matrix between Variables for All Participants

Variable	1	2	3	4	5	6	7	8	9	10
Participants (N=97)										
1.ABI	--	-.85**	.78**	.25*	.06	.24*	-.01	.37**	.01	.05
2.ENT		--	-.39**	-.21*	-.04	-.26*	.05	-.34*	-.09	-.12
3.INC			--	.24*	.09	.18	.05	.31*	-.07	-.04
4.IM				--	.75**	.73**	.50**	.55**	.30*	.13
5.PC					--	.30*	.38*	.16	.59**	.09
6.IE						--	.07	.65**	-.01	.24*
7.TP							--	-.13	.16	-.19
8.EI								--	-.01	.30*
9.PER									--	.01
10.PS										--

Note. * $p < 0.05$; ** $p < 0.0001$

According to the literature, the more competence, the more interest and enjoyment and the less tension students show during engagement in physical activities, and the better performance they will achieve (Bandura, 1997; McAuley, et al., 1989). The data in this study indicated that participants with higher levels of perceived competence displayed higher levels of interest and enjoyment, experienced less tension and pressure, and achieved better performance scores. The correlational analyses also indicated that participants who showed more interest and

enjoyment were likely to exert more effort and persist longer, and those who exerted more effort were also likely to persist longer at the task.

Regression Analyses

Multiple regression analyses with interaction effects were used to investigate the effects of predictor variables on persistence and performance. The statistical models with persistence or performance as dependent variables were composed of three predictor variables: dispositional ability conceptions, intrinsic motivation, and the interaction between dispositional ability conceptions and intrinsic motivation. Because multiplicative terms can produce high levels of multicollinearity, the scores for intrinsic motivation and dispositional ability conceptions were centered. The centered scores for these two variables were calculated by using the original scores from each variable minus the mean of that variable. The product of intrinsic motivation and dispositional ability conceptions was computed for each subject by using the centered scores (Jaccard, Turrisi, & Wan, 1990).

For the model with persistence and performance as the dependent variables, the plots of residuals versus predicted values showed in Figure 1(a) and (b) indicated evidence that there were potential outliers. The tests of normality with the Shapiro-Wilk W statistics indicated that the assumption of normality for residuals was violated at a 0.05 significance level. The p values of for the tests of the normality for the residuals were 0.001 and 0.005, respectively. The probability plots as reflected in Figure 2(a) and (b) also showed evidence that the residuals from the two models were not normally distributed. Therefore, the ordinary least squares method may not provide a good fit to the data.

As an alternative to the ordinary least squares, robust regression is appropriate for the data when the residuals are considerably not normally distributed, and/or there are outliers

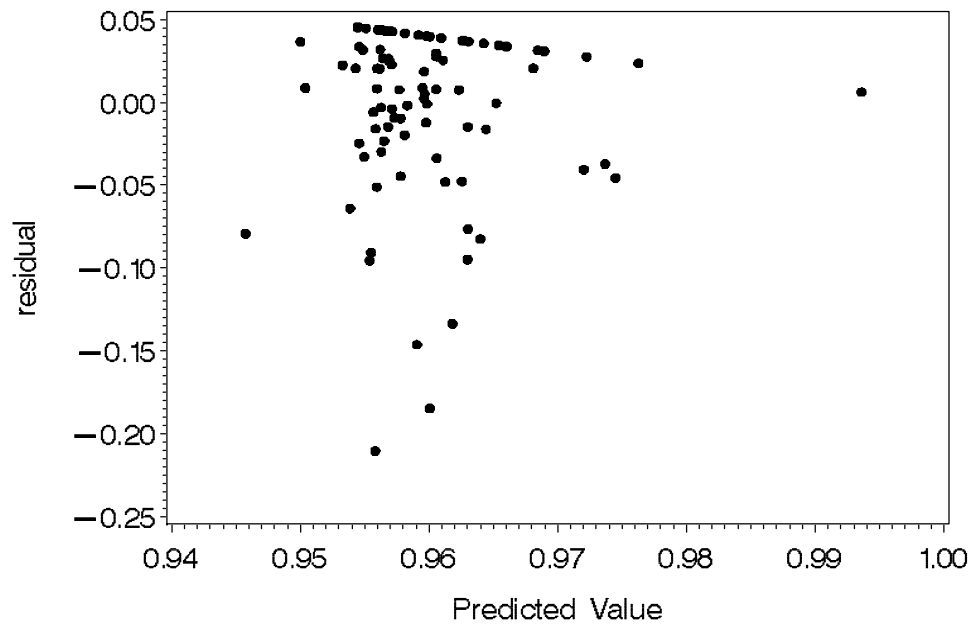


Figure 1(a). Residual Plot for Model with Persistence as Dependent Variable

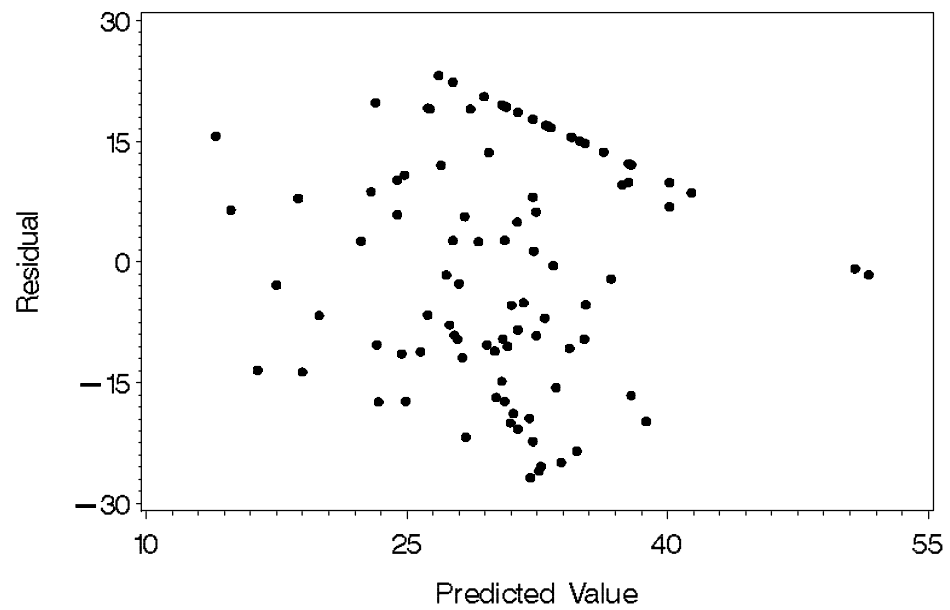


Figure 1(b). Residual Plot for Model with Performance as Dependent Variable

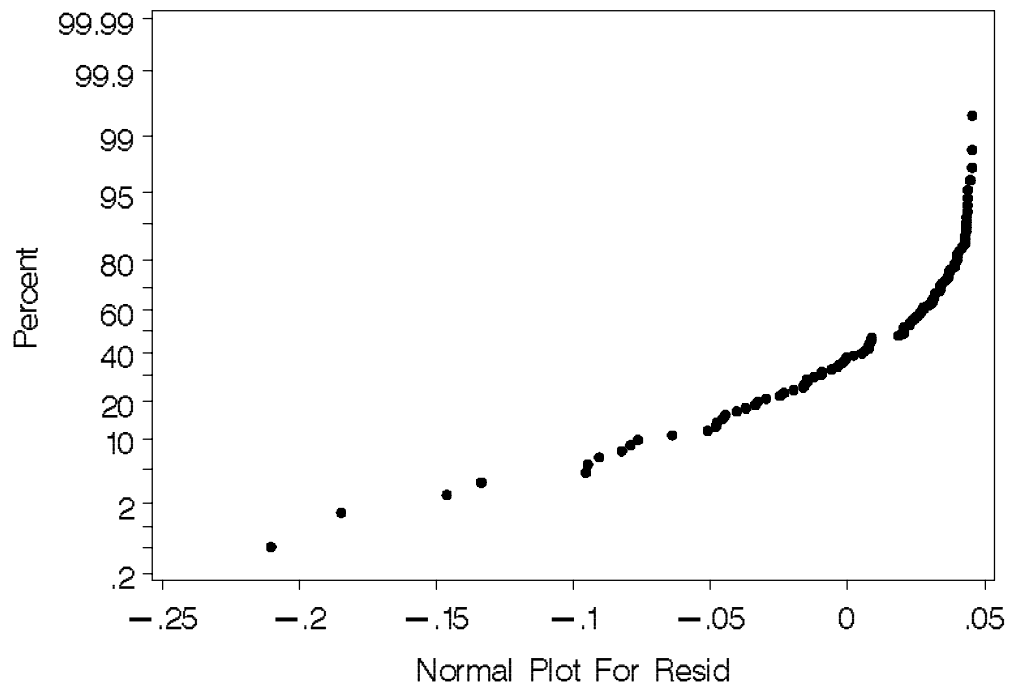


Figure 2 (a). Normal Probability Plot of the Residuals: Persistence

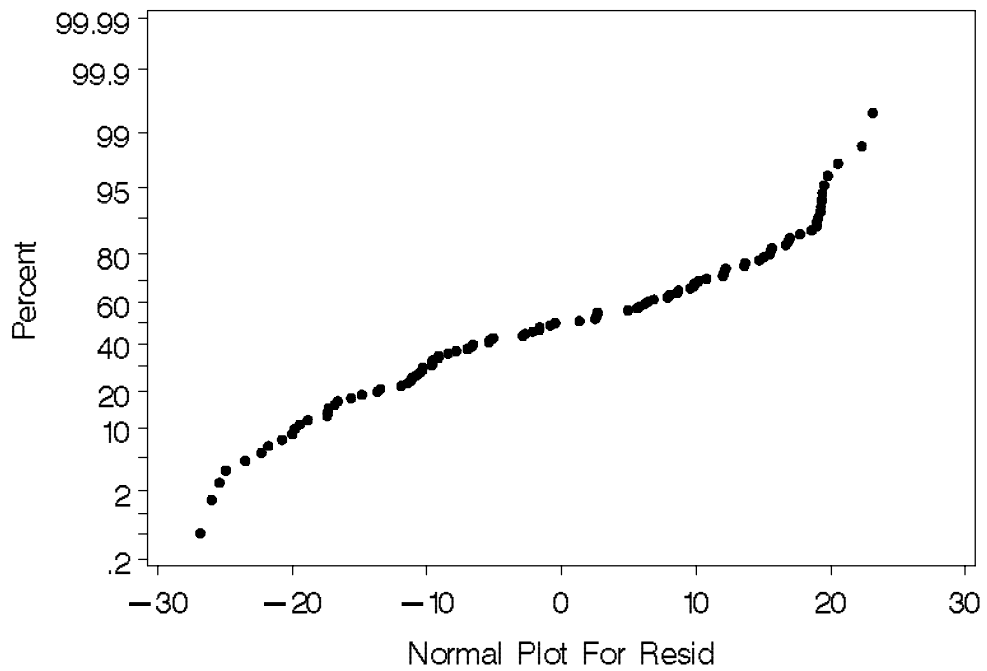


Figure 2 (b). Normal Probability Plot of the Residuals: Performance

affecting the equation (Ryan, 1997). The influential outliers will be assigned a weight of zero or close to zero. Robust regression with Least Trimmed Squares (LTS) was employed to analyze the data because it can produce resistant estimators of parameters. LTS estimation is a high breakdown value method. The breakdown value is a measure of the proportion of contamination that a procedure can withstand and still maintain its robustness.

The LTS estimate produced the regression model for persistence with R-square as 0.0898 (Table 3). LTS has identified 10 outliers (0.1031% of total observations) and 20 leverage points (0.2062%) in the data (Table 4). The cutoff value is 3.0 for an outlier and 3.0575 for the leverage points. Outlier contamination is quite serious for the data. The robust residual for outliers ranged from -7.602 to 0.8386 . Except for observations #36, #51, #57, #60, and #92 (with robust residuals ranging from -2.0393 to -5.1461), the leverage points had small values of robust residuals. They were identified as good leverage points, close to the regression line.

The LTS estimate produced the regression model for performance with R-square as 0.2823 (Table 5). LTS identified 20 leverage points (0.2062%) in the data (Table 6). No outlier was identified. The cutoff value is 3.0 for an outlier and 3.0575 for the leverage points. Outlier contamination is not a problem for the data. The robust residual for outliers ranged from -2.0818 to 1.2264 . Except for the observation #37 (with robust residuals -2.0818), the leverage points had small values of robust residuals. They were identified as good leverage points, which are close to the regression line.

It was predicted that dispositional ability conceptions, intrinsic motivation, and the interaction between the variables would affect students' persistence and performance. However, regressing persistence on dispositional ability conceptions, intrinsic motivation, and the interaction between these two variables yielded a significant main effect for intrinsic

Table 3. Parameter Estimations for Final Weighted Least Squares Fit by Least Trimmed Squares for the Persistence Data

Parameter	DF	Estimate	Standard Error	95% Confidence Limits		Chi-Square	Pr>ChiSq
Intercept	1	0.9746	0.0030	0.9689	0.9805	102843	<.0001
Ability Conceptions (AC)	1	-0.0007	0.0069	-0.0142	0.0129	0.01	0.9251
Intrinsic Motivation (IM)	1	0.0114	0.0050	0.0016	0.0211	5.25	0.0219
AC x IM	1	-0.0105	0.0105	-0.0311	0.0102	0.99	0.3203
Scale	0	0.0273					

Table 4. Outliers and Leverage Points Diagnostics by Least Trimmed Squares for the Persistence Data

Obs.	Mahalanobis Distance	Robust MCD Distance	Leverage	Robust Residual	Outlier
3	2.2888	4.9560	*	-1.7973	
17	2.1663	3.7615	*	0.9010	
20	2.6173	3.8539	*	0.4410	
21	2.9843	4.9053	*	0.3196	
30	1.3835	1.9997		-3.6793	*
32	2.8917	5.1371	*	-0.8928	
35	1.9727	3.2835	*	-0.3293	
36	2.3781	5.2089	*	-2.0814	
37	4.2336	7.3297	*	0.464	
38	1.1857	1.6985		-7.602	*
39	2.3161	3.5117	*	-1.5686	
41	6.1744	14.2877	*	0.0703	
47	3.4832	4.8728	*	-0.4809	
48	0.4451	0.5048		-5.5958	*
49	3.0355	5.5698	*	-0.7182	
51	2.2136	3.2649	*	-5.1461	*
52	2.6916	5.8089	*	0.1715	
55	2.4703	4.2691	*	0.1929	
56	0.6562	0.9996		-3.8865	*
57	2.0522	3.9552	*	-2.0393	
60	3.5178	5.1835	*	-3.2635	*
65	3.8461	7.0054	*	-0.0702	
66	1.2586	1.7518		-3.977	*
75	0.7560	1.3043		-3.4607	*
80	1.5972	2.1805		-6.9935	*
92	3.4406	4.7621	*	-3.6637	*
93	1.8699	3.1502	*	0.8386	

Table 5. Parameter Estimations for Final Weighted Least Squares Fit by Least Trimmed Squares for the Performance Data

Parameter	DF	Estimate	Standard Error	95% Confidence Limits		Chi-Square	Pr>ChiSq
Intercept	1	31.4639	1.5152	28.4942	34.4337	431.21	<.0001
Ability Conceptions (AC)	1	-0.0007	0.0069	-9.0469	4.5263	0.43	0.5139
Intrinsic Motivation (IM)	1	0.0114	0.0050	3.8680	12.8874	13.26	0.0003
AC x IM	1	-0.0105	0.0105	-25.9176	-4.7363	8.05	0.0046
Scale	0	14.5414					

Table 6. Outliers and Leverage Points Diagnostics by Least Trimmed Squares for the Performance Data

Obs	Mahalanobis Distance	Robust MCD Distance	Leverage	Robust Residual	Outlier
3	2.2888	4.9560	*	-1.7770	
17	2.1663	3.7615	*	-0.6615	
20	2.6173	3.8539	*	-1.6913	
21	2.9843	4.9053	*	0.2532	
32	2.8917	5.1371	*	1.2264	
35	1.9727	3.2835	*	0.7161	
36	2.3781	5.2089	*	0.8400	
37	4.2336	7.3297	*	-2.0818	
39	2.3161	3.5117	*	-0.8184	
41	6.1744	14.2877	*	-0.1235	
47	3.4832	4.8728	*	-0.0986	
49	3.0355	5.5698	*	0.7908	
51	2.2136	3.2649	*	0.2235	
52	2.6916	5.8089	*	-0.6515	
55	2.4703	4.2691	*	-1.9907	
57	2.0522	3.9552	*	0.5503	
60	3.5178	5.1835	*	-0.1359	
65	3.8461	7.0054	*	-0.5594	
92	3.4406	4.7621	*	-0.7194	
93	1.8699	3.1502	*	0.3029	

motivation (Table 3). In the regression analysis, the model accounted for 8.98% of the variance in persistence. This suggests that participants who were more intrinsically motivated were likely to persist longer at the task. The regression of performance on the same predictor variables indicated that intrinsic motivation positively predicted performance, the interaction of intrinsic

motivation and dispositional ability conceptions negatively predicted performance, and dispositional ability conceptions did not significantly predict performance (Table 5). This model accounted for 28.23% of the variance in performance. The results suggest that participants who were more intrinsically motivated during the instructional session performed better on the final skill test, and the effect of dispositional ability conceptions on performance varied across the range of intrinsic motivation.

Given that a significant interaction was detected, techniques of both plotting the interaction and post hoc statistical testing were used to sharpen the understanding of its meaning (Aiken & West, 1991; Jaccard, et al., 1990). The regression equation (1.1) was rewritten to express the regression of performance (y) on dispositional ability conceptions (x) at levels of intrinsic motivation (z) as follows.

$$y = \beta_0 + \beta_1x + \beta_2z + \beta_3xz + \varepsilon \quad (1.1)$$

$$y = \beta_0 + \beta_2z + (\beta_1 + \beta_3z)x + \varepsilon \quad (1.2)$$

The slope of the regression of performance (y) on dispositional ability conceptions (x) depends on the particular value of intrinsic motivation (z) at which the slope is considered. According to Cohen and Cohen (1983), the values of z_M , z_H , and z_L were used in this study, which corresponded to the mean of the centered intrinsic motivation, one standard deviation above the mean, and one standard deviation below the mean, respectively. As shown in Figure 3, the distribution indicated that the chosen values of 0.68, 0, and -0.68 reflected the high, medium, and low levels of intrinsic motivation.

The generated model was $\hat{y} = 31.4639 - 2.2603x + 8.3777z - 15.3269xz$. The values of 0.68, 0, and -0.68 were substituted into equation 1.2 to generate three estimated simple regression equations of performance on dispositional ability conceptions at specific values of

intrinsic motivation (Table 7). These equations were plotted to display the relationship between the interaction effect and performance (Figure 4). Inspections on the plot indicated a negative

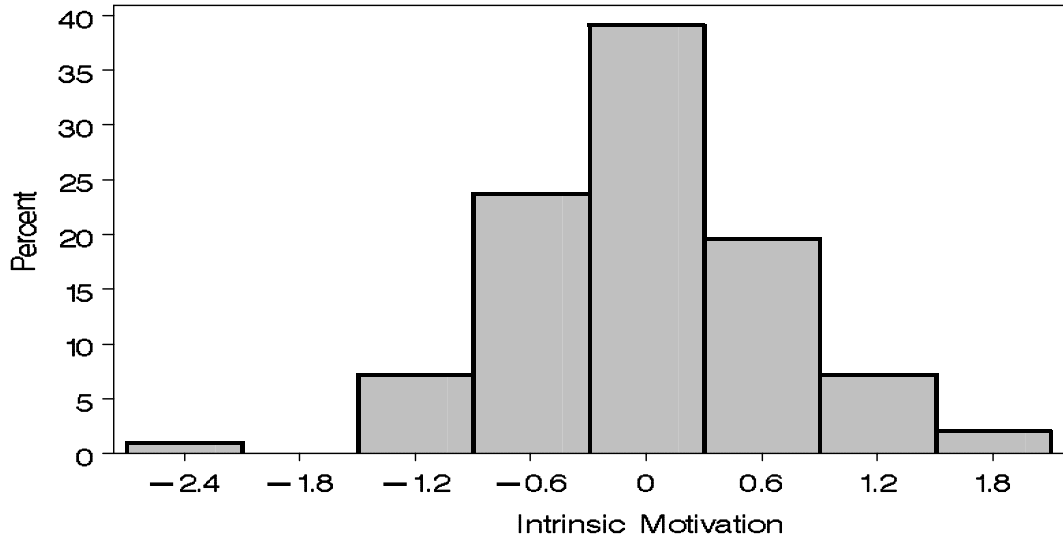


Figure 3. Histogram for Centered Intrinsic Motivation

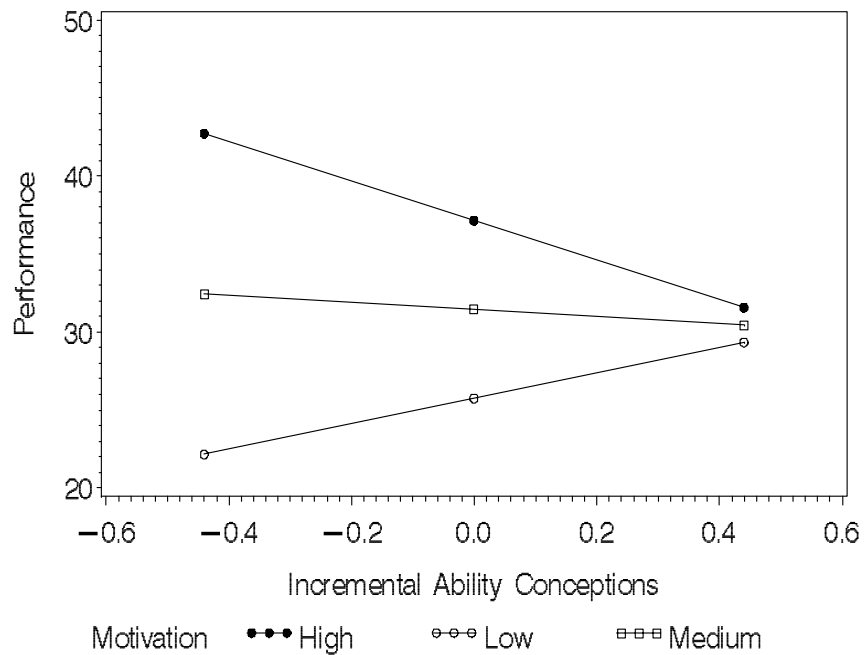


Figure 4. Scatter plot for the Interaction Effect between Performance and Incremental Conceptions at High, Medium, and Low Levels of Intrinsic Motivation

regression of performance on dispositional ability conceptions for the low value of intrinsic motivation, no relationship between performance and dispositional ability conceptions for the medium value of intrinsic motivation, a positive relationship between performance and dispositional ability conceptions for the high value of intrinsic motivation.

Table 7. Simple Regressions of Performance (y) on Dispositional Ability Conceptions (x) at Particular Values of Intrinsic Motivation (z) for Centered Data

Intrinsic Motivation	Estimated Regression Equations
$z_H = 0.68$	$\hat{y}_H = 37.16 - 12.68 * x$
$z_M = 0$	$\hat{y}_M = 31.46 - 2.26 * x$
$z_L = -0.68$	$\hat{y}_L = 25.76 + 8.16 * x$

T-tests were conducted to determine if the regression of performance on dispositional ability conceptions for a specified value of intrinsic motivation was significantly different from zero. The testing of significance of the simple slopes of regression lines involves the calculation of the estimated standard errors of these slopes. The estimated standard error for the estimate ($\hat{\beta}_1 + \hat{\beta}_3 * z$) is obtained from:

$$\sqrt{\text{var}(\hat{\beta}_1) + 2 * z * \text{cov}(\hat{\beta}_1, \hat{\beta}_3) + z^2 * \text{var}(\hat{\beta}_3)} \quad (1.3)$$

The estimated standard error in equation 1.3 varied as a function of the value of intrinsic motivation (z). The estimated standard errors were calculated at the values of z=-0.68, 0, and 0.68 and the t-tests for the estimated coefficients were calculated (Table 8). The t-tests indicated a negative relationship between performance and dispositional ability conceptions for the high level of intrinsic motivation, but no significant relationships for the value of intrinsic motivation at both the medium and low levels of intrinsic motivation. Participants who were highly

intrinsically motivated had lower performance scores as they were more oriented toward incremental ability beliefs.

Table 8. Estimated Coefficients, Estimated Standard Errors, and *t*-tests

Estimated Coefficients	Estimated Standard Errors	<i>t</i> -tests
$\hat{\beta}_H = -12.68$	5.14	-2.47*
$\hat{\beta}_M = -2.26$	3.46	-0.65
$\hat{\beta}_L = 8.16$	4.96	1.65

Note. * $p < .05$

DISCUSSION

Individuals are predispositionally oriented to different conceptions about their nature of ability. These dispositional ability beliefs play an important role in their achievement strivings. When a person believes that ability can be changed, he or she tends to be more determined and intrinsically motivated, and looks for ways to become more mastery oriented in the face of difficulty (Dweck, 1999). Consistent with the literature, the results of this study showed that participants who were more oriented toward incremental ability beliefs were likely to show more interest and enjoyment at the Lunastix activity and be more intrinsically motivated to learn it. The results also indicated a positive relationship between dispositional ability conceptions and effort/importance, suggesting that participants with stronger incremental ability conceptions were likely to exert more effort during the practice session. Willingness to put forth effort during learning a task is one of the most important adaptive motivational patterns. This finding extended the evidence for the role of dispositional ability conceptions as mediators of motivational patterns. Considering the findings of this study, physical practitioners and educators should gain a clear understanding of students' ability conceptions in order to structure an instructional

environment that will foster their interest and enjoyment and motivate them to engage in activities. This can be achieved by implementing instructional practices such as emphasizing the efficacy of effort and evaluating students based on personal improvement. For researchers, these dispositional ability beliefs should be accounted for when investigating the effects of situational ability conceptions on individuals' achievement striving. Otherwise, the results might be confounded by ignoring the role of dispositional ability beliefs.

Theoretical predictions suggest a negative correlation between entity and incremental ability conceptions, and this has been supported by previous research in academic settings (Dweck, 1999). For the physical activity domain, a mixture of results has been reported in several studies. For example, Wang and Biddle (2001) reported a low but significant negative correlation between these two variables with a coefficient of -0.10 ($p < 0.01$). In another study by Wang et al. (2002), however, there was no significant correlation between entity and incremental ability conceptions. The data in this study clearly showed a moderate negative correlation between entity ability conceptions and incremental ability conceptions, which is consistent with the theoretical prediction, the classroom literature, and the Wang and Biddle (2001) study.

Perceived competence has been theorized as an important construct that mediates individuals' achievement strivings. It also plays a central role in intrinsic motivation. The growth of a student's intrinsic interest and enjoyment in an activity is fostered through his or her competence or efficacy beliefs (Bandura, 1997). Consistent with the literature, participants in this study who felt more competent were likely to display higher levels of interest and enjoyment, experience less tension and pressure, be more intrinsically motivated, and achieve better performance scores. These results provided evidence supporting the link between perceived competence and intrinsic motivation, and between perceived competence and achievement

strivings and outcomes. An important implication for teaching practice is that teachers should create an environment where students can feel competent. This can be accomplished by focusing students on personal improvement, disseminating the efficacy of effort beliefs, and providing opportunities for successful experience.

According to the literature, both dispositional ability conceptions and intrinsic motivation should positively predict persistence and performance. That is, individuals with higher levels of incremental conceptions of ability should persist longer at the task and achieve better performance. Likewise, individuals who are more intrinsically motivated should display higher levels of persistence during practice and obtain better performance. The results of this study showed that participants who were more intrinsically motivated were likely to stay on task longer and obtain better performance scores. The correlational analyses also indicated that participants who showed more interest and enjoyment were likely to exert more effort and persist longer, those who felt more competent were likely to achieve better performance scores, and those who exerted more effort were likely to persist longer at the task. These results suggest that perceived competence greatly contributes to the prediction of performance, while the two subscales of effort/importance and interest/enjoyment made great contributions to the significant prediction of persistence. Collectively, these findings provided empirical support for the role of intrinsic motivation in achievement strivings (Deci & Ryan, 1985), and strengthened support for the notion that intrinsic motivation is crucial for understanding the motivational processes underlying behavior. These findings have important implications for the teachers. To encourage students to persist in the face of difficulty and improve their learning outcomes, physical education teachers should enhance their intrinsic motivation by creating an environment where

students can experience success, value the task, enjoy the task, and feel competent in the face of challenge or difficulty.

However, inconsistent with the expectations, ability conceptions and the interaction between ability conceptions and intrinsic motivation did not significantly predict persistence. One possible explanation is the characteristics of subjects used in this study. The students were volunteers from classes where the instructors promote a focus on task mastery and offer opportunities for cooperative learning activities. They are likely to be interested in working on a novel task at the early stages of learning. Inspection of the mean for interest/enjoyment ($M = 4.95$, $SD = 1.10$) also showed that, overall, participants were highly interested in the task. Therefore, participants may have been more likely to stay on task during the time allotted regardless of their beliefs. According to theory (Dweck, 1999), however, students who are oriented to entity ability beliefs may begin to show some frustrations and even lose interest when having difficulty in mastering the task over time. Given that entity theorists believe that effort is a measure of ability and hard work translates to lower ability (Dweck & Sorich, 1999), these students should display less persistence in the face of failure as time progresses during practice. It is suggested that future research examine the effect of dispositional ability conceptions on persistence at different practice stages.

This study attempted to analyze the effect of dispositional ability conceptions on performance in a physical activity setting, with a higher score indicating an orientation toward an incremental conception. The results indicated no significant relationship between dispositional ability conceptions and performance. This finding was consistent with the Belcher, et al. (2003) study, but inconsistent with the classroom literature (e. g. Dweck, 1999). An interesting question raised here is why students' predispositions toward ability beliefs are an important predictor of

performance in academic classrooms, but this is not the case in physical activity settings.

One explanation for this finding is the difference existing between physical education and academic classrooms. In physical education, students are under less pressure and have more freedom to choose their level of engagement than in classrooms. This is especially true when the objective of physical education is primarily to promote physically active lifestyles, and teachers put more emphasis on encouraging students to participate in physical activity for health and well being. In many settings students are evaluated mainly on how they behave in class and how much effort they put forth (Xiang, Solmon, & McBride, 2003). Students are not held accountable for achievement of motor skills.

Finally, college students may be a homogenous group with regard to their incremental theories in physical domains. Most of them believe that effort and hard work will transfer to positive results. Several studies (e. g. Belcher, et al., 2003; Li, Harrison, & Solmon, in press) have shown that very few participants strongly believe that ability is fixed. Inspection of the frequency distribution of dispositional ability conceptions indicated that approximately eighty-five percent of the participants' ability beliefs scored at the midrange between 3.2 and 4.4 with only a few participants expressing a very strong or weak ability belief. The cluster of scores around the middle provides some explanation for the lack of support for a significant relationship between dispositional ability conceptions and performance.

The results indicated that intrinsic motivation and dispositional ability conceptions interacted to affect performance, but the hypothesis that the effect of dispositional ability conceptions would be greater at higher levels of intrinsic motivation was not supported. Participants who were highly intrinsically motivated had lower performance scores in Lunastix when they were more oriented toward incremental conceptions. The available research literature

has demonstrated that an entity theory can be predictive of high performance under certain circumstances such as having high levels of ability (Dweck, 2002). This finding provided evidence supporting the notion that an entity theory can be motivating. Future research should continue to investigate conditions in which an entity theory is predictive of adaptive motivational processes. An incremental conception of ability can aid performance in the face of challenging tasks (Jourden et al., 1991; Taberero & Wood, 1999; Wood & Bandura, 1989), but for teachers it is important to know more precisely when this belief begins to affect important aspects of students' motivation and performance (Dweck, 2002). It is suggested that future research be conducted to study the effects of ability conceptions on motivational patterns and outcomes across the learning stages.

The results highlighted the importance of studying ability conceptions and intrinsic motivation in combination. Individual differences in intrinsic motivation appear to play an important role in determining performance, and moderate the effect of dispositional ability conceptions on performance. Therefore, future research should consider an interaction approach in attempting to clarify the complex relationships between motivational constructs and achievement strivings and outcomes.

PHASE 2: DISPOSTIONAL ABILITY CONCEPTIONS, SITUATIONAL ABILITY CONCEPTIONS, INTRINSIC MOTIVATION, PERSISTENCE, AND PERFORMANCE

In achievement situations students typically differ in the extent to which they view their ability to be fixed or changeable with effort and persistence. These dispositional ability conceptions play an important role in mediating motivational patterns, and must be considered when researchers study how teacher practices might promote a fixed or flexible belief. There is also some research (Jagacinski & Nicholls, 1984; Jourden, et al., 1991; Kasimatis, et al., 1996; Martocchio, 1994; Nicholls & Miller, 1984; Wood & Bandura, 1989) to indicate that instructional approaches can foster situational ability conceptions as being entity or incremental. In this study, situational ability conceptions are defined as beliefs fostered when the learning environments that are manipulated to reflect entity or incremental views. The extent to which students' beliefs can be shaped through climate manipulations was the focus of the second phase of this study.

Taberner and Wood (1999) suggest that an interaction approach can be applied to investigate how dispositional and situational ability conceptions interact to influence individuals' motivational and behavioral responses in achievement contexts. When an individual engages in a novel task, his or her dispositional ability conceptions may be matched or mismatched with situational ability conceptions. That is, a teacher can create a situation to emphasize ability as unchangeable or changeable, and consequently focus more on task mastery or performance. When there is a match between the dispositional and situational ability conceptions, the predisposition to adopt a particular motivational pattern will be enhanced. In contrast, when the dispositional ability conceptions are mismatched to the teachers' approach, students' motivational patterns especially when learning a novel task will be largely determined by their dispositional conceptions at the early stage of learning. Over time, however, it is predicted that

situational ability conceptions will override the effects of dispositional ability conceptions on motivational response patterns. With extended exposure and a clear message from teachers, students with entity conceptions of ability in incremental conditions could shift toward the adaptive motivational patterns of those with incremental views (Taberero & Wood, 1999; Wood & Bandura, 1989).

Ability conceptions and intrinsic motivation are important constructs mediating motivational patterns. Most researchers have examined how these two constructs affect individuals' motivational responses in isolation, or the relationship between them. Little research has been conducted to investigate how these two constructs interact to affect motivational patterns. Given that perceived competence moderates the effects of ability conceptions on motivational patterns and achievement outcomes, and has been placed at the heart of intrinsic motivation, it is possible that the effects of ability conceptions on motivational patterns and outcomes could be moderated by intrinsic motivation.

The present study was an initial attempt to understand the effects of dispositional ability conceptions, situational ability conceptions, and intrinsic motivation on persistence and performance in combination. Specifically, two questions were addressed: (a) How do dispositional ability conceptions and situational ability conceptions interact to affect intrinsic motivation? (b) How do dispositional ability conceptions, situational ability conceptions, and intrinsic motivation interact to affect persistence and performance?

METHOD

Participants

Seventy-two participants from the original 97 returned for the second phase of the study. The students' ages ranged from 18 to 44 years ($M = 22.57$, $SD = 4.88$).

Research Personnel

The four research assistants recruited and trained to monitor student practice and administer the final skill test during Phase I were trained to manipulate the instructional environment toward entity or incremental beliefs. Scripts that specified the different treatment comments research assistants were to provide during the independent practice session were introduced and practiced. The four research assistants' capability to make the comments according to the scripts was verified during the training session. The inter-rater reliability for the scoring of the trials assessed by the intra-class correlation coefficient yielded a coefficient of 0.80.

Experimental Task

The participants were instructed to learn a novel object manipulation skill called the "spin skill" which is an advanced Lunastix task. The spin skill required participants to flip the baton over, follow it with the control handle, and catch the baton just off center.

Video-taped Instructions and Demonstrations

A skilled female was video-taped as she presented learning instructions for the task, demonstrated the skill, and induced environmental manipulations. This instructor was selected because she is well-skilled in the delivery of the instructions and could successfully execute the skill. The video tape was used in all instructional sessions to assure that information provided to participants was consistent across groups.

Instructional Cues

Additional skill-related instructions were provided to participants during practice using written materials. The cues were taken from the learning instructions provided on the video and included points in techniques: (a) keep your eyes on the baton, and catch the baton with the

control sticks on the top 1/3 of both the baton and the stick; (b) the hand that flips should use a little more force and should follow through across the midline of the body; (c) lock your wrists and keep your elbows flexible; (d) as you catch the baton, absorb the force and feel the rhythm.

Treatment Conditions

Two treatment groups were designed to manipulate the learning environments to reflect the need for either natural ability or the efficacy of effort. In the natural ability condition, manipulations emphasized that individuals must be born with natural ability or have special talent to be successful in learning this spin skill. In the effort condition, participants were instructed to believe that individuals can be good at the spin skill if they work hard enough (Eccles, Wigfield, & Schiefele, 1995). The environmental conditions were reinforced four times during a 15-minute independent practice session and were integrated within the instructions for the task. All participants consistently received either ability or effort information.

The ability manipulation led students to believe that the spin skill requires natural ability. The female model explained that “scientific research has demonstrated that object manipulation ability is important in a number of physical activities such as tennis and baton twirling. This new spin exercise is a test of object manipulation ability, and we are working to validate the task. This task is more difficult than the Lunastix skill, and takes a lot of natural ability or talent. Individual differences in performance on this spin task are due to the level of natural object manipulation ability that you were born with.”

In contrast, the effort manipulation led students to believe that with practice the spin skill can be mastered. In this introduction, the following message was provided: “scientific research has demonstrated that object manipulation ability is important in a number of physical activities such as tennis and baton twirling. This new spin exercise is a test of object manipulation ability,

and we are working to validate the task. This task is more challenging than the Lunastix skill. Individual differences in performance on this spin task are dependent on how much effort you put into it. Everybody can be good at this task if they just work hard enough. Remember the old saying ‘Practice makes perfect,’ which holds true for learning this spin skill.”

Instrumentation

Intrinsic Motivation. The Intrinsic Motivation Inventory (McAuley, Duncan, & Tammen, 1989), which consists of 16 7-point Likert-type items, was used to assess students’ intrinsic motivation with regard to the spin skill.

Manipulation Check. Two items reflecting ability or effort attributions were used to assess the efficacy of the environment manipulations: “ individual differences in performance on this spin skill are due to the level of natural ability they were born with,” and “individual differences in performance on this spin skill are dependent on how hard they work” (reverse-scored). The responses were on 5-point scales, ranging from “strongly disagree” to “strongly agree.” Possible scores ranged between 2 and 10. A high score reflects an ability attribution.

Skill Difficulty. A multiple choice question was developed to rate the difficulty of the spin skill as compared to the original Lunastix skill: "As compared to the Lunastix skill you practiced last week, how does this spin skill compare." The four choices were: A) spin skill is easier than the Lunastix skill; B) spin and Lunastix skills are of equal difficulty; C) spin skill is a little more difficult than Lunastix; and D) spin skill is a lot more difficult than Lunastix.

Persistence. The engaged time during the independent 15-minute practice time was used to assess participants' persistence. It was recorded by systematically coding the videotaped learning session using a stopwatch. Participants were considered to be engaged in learning the task if they were involved in preparation, actually practicing, observing others, reading

instructions, or retrieving the baton. Behaviors such as holding the sticks, sitting, or visiting with other students were coded as off task. The inter-rater reliability was assessed using the intraclass correlation coefficient, and it yielded a coefficient of 0.91.

Performance. A final skill test was administered to all participants. Participants were given one minute to perform the task. The total number of trials in one minute was recorded on a score sheet by the research assistants.

Procedures

A week after completing the Phase I experiment, participants returned to the practice area and were told they would work on a more difficult task that would require more object coordination ability. Then participants were randomly assigned to one of the two treatment groups at the practice area. Participants in the entity condition were directed to TV Station One, and those in the incremental condition were directed to TV Station Two. Videotaped instructions and demonstrations of the spin skill were shown, and the environment for each group was manipulated to reflect an ability or effort attribution following the skill instructions and demonstration. Participants were allowed to perform the skill while watching the instructions and demonstration of the skill. Participants in treatment condition one received instructions associated with effort attributions, while those in treatment condition two were provided instructions related to ability attributions.

Participants were then directed to the practice areas and given a 15-minute session of independent practice time. There were two practice areas for each TV Station and two small learning groups in each practice area. During the independent practice session, the trained research assistants made comments to enhance the specific treatment condition, but did not encourage students to stay on task. The participants were free to practice as much or as little as

they desired. A video camera was situated to record participants' actions during the experimental time.

At the end of the independent practice session, the intrinsic motivation questionnaire, one item rating the difficulty of the spin skill as compared to the original Lunastix skill, and two items checking on the environmental manipulations of ability and effort attributions were administered, and the final skill test was completed.

RESULTS

Internal consistency reliability for all subscales from the IMI was assessed by using the Cronbach's (Cronbach, 1951) coefficient alpha. All subscales from the IMI demonstrated average or above average acceptable levels of internal consistency ranging from 0.76-0.92. The aggregate scores were calculated by summing all responses for each item and dividing by the relevant number of items per subscale. All negatively worded items in the IMI were reversed before the data analysis. The aggregate score for intrinsic motivation was derived by summing all four sub-scales and dividing by four. For the tension and pressure sub-scale of IMI, a higher number indicated a more relaxed feeling during the practice session. Means and standard deviations for dispositional ability conceptions, intrinsic motivation, persistence, performance and manipulation check by treatment conditions and Cronbach coefficient alphas are presented in Table 9.

The frequency distribution for skill difficulty was examined to assess students' perceived levels of difficulty of the spin skill as compared to the Lunastix skill. Participants were instructed to believe that the spin skill is more difficult than the Lunastix skill. The frequency distribution indicated that 49 of the 72 participants (68%) perceived the spin skill as a more difficult task, and 23 participants (32%) believed that the spin skill was easier than (15%) or the same difficult as

the Lunastix skill (17%). These results suggest that, overall, participants perceived the spin skill to be more difficult than the Lunastix skill. The more difficult skill should challenge participants' ability.

To assess the efficacy of the environmental manipulations, a one-way ANOVA was conducted to examine the difference in attributions across the two treatment conditions. For the environmental manipulations, the higher score represented a stronger belief that ability is fixed. The one-way ANOVA indicated a significant difference in entity conceptions of ability across the two treatment conditions ($F(1, 70)=11.43, p=0.0012$), suggesting that environment manipulations had an impact on participants' thinking about the role of natural ability and effort on successful performance. Inspections of the means indicated that participants in the entity condition were more likely to make ability attributions than those in the incremental condition.

Regression Analyses

Multiple regression analyses with interaction effects were used to investigate the effects of predictor variables of interest on intrinsic motivation, persistence, and performance. The variable of situational ability conceptions was coded as a dummy variable with zero and one. Participants in the incremental condition received a code of zero, while those in the entity condition received a code of one. The first statistical model with intrinsic motivation as a dependent variable was composed of three predictor variables: dispositional ability conceptions, situational ability conceptions, and the interaction between these two variables. The last two models with persistence or performance as dependent variables were composed of seven predictor variables: dispositional ability conceptions, situational ability conceptions, intrinsic motivation, and the interactions between dispositional ability conceptions, situational ability

conceptions, and intrinsic motivation. Because multiplicative terms can produce high levels of multicollinearity, the scores for intrinsic motivation and dispositional ability conceptions

Table 9. Means and Standard Deviations for Dispositional Ability Conceptions, Intrinsic Motivation, Persistence, Performance, and Manipulation by Treatment Conditions and Cronbach Coefficient Alphas

variable	Alpha (where appropriate)	Treatment			
		Entity (N=37)		Incremental (N=35)	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Dispositional Ability					
Conceptions	--	3.69	0.52	3.75	0.41
Entity Ability					
Conceptions	0.78	2.62	0.69	2.49	0.52
Incremental Ability					
Conceptions	0.76	4.00	0.45	3.99	0.48
Intrinsic Motivation	--	4.74	0.66	4.65	0.68
Perceived competence	0.92	4.27	1.35	4.09	1.24
Interest/Enjoyment	0.82	5.05	0.78	5.05	0.85
Tension/Pressure	0.86	4.39	1.09	4.19	0.97
Effort/Importance	0.79	5.26	0.89	5.26	0.83
Performance	--	14.92	8.85	14.06	8.76
		hits/trial		hits/trial	
Persistence	--	93%	0.07	93%	0.08
Manipulation	--	3.24	0.95	2.53	0.84

were centered. All products involving intrinsic motivation and dispositional ability conceptions were computed for each subject by using the centered scores (Aiken & West, 1991; Hardy, 1993; Jaccard, Turrisi, & Wan, 1990).

For the model with intrinsic motivation as the dependent variable, the residuals plot showed in Figure 5 indicated evidence that there were potential outliers, but they were not influential based on the Cook's D influence statistics. A value of one was used as the cutoff value (Cook & Weisberg, 1999). The largest value was 0.26. The normality test with the Shapiro-Wilk W indicated that the assumption of normality for the residuals was not violated at a 0.05 significance level. The p value of for the normality test was 0.81. The probability plot reflected in Figure 6 also did not show evidence that the normal assumption for the residuals was violated. The asymptotic covariance matrix of estimates assuming heteroscedasticity (White, 1980) was used to test the homogeneity assumption. There was no evidence showing that the assumption of homogeneity of covariance was violated ($\chi^2(5, N=72)=2.93, p=0.7113$). There was no strong evidence supporting any quadratic or cubic behaviors from the partial residuals plots. Therefore, the ordinary least squares model was adequate to fit the data. As reflected in Table 10, regressing intrinsic motivation on dispositional ability conceptions, treatment conditions, and the interaction between these two variables indicated that only dispositional ability conceptions ($F(1, 68)=7.13, p<0.0096$) positively predicted intrinsic motivation. Participants with stronger beliefs in the efficacy of effort were likely to be more intrinsically motivated during the session (See Figure 7). In the analysis, the model accounted for 10% of the variance in intrinsic motivation.

For the model with persistence as the dependent variable, the residuals plot showed in Figure 8 indicated that there were potential outliers. The normality test with the Shapiro-Wilk W

indicated evidence that the normal assumption for the residuals was seriously violated. The p value of for the normality test was 0.001. The probability plot showed in Figure 9 also provided

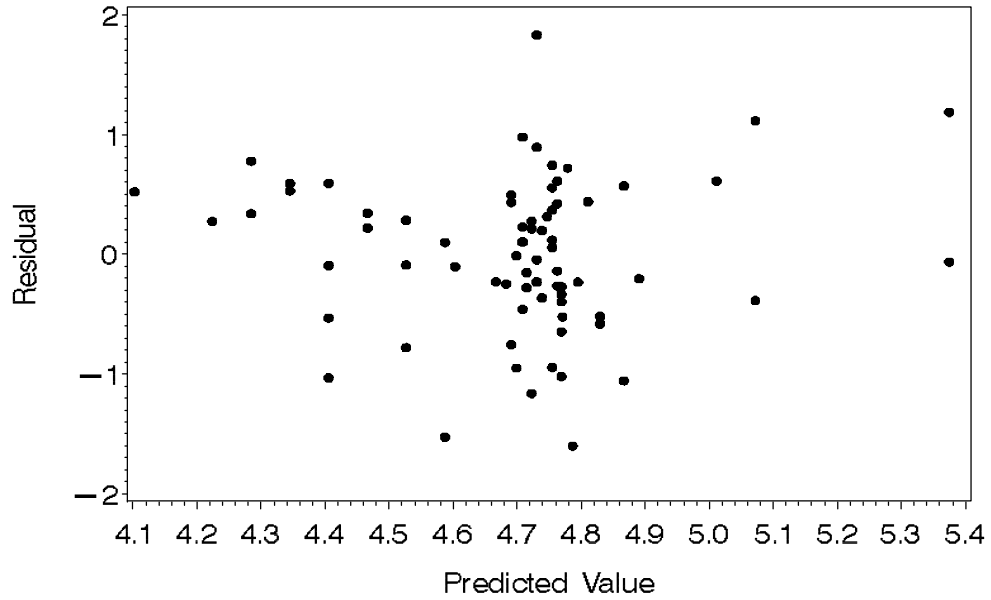


Figure 5. Residual Plot for Model with Intrinsic Motivation as Dependent Variable

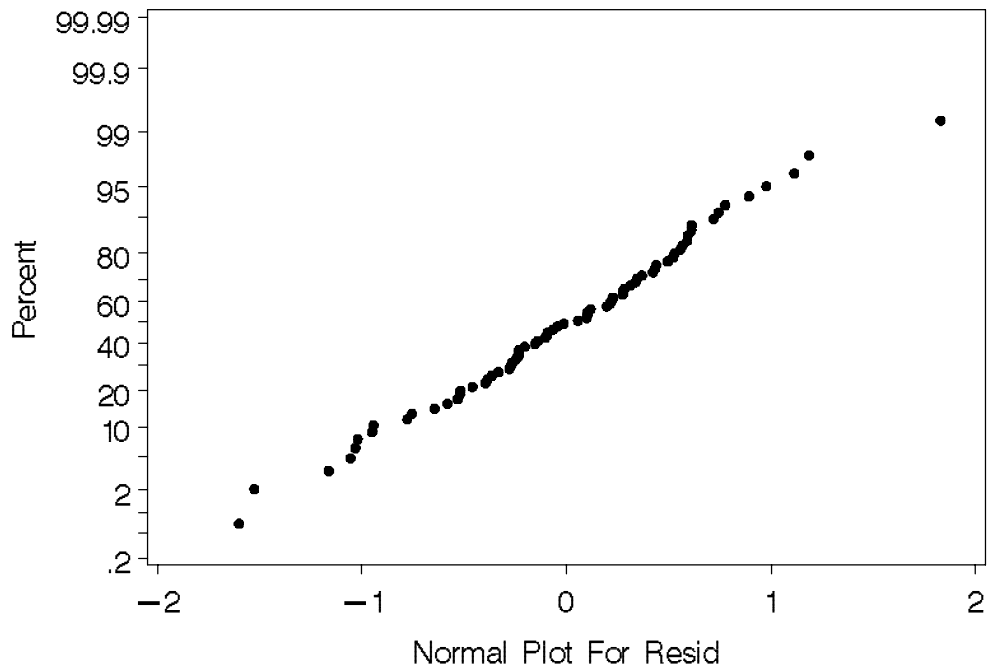


Figure 6. Normal Probability Plot of the Residuals: Intrinsic Motivation

Table 10. Multiple Regression Analysis for Three Variables Predicting Intrinsic Motivation

Variable	Estimated Coefficients	Estimated Standard Errors	T-tests
Dispositional Ability			
Conceptions (D)	0.727	0.27	2.67*
Situational Ability			
Conceptions (S)	0.117	0.15	0.76
D x S	-0.631	0.41	-1.83

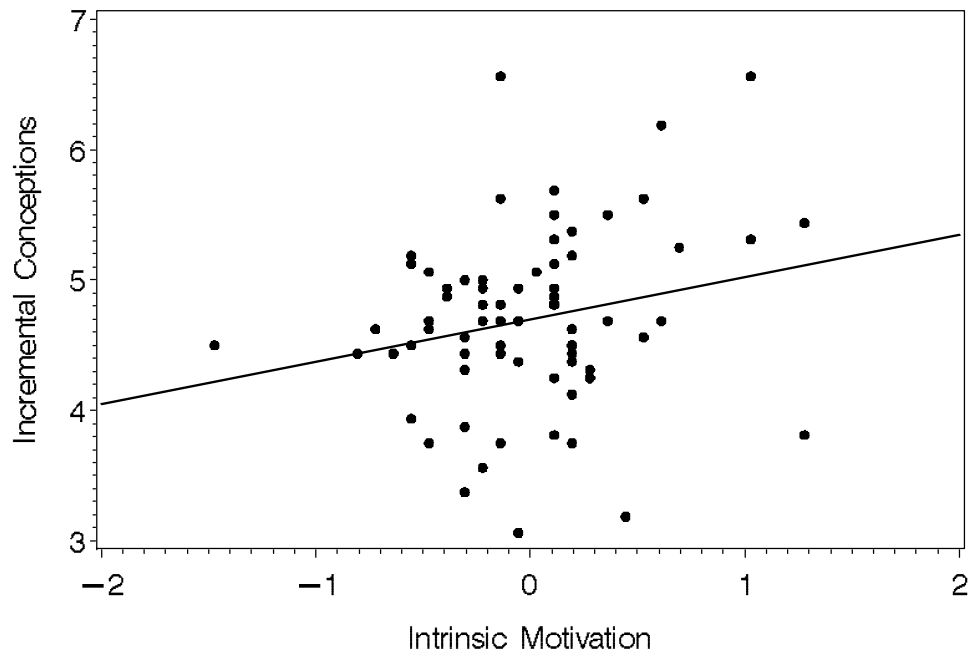


Figure 7. Scatterplot for Intrinsic Motivation and Ability Conceptions by Treatment evidence that the assumption of normality for the residuals was violated at a 0.05 significance level. Therefore, robust regression with the LTS estimation was used to analyze the data.

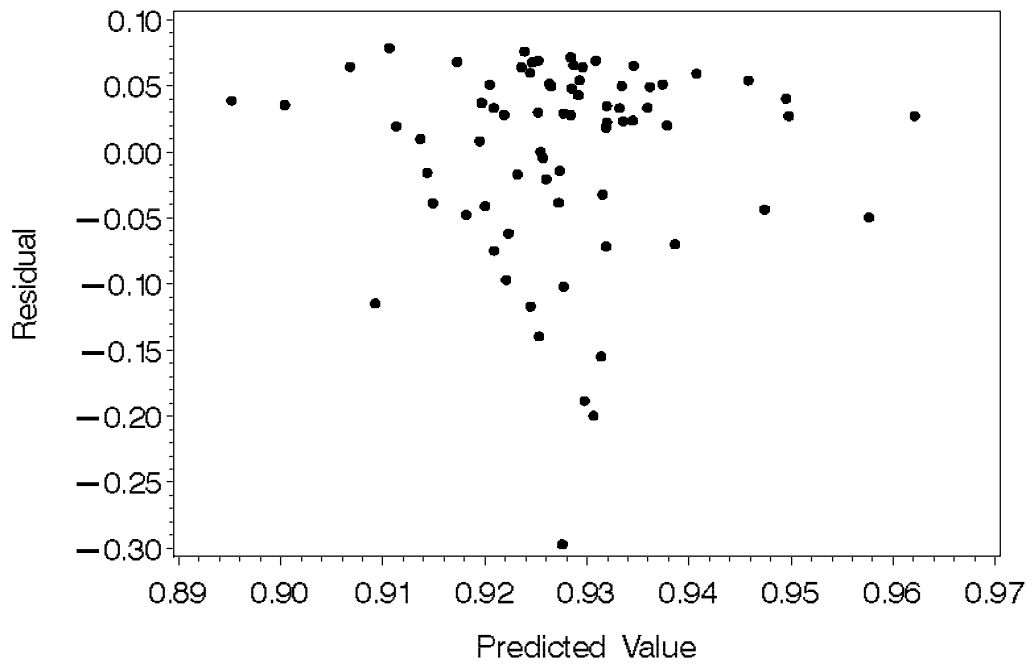


Figure 8. Residual Plot for Model with Persistence as Dependent Variable

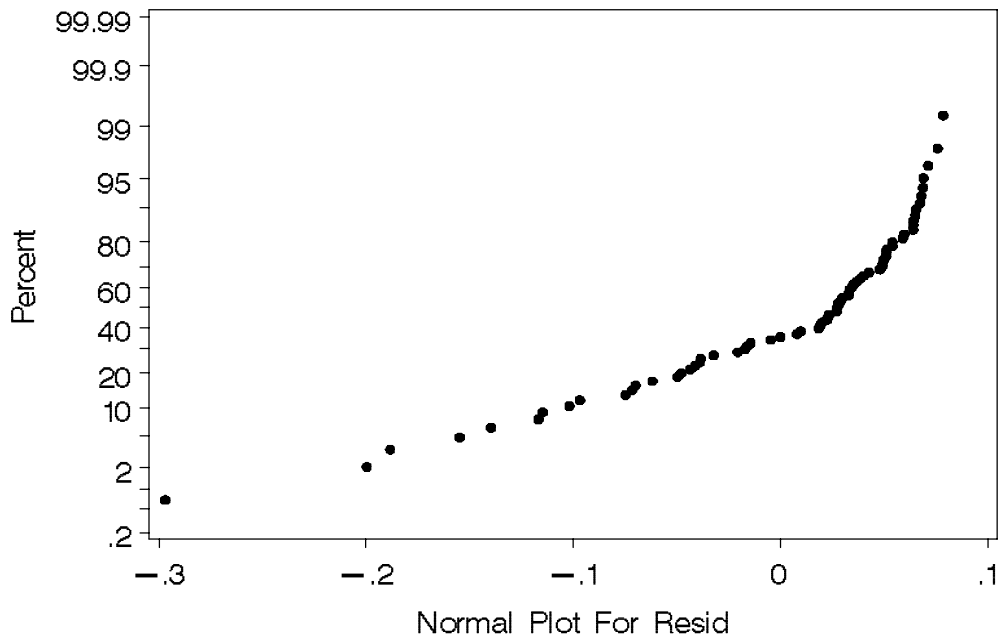


Figure 9. Normal Probability Plot for the Residuals: Persistence

The LTS estimate produced the regression model for persistence with R-square equal to 0.2823: $\hat{y} = 0.9532 + 0.0082x + 0.0119z + 0.0017trt - 0.0146xz + 0.0178xtrt + 0.04xtrtz - 0.0365trtz$ (Table 11). LTS identified 10 outliers (0.1389) with no leverage point in the data (Table 12). The cutoff value is 3.0 for an outlier and 4.0016 for the leverage points. Outlier contamination was a problem for the data. The robust residual for outliers ranged from -7.6173 to -3.1903 .

Table 11. Parameter Estimations for Final Weighted Least Squares Fit by Least Trimmed Squares for the Persistence Data

Parameter	DF	Estimate	Standard Error	95% Confidence Limits		Chi-Square	Pr>ChiSq
Intercept	1	0.9532	0.0074	0.9386	0.9678	16379.6	<.0001
Ability Conceptions (AC) Intrinsic	1	0.0082	0.0215	-0.0340	0.0504	0.15	0.7033
Motivation (IM)	1	0.0119	0.0121	-0.0118	0.0357	0.97	0.3236
Treatment (TRT)	1	0.0017	0.0102	-0.0183	0.0218	0.03	0.8644
AC x IM	1	-0.0146	0.0238	-0.0612	0.0320	0.38	0.5393
AC x TRT	1	0.0178	0.0251	-0.0314	0.0670	0.50	0.4775
IM x TRT	1	-0.0365	0.0166	-0.0238	0.1039	4.84	0.0278
AC x IM x TRT	1	0.0400	0.0326	-0.0691	-0.0040	1.51	0.2191
Scale	0	0.0381					

Table 12. Outliers and Leverage Points Diagnostics by Least Trimmed Squares for the Persistence Data

Obs.	Mahalanobis Distance	Robust MCD Distance	Leverage	Robust Residual	Outlier
15	3.3148	0.8845		-4.1310	*
37	1.0225	0.4600		-4.0899	*
38	2.9646	0.0000		-5.2002	*
39	1.2740	0.1291		-4.5838	*
40	2.3595	0.3488		-5.1138	*
43	2.1382	0.0000		-3.1903	*
44	4.3574	0.7996		-3.2031	*
48	2.2358	0.0000		-7.6173	*
49	2.5558	0.0000		-3.6557	*
50	1.3776	0.6151		-3.7744	*

The regression of persistence on the seven predictor variables yielded a significant interaction effect for intrinsic motivation and treatment manipulation ($\chi^2 (1, N=72)=4.84, p<0.0278$). The seven predictors were dispositional ability conceptions, situational ability conceptions, intrinsic motivation, and the interactions between these three variables. The model accounted for 23.51% of the variance in persistence. According to the quantiles of the centered intrinsic motivation, participants whose scores were below the first quantile (-0.322) were classified as low in intrinsic motivation. Those who scored above the third quantile (0.3655) were classified as high in intrinsic motivation. Two nonparametric one-way ANOVAs were conducted to test if there were significant differences across the two treatment conditions. The Kruskal-Wallis test indicated that there was significant difference in persistence across two treatment conditions for the highly intrinsically motivated group ($\chi^2 (1, N=72)= 4.26, p<0.0391$), but no significant difference for the lowly intrinsically motivated group ($\chi^2 (1, N=72)=0.39, p=0.53$). The results suggest that participants with high levels of intrinsic motivation in the incremental condition persisted longer than those in the entity condition as reflected in Figure 10.

For the regression of performance on the seven predictors, the residuals plot showed in Figure 11 indicated that there were outliers, but they were not influential based on the Cook's D influence statistics. A value of one was used as the cutoff value (Cook & Weisberg, 1999). The largest value was 0.27. The normality test with the Shapiro-Wilk W did not show evidence that the normal assumption for the residuals was violated. The p value for the normality test was 0.41. The probability plot showed in Figure 12 also did not show evidence that the residuals were not normally distributed.

The asymptotic covariance matrix of estimates assuming heteroscedasticity (White, 1980) was used to test the homogeneity assumption ($\chi^2 (17, N=72)=15.3, p=0.5742$), which failed to

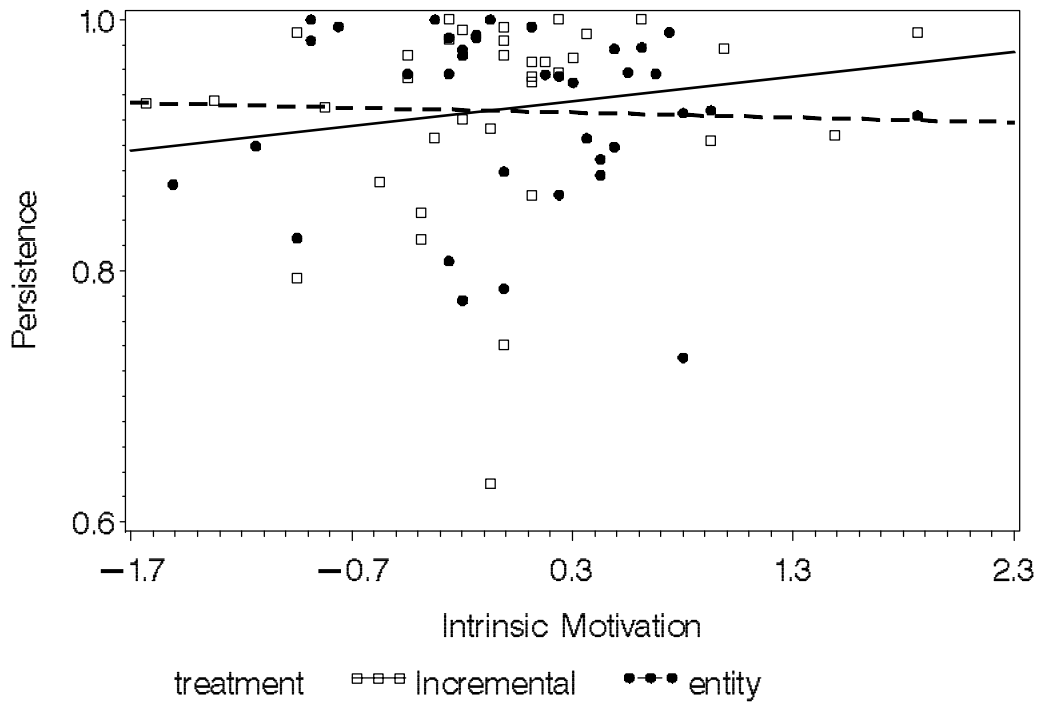


Figure 10. Interpretation of Interaction Effect between Treatment and Intrinsic Motivation

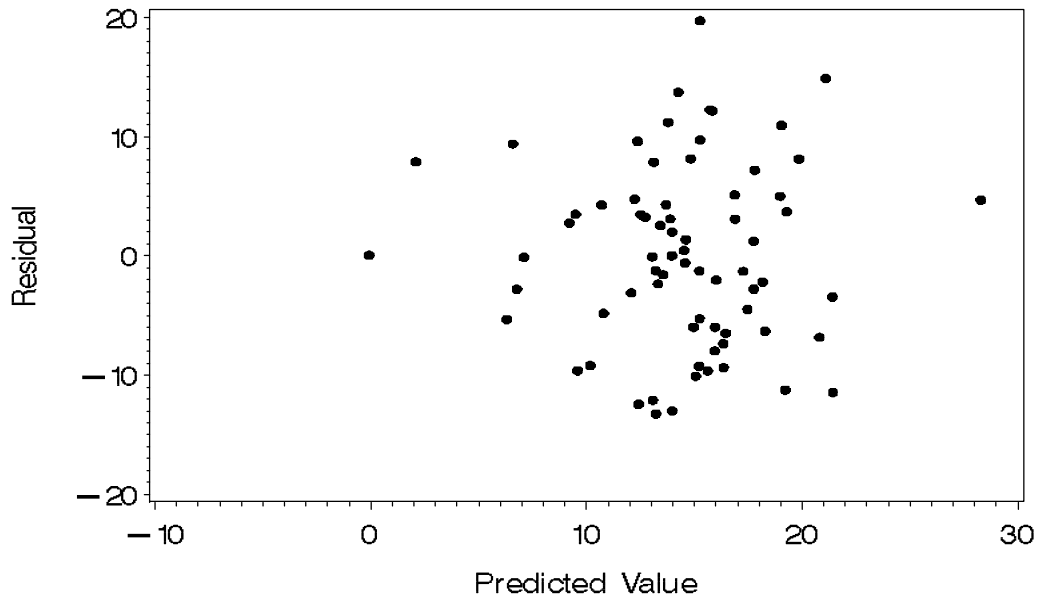


Figure 11. Residual Plot for Model with Performance as Dependent Variable

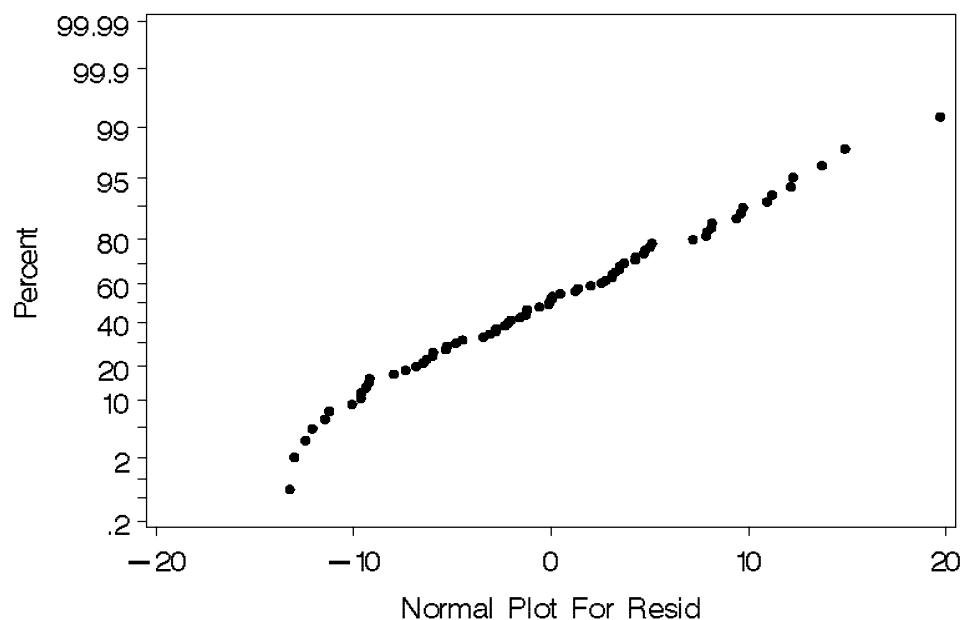


Figure 12. Normal Probability Plot for the Residuals: Performance

Table 13. Multiple Regression Analyses for Seven Variables Predicting Performance

Variable	Estimated Coefficients	Estimated Standard Errors	<i>T</i> -tests
Dispositional Ability			
Conceptions (D)	0.497	4.03	0.12
Intrinsic Motivation (I)	4.917	2.43	2.02*
Situational Ability			
Conceptions (S)	-0.243	1.97	-0.12
D x I	-3.597	4.73	-0.76
D x S	-1.932	4.81	-0.40
I x S	2.842	3.19	0.89
D x S x I	6.827	6.38	1.07

Note. * $p < .05$

reject the assumption of homogeneity of covariance. To test the lack of fit of the proposed linear model, a quadratic model was considered, but there was not significant evidence of any quadratic behavior. Therefore the relationship between performance and the predictors tends to be linear.

The regression analysis indicated that only intrinsic motivation positively predicted performance ($F(1, 64)=4.08, p<0.0475$). In the analysis, the model accounted for 25% of the variance in performance. In this study, participants with higher levels of intrinsic motivation demonstrated better performance. The multiple regression analyses with performance as dependent variables are located in Table 13.

DISCUSSION

It was hypothesized that dispositional and situational ability conceptions would interact to affect intrinsic motivation. The data in this study partially supported that hypothesis, indicating that only dispositional ability conceptions predicted intrinsic motivation, but not situational ability conceptions and the interaction between these two variables. Participants who were more oriented toward incremental ability beliefs were likely to be more intrinsically motivated. Students hold strong beliefs about themselves when entering an achievement context, and these beliefs direct their thoughts and actions (Dweck, 1999; Solmon & Lee, 1996). When situational cues are mismatched to their dispositional ability beliefs, these dispositional ability beliefs may be weakened. The ANOVA showed that the environmental manipulations did have an impact on students' thinking about the role of natural ability and effort on successful performance. Students in the entity condition were less likely to believe in the efficacy of effort than those in the incremental condition. However, at the very early stage of learning, these situational cues were not strong enough to override the effect of dispositional beliefs on students' motivational patterns. With continuous exposure to the mismatched environment, students

should shift toward the motivational patterns corresponding to the ability beliefs emphasized in the manipulated climate. These findings suggest that physical education teachers should teach motivational beliefs as well as skill content to enhance students' learning. To improve intrinsic motivation, a positive environment where students can experience success, value the efficacy of effort, feel competent, and persist in the face of difficulty or challenge should be created in physical education classes. It is also suggested that if physical educators want to create positive environments to motivate students to engage in learning they must try to strengthen the beliefs of the efficacy of effort over time.

Participants were led to believe that the spin skill was a complex task so it was expected that a willingness to persist after making errors would be dependent on ability beliefs and intrinsic motivation. The results indicated that the interaction between intrinsic motivation and treatment conditions significantly predicted persistence, which partially supported the hypothesis. Participants with high levels of intrinsic motivation in the incremental condition persisted longer than those in the entity condition. The findings of this study suggest that for participants who were highly intrinsically motivated, learning environments emphasizing the efficacy of effort can have a positive effect on their persistence. For those who had middle or low levels of intrinsic motivation, learning environments did not make a significant difference on their persistence. One possible explanation is the relatively short time period for practice. In this study, participants were only given fifteen minutes for practicing the skill. In this relatively short time period, for participants who were not highly intrinsically motivated, their willingnesses to persist at the task was unlikely to be affected by the learning environments, especially when they had trouble mastering the skill. An interesting area for future research is to investigate the time

that learning environments emphasizing the efficacy of effort can have an effect on students' willingness to persist when they lack intrinsic motivation and struggle to master the skills.

Performance was significantly predicted by intrinsic motivation, but not the other six variables, providing partial support for our hypothesis. Consistent with the literature (Vallerand, 2001), participants who were more intrinsically motivated were likely to achieve better performance scores. The results did not indicate any significant relationship between dispositional ability conceptions and performance, which was inconsistent with the hypothesis. As explained in the Phase I study, one explanation for this finding is the difference existing between physical education and academic classrooms. Another possibility is that college students may be a homogenous group with regard to their incremental theories in physical domains. Inspection of the frequency distribution of dispositional ability conceptions indicated that approximately eighty-two percent of participants' ability beliefs scored at the midrange between 3.2 and 4.4. Only a few participants were oriented toward strong entity ability beliefs.

The interaction between dispositional ability conceptions and intrinsic motivation did not significantly predict performance. One possible explanation was the sample used in these two studies. Comparing the frequency distributions of dispositional ability conceptions from the two phases showed that 24 of the 25 participants (96%) who did not return for the second phase study scored at the midrange between 3.2 and 4.8. Since these participants were highly intrinsically motivated, their dropout from the second phase study might have weakened the relationship between the interaction and performance. Another possible explanation is that the relationship between the interaction and performance may be confounded by introducing the learning environments into the study.

Results of this study support the role of intrinsic motivation as a prominent influence in learning difficult and more complex motor tasks. Students who are intrinsically motivated attach value to the relevance of the task and are interested in learning for the sake of learning. They are not likely to participate in activities for other reasons such as grades, recognition, or rewards. Participants in this study were volunteer females who were under no pressure to perform to a standard and could regulate their levels of engagement. They were free to use their peers as learning resources, and select and use learning strategies of their choice. The conditions in the setting were right for the promotion of learning for its own sake.

Previous research has supported the link between interest and intrinsic motivation (e. g. Eccles, Wigfield, & Schiefele, 1998), and suggests that as students age they maintain interest in those activities that are appropriate for their gender and social group affiliation. The instructional phase in this study linked the Lunastix task to baton twirling which is typically labeled as a feminine task. Thus, while the same tasks do not always elicit a positive motivational response from all students, the task in this study was consistent with gender related interests. Finally, learning in a social context has been shown to generate interest among students (Eccles, Wigfield, & Schiefele, 1998, pp. 10-12) and the peer groups in this study could have facilitated intrinsic motivation and learning. Students were free to work together, help each other, and were under no pressure to outperform others in the groups.

GENERAL DISCUSSION

Ability conceptions are important motivational constructs theorized to mediate individuals' achievement strivings and outcomes. The present study provided evidence partially supporting the important role of dispositional ability conceptions in mediating individuals' achievement strivings and outcomes. Inconsistent with the theoretical predictions, the findings of this study and the Belcher et al. (2003) study indicated that participants' ability conceptions produced no significant difference in performance. Perhaps, ability conceptions are not an important performance predictor in the physical domain. Future research should continue to investigate the relationship between ability conceptions and performance. The results of this study indicate that dispositional ability conceptions play an important role in mediating students' intrinsic motivation, effort/importance, and interest/enjoyment. It is suggested that when studying the effects of situational ability conceptions on motivational patterns dispositional ability conceptions should be considered. Teachers should emphasize the efficacy of effort beliefs in their teaching practice to develop students' adaptive motivational patterns.

This study was an initial attempt in understanding how motivational constructs interact to affect achievement strivings and outcomes. The hypotheses were partially supported. The results indicated that dispositional ability conceptions and intrinsic motivation interacted to affect students' performance; and situational ability conceptions and intrinsic motivation interacted to affect students' persistence. These results suggest that an interaction approach promises to provide a deeper understanding of how motivational constructs interact to affect students' motivational patterns. It is suggested that future research should apply an interaction approach to investigate the relationships between motivational constructs and how those constructs interact to affect students' achievement strivings and outcomes.

Perceived competence and intrinsic motivation have been identified as important motivational variables predicting individuals' performance, and this was supported by the data in this study. It is suggested that if physical education teachers want to improve students' learning outcomes a positive environment should be created, whereby their perceptions of competency and intrinsic motivation will be enhanced. Teachers should orient students toward incremental views that ability can be changed, design a curriculum to provide opportunities for students to have successful experiences in a variety of activities, and emphasize the mastery of task rather than outperforming other students.

One limitation for this study is that this experiment was conducted in a single session lasting 45 minutes. Future research should replicate this study by expanding the experiment time. Another main concern is the factorial validity of Conceptions of Ability in Object Manipulation questionnaire. Due to the relative small sample, confirmatory factor analysis was not conducted to test the factorial validity. Future research should assess the factorial validity of this measurement using a large sample.

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APPENDIX A
LITERATURE REVIEW

A plethora of theories on achievement motivation has been established to understand the complex interaction of motivational variables and identify the conditions that optimize or produce an adaptive pattern of behavior. Motivational patterns are defined in terms of a number of cognitive and affective processes, and are classified as either adaptive or maladaptive. Adaptive patterns of behavior reflect high levels of motivation and include using effective learning strategies, employing effort, attending, reanalyzing problems, and showing interest, enjoyment, and persistence in the face of challenging or difficult tasks. In contrast, maladaptive motivational patterns reflect a lack of motivation and involve low task engagement, ineffective cognitive strategies, lower interest, enjoyment, effort, and persistence, and the display of extrinsic motivation in the face of challenging tasks (Diener & Dweck, 1978, 1980; Dweck, 1986; Dweck & Repucci, 1973; Meece & Holt, 1993; Nicholls, 1984b; Pintrich & De Groot, 1990). An adaptive motivational pattern has been shown to facilitate the development of cognitive skills necessary to increase effortful achievement-related behavior that will eventually foster better achievement. Conversely, a maladaptive motivational pattern is unlikely to produce high level of achievement (Pintrich & Garcia, 1992; Schraw, Horn, Thorndike-Christ, & Bruning, 1995).

Research in academic, sport, and physical activity domains has demonstrated that motivational constructs such as conceptions of ability, achievement goals, and self-efficacy influence students' strivings in achievement contexts. Yet, questions of how the motivational processes affect achievement remain largely unanswered, especially in physical activity settings. It has been hypothesized that the motivational factors influence selected cognitive and affective processes such as the use of effective learning strategies or attention and effort deployment and that these processes then more directly influence achievement (Graham & Golan, 1991).

Beliefs about the nature of ability are one of several common threads that run through major motivational theories. Hong, Chiu, and Dweck (1995) argue that when faced with a challenging task, individuals' beliefs about the nature of ability play a more fundamental role in predicting motivational patterns than self-efficacy beliefs, achievement goals, and other motivational constructs. The purpose of this paper is to examine the role of beliefs about the nature of ability in achievement situations with the goal of identifying the major contributions to the research knowledge base. Conceptions of ability will be defined and distinguished from perceptions of ability. Next, the role of conceptions of ability in attribution theory, achievement goals, and self-efficacy will be examined. Then, factors that influence conceptions of ability will be examined and a future research agenda will be generated.

DEFINITION OF ABILITY

A lot of research effort has been exerted to understand the cognitive processes and motivational variables influencing students' learning in school settings. It is clear that many factors affect a student's performance or achievement in school, such as ability, amount of effort exerted, level of task difficulty, and the amount of help from others. However, among these factors, ability and effort have been identified as the two main performance determinants exerting a profound influence on students' school performance and achievement (Blumenfeld, Pintrich, Meece, & Wessels, 1982; Dweck & Elliott, 1983).

The study of ability is challenging because the construct is explained and defined in more than one way. It is a very nebulous term, and has been viewed in general and scientific ways. For example, in academic settings it has been referred to as "intelligence" (Dweck, 2002), and "capacity" (Nicholls, 1984a, 1984b, 1989). The physical activity literature has used "motor ability", "functional ability", "capacity", "an individual difference variable" (Magill, 2001),

“perceptual ability”, “general ability”, and “psychomotor ability” (Ackerman, 1992) to describe the term.

Definitions of ability are numerous and varied, with much disagreement over its precise nature. A common controversy about the nature of ability is whether ability is changeable or unchangeable. One viewpoint holds that ability is an individual difference variable, and is genetically determined (e. g. Magill, 2001). The opposite view is that ability is malleable, and can be changed through learning and effort (Fleishman, 1972; Kun, Parsons, & Ruble, 1974).

Although there is a disagreement about the precise nature of ability, this review will define ability as “a general trait or capacity of an individual that is a determinant of a person’s achievement potential for the performance of specific skill (pp.17)” (Magill, 2001). That is, ability is a potentially stable trait of the self. A person can improve his or her performance but not ability through effort and the level of ability limits the effect of effort on performance. For example, if student A has more ability than student B and they put the same amount of effort into a task, then student A will potentially obtain better performance than student B. In any discussion of ability, it is important to remember that the relationships among ability, effort, and performance are complex and multiplicative (Dweck, 2002; Kun, Parsons, & Ruble, 1972), and in this paper we will explore how these connections might influence student motivation in physical activity.

AGE RELATED DIFFERENCES

Developmental research has clearly identified changes that take place in children’s understanding of ability and effort as they age and progress through the grades at schools (e. g. Dweck, 2002). Research on the nature of ability indicates that children about 7-8 years old are beginning to understand ability as an internal, stable personal quality, and tend to use ability

information to predict future performance or behavior (Dweck, 2002; Rholes & Ruble, 1984). At the time children reach 10-12 years of age, more students begin to perceive ability as a capacity rather than a malleable quality. Although these students understand the nature of ability as a more fixed or stable attribute, they do not always adopt that view as their own and some will continue to believe ability to be malleable, and a quality that can be changed through learning and effort (Dweck, 2002). The older children are more likely than younger ones to realize that physical ability is a fixed trait but many still believe in the efficacy of effort. They refuse to accept that high effort implies low ability for them even though they recognize ability as a set attribute.

In physical education, several researchers (Fry & Duda, 1997; Lee, Carter, & Xiang; 1995; Xiang & Lee; 1998) have used Nicholls' developmental theory to examine changes in children's conceptions of ability by using both qualitative and quantitative approaches. Consistent with predictions, the results show children's conceptions of ability change with age, and older children are more likely to hold a differentiated conception of ability. According to Nicholls (1984a; 1984b; 1989), a differentiated conception is consistent with the understanding of ability as a fixed factor that is separate from effort. An undifferentiated conception, on the other hand, corresponds with a belief that with more effort ability can be improved. Researchers have recently (Lee, Carter, & Xiang, 1995; Xiang, Lee, & Williamson, 2001) reported that some older children who have a differentiated conception of ability still believe strongly in the efficacy of effort. Xiang, Lee, and Williamson (2001) further investigated the influence of age on conceptions of ability by comparing children and adolescents in physical education. The results indicated that adolescents employed different criteria to judge their own ability. The younger children were more likely to identify task mastery and class behavior as evidence of ability.

These findings are consistent with earlier research (Lee, Carter, & Xiang, 1995) showing that 1st, 4th, and 5th graders explain their ability in terms of effort and mastery but showed great concern over social behavior and playground rules. In this study, students at all grade levels, however, were also inclined to use social comparison to make their judgements. According to Dweck (2002) and others (Stipek & Daniel, 1990) young children understand little about ability but at the same time use children's classroom social behavior to explain their ability. Their motivational systems seem to be built around concepts of goodness and badness.

While theory predicts that the younger children would be less likely to make normative judgments, the nature of the learning environment in physical education is a reasonable explanation for more interest in social comparison. In physical education class, the activities are always public and students can easily view the performance of other students. The availability of normative information makes it easy for even the young students to make social comparisons. There is some evidence from the classroom literature (Stipek & Daniels, 1990) that even though young children are beginning to understand normative information they do not use the knowledge to make predictions about their future learning experience.

CONCEPTIONS OF ABILITY

Based on an individual's understanding and differentiating effort and ability, both Dweck (1999) and Nicholls (1978, 1984a, 1989) have independently proposed that one tends to view ability as either 'gifted' (entity or differentiated) or malleable (incremental or undifferentiated). Conceptions of ability are distinguished from self-perceptions of ability and perceived ability (perceived competence). Self-perceptions of ability are multidimensional constructs that involve two components: conceptions of ability and perceived competence. Perceived competence refers

to a person's belief about what one can do and how good he or she is at different tasks (Xiang, & Lee, 1998).

According to both Dweck (1999) and Nicholls (1978, 1984a, 1989), implicit theories of intelligence or conceptions of ability can be defined using two constructs to describe students' personal belief systems. Although different labels have been attached to the two views, they actually represent parallel constructs across the models. The terms used to describe the two dimensions of conceptions of ability in this paper will combine Dweck and Nicholls' work: an incremental conception of ability and entity conception of ability. However, when describing results of research by Nicholls the terms differentiated and undifferentiated will be used. The goal of research on conceptions of ability (Nicholls' terminology) or implicit theories of intelligence (Dweck's terminology) is to find out and reconstruct the form and content of informal beliefs about ability or intelligence that reside in a person's mind. Although there are some subtle differences in the ways the constructs are defined, evidence is clear that students' conceptions of ability or implicit theories of intelligence affect their motivational patterns and behavior in achievement events (Dweck & Elliott, 1983; Dweck & Leggett, 1988; Nicholls, 1984a, 1984b; Nicholls & Miller, 1984).

Dweck (2002) reviews current literature on various views of ability and reports that many modern theorists believe that definitions of ability are socially and individually constructed. Some contemporary authors have speculated that even though researchers refer to a mature conception of ability as an understanding that ability is a stable trait separate from effort, this acceptance varies and there is not universal agreement among the scholars. For example, according to Dweck (2002), Alfred Binet, author of the major intelligence test (IQ) accepts that children can improve capacity through learning. In the physical activity literature Fleishman

(1972) wrote extensively in his attempts to analyze and describe and distinguish learning from ability in the psychomotor domain. While he refers to ability as a general trait of the individual he argues that many abilities are products of learning and experience. Others (e. g. Safrit & Wood, 1995) agree that it seems reasonable that students might possess an innate physical ability, but there is no scientific evidence that these traits can be measured, and it is very difficult to separate innate ability from learning and experience. From the literature reviewed it seems clear that ability is a vague term that is difficult to define in a precise way. Scientists might argue that ability is a fixed capacity but individuals are free to construct their own meanings and some mature learners could believe that ability is controllable. This paper will present evidence that it is not the personal definition of ability that is critical but rather the consequences of the various beliefs surrounding ability. The important issue is related to a learner's views about how and under what conditions his or her ability will affect performance.

An entity conception of ability is the view that ability is fixed and can not be changed through effort. In contrast to this view, an incremental conception of ability is consistent with a view that ability is malleable and can be changed through effort. Research efforts in educational and physical activity settings have demonstrated that an incremental conception of ability is positively associated with many adaptive motivational patterns such as positive self-inference, positive affect, self-regulation, and greater effort and persistence, which should produce positive achievement outcomes in the face of challenges and difficulties. On the other hand, students with an entity conception of ability tend to display a number of maladaptive motivational patterns such as negative self-cognition, negative affect, and lower effort and persistence, which should result in performance decrements especially when perceived ability is low. Additionally, entity theorists are more likely to focus on "looking smart or athletic" rather than on competence

improvements. In contrast, incremental theorists are more likely to emphasize learning or mastering a skill, and they will try their best to acquire new competencies. Failure will not harm their self-esteem. On the contrary, incremental theorists believe that failure is a necessary step toward learning (e. g. Nicholls & Miller, 1984).

Kasimatis, Miller, and Marcussen (1996) reported a causal link between implicit theories of ability and motivation in physical activity. These researchers manipulated individuals' theories about athletic coordination in a difficult step aerobics exercise. Participants in the incremental condition were told that athletic coordination is largely learned, while participants in the entity condition were told that athletic coordination was largely determined by genetics. The participants in the entity condition were less motivated to persist at the task and displayed more negative affect than those in the incremental condition when the exercise requiring athletic coordination became difficult. The findings were encouraging, but it was unclear from this study whether those participants actually embraced the ability beliefs that were presented to them during instruction. According to Kasimatis et al. (1996), future research needs to examine the causal link between implicit theories of ability and motivation on the basis of students' current views of ability.

CONCEPTIONS OF ABILITY AND ATTRIBUTIONS

According to Graham (1991), conceptions of ability grew out of attribution theory (Weiner, 1986). Attribution theory has focused attention on the process whereby people determine the causes of success and failure in achievement contexts. This process is most likely initiated in the face of failure. In achievement contexts, ability, effort, task difficulty, luck, mood, and help or hindrance from others are typically identified as the causes of success and failure (Graham, 1991). Among these causal ascriptions, the most dominant variables are ability and

effort. The motivational consequences of causal ascriptions have been related to the underlying properties of the stability dimension of causality. Ascribing failures to relatively stable variables such as lack of ability is associated with performance decrements in future attempts. Attributing failures to more malleable variables, like lack of effort, characterizes more “mastery-oriented” individuals who maintain or improve performance following failure. In a study by Diener and Dweck (1980), the mastery-oriented students tended to maintain positive affect toward the task, valued effort, and continued to express a positive prognosis for their performance. They did not appear to define themselves as having failed at all. In contrast, the learning helpless students began to express an appreciable degree of negative affect, doubt their ability, and lose faith in their ability to perform the task. Their statements implied that they had given up trying to solve the problems. Learned helplessness is a process whereby students are discouraged to engage in the task at hand by attributing failure to lack of ability.

Conceptions of ability provide a model to explain the belief systems students use to make judgments about reasons for their success and failure. There is much evidence to suggest that individuals come to a situation with entry characteristics such as their ability related belief systems or conceptual frameworks (Solomon & Lee, 1996). These beliefs play an important role in motivation, personality, and development in achievement contexts (Dweck, 1999), and will create a context within which attributions occur. A body of evidence consistently suggests that implicit theories of ability create a motivational framework that directs the individuals’ striving prior to an outcome and sets up a meaning system for the formulations of attributions (Hong, Chiu, Dweck, Lin, & Wan, 1999). Students holding an entity conception of ability are more likely to use normative information and explain their failure or success in terms of ability. In

contrast, students with an incremental conception would rely more heavily on effort for their explanations.

CONCEPTIONS OF ABILITY AND ACHIEVEMENT GOAL CHOICE

Contemporary achievement goal theories propose that a distinguishing feature of motivation in school contexts is the concept of goal perspective. Central to the theory is an assumption that students set goals for themselves and these goals mediate and determine students' motivational, affective, cognitive, and behavioral responses in achievement settings. The two major goals operating have been defined and contrasted as task orientation versus ego orientation (Nicholls, 1984a, 1984b, 1989), mastery versus ability goals (Ames; 1992; Ames & Ames, 1989; Ames, & Archer, 1988), and learning versus performance goals (Dweck & Elliot, 1983). Although different labels have been attached to these dimensions of goal perspectives, the central concepts embedded in the constructs are the same.

An ego involved goal perspective is associated with using norm-referenced criteria for success, where success is evaluated by comparisons with the performance of others. Students who are ego involved set goals of being superior to others when entering achievement contexts, and feel successful only when they establish superiority over others in performance. These individuals typically use norm-referenced criteria to judge their success, and would be more likely to display maladaptive achievement-related behavioral patterns such as withdrawing effort and persistence, expressing negative affect in the face of difficulty, avoiding challenging tasks, attributing success or failure to ability, and displaying performance deterioration, especially when perceived ability is low (e. g. Nicholls, 1984a, 1984b, 1989).

A task involved goal perspective is delineated by self-referenced criteria for success, where learning or mastering a skill and improving individual performance are the main focus.

Individuals who are task involved find satisfaction in self-improvement, attainment of knowledge, and completion of a task successfully. These individuals are more likely to exhibit adaptive achievement-related behavioral patterns including exerting effort and persistence, employing learning strategies, expressing positive affect when facing challenging task, choosing challenging tasks, and attributing success or failure to effort (e. g. Nicholls, 1984a, 1984b, 1989).

Contemporary goal theories have been applied and tested in achievement contexts in the realm of sport and physical activity. The results have demonstrated that the rational interrelationships between goals and beliefs generalize across the academic, sport (e. g. Duda, 1993; Duda & Nicholls, 1992; Duda & Whitehead, 1998; Roberts, 2002; Treasure & Roberts, 1995), and physical education domains (Solmon & Boone, 1993; Walling & Duda, 1995). Findings on the two goal perspectives in academic and physical activity settings are consistent with theoretical predictions, and have revealed that individuals adopt different goals when engaging in achievement situations. Further, individuals with different goal involvement will focus on different information and attend to achievement events in different ways (Duda, Chi, Newton, Walling, & Catley, 1995; Goudas, Biddle, & Fox, 1994; Nicholls, 1989; Papaioannou, 1995; Pintrich, 2000; Roberts, 2002; Solmon & Boone, 1993; Theeboom, Knop, & Weiss, 1995).

Recent efforts to better understand students' motivation have provided a context for merging two of the most important motivational constructs: conceptions of ability and achievement goals. Nicholls and his colleague (Jagacinski & Nicholls, 1984; Nicholls, 1984a, 1984b, 1989) argued that students hold one of two different goal perspectives when entering an achievement setting, and at the same time will hold undifferentiated or differentiated conceptions of ability. Two conceptions of ability are embedded within two dimensions of goal orientations. Some students focus mainly on ability and interpersonal comparison to establish superiority over

others. These ego-oriented learners will hold a differentiated conception of ability because they tend to evaluate their ability on the basis of norm referenced information. Others define success as the results of effort and mastery, and self-improvement and learning or mastery of tasks are their major goals. Students with a task-oriented goal will reflect an undifferentiated conception of ability because they believe that effort and ability co-vary, and high effort implies high ability.

Dweck and her colleagues (Dweck & Elliot, 1983; Dweck & Bempechat, 1983; Elliot & Dweck, 1988) also propose that students' achievement-related behavioral patterns can be explained by adoption of particular achievement-related goal perspectives, which are determined by their conceptions of ability. Entity theorists are more likely to adopt an ego-oriented goal perspective because they believe that ability is fixed and can not be changed through effort. They focus on interpersonal competition and try to demonstrate superiority in ability by outperforming others. Additionally, in physical activity settings entity theorists are more likely to focus on "looking athletic" rather than on improving competencies. In contrast, incremental theorists will be inclined to adopt a task-oriented goal perspective because they hold the view that ability is malleable and can be changed through effort. Thus entity theorists will more likely emphasize learning or mastering a skill, and search every opportunity to improve competencies. Failure will not hurt their self-esteem because they entity theorists consider failure as the necessary step in the learning process.

Although there are some disputes about whether conceptions of ability or goal orientations are more fundamental to understanding motivation, most research findings have demonstrated that an incremental or undifferentiated conception of ability is associated with a task-involved goal perspective. These individuals view ability as changeable through effort and believe their success is a result of the effort exerted. They focus on task mastery and self-

improvement. On the other hand, an entity or a differentiated conception of ability is related to an ego-involved goal perspective, where individuals evaluate their ability on the basis of norm-referenced information, and try to demonstrate superiority in ability by outperforming others (e.g. Elliot & Dweck, 1988; Kavussanu & Roberts, 1996; Sarrazin, Biddle, Famose, Cury, Fox, & Durand, 1996).

Research findings in both academic and physical activity and sport settings have demonstrated a positive relationship between an entity conception of ability and an ego goal state, and an incremental conception of ability and a task goal state (Kavussanu & Roberts, 1996; Fry & Duda, 1997; Sarrazin, et al., 1996). These relationships, however, on the basis of correlational analysis can not explain which one is more fundamental. To date, little research has focused on examining the causal relationship between those two motivational constructs. Future research needs to explore the causal relationship between conceptions of ability and goal orientations by using a method of instructional equation modeling or path analysis. The findings from a more comprehensive analysis will provide a better understanding of students' motivation in achievement contexts.

CONCEPTIONS OF ABILITY AND SELF-EFFICACY

Self-efficacy is accepted as one of the most important motivational constructs influencing achievement strivings and outcomes in achievement contexts (Feltz, 1992; Graham & Golan, 1991; McAuley, Peña, Jerome, 2002). The term of self-efficacy refers to a person's belief in his or her capabilities to successfully complete a specific task and achieve certain outcomes. Self-efficacy beliefs are theorized to affect an individual's motivation, affect, achievement-related behavior, and performance (Bandura, 1986; 1997).

Self-efficacy as an important construct within social cognitive theory is distinguished from perceived ability, perceived competence, and other self-related constructs such as self-concept of ability, self-worth, and self-esteem (Bandura, 1997; McAuley, et al., 2002). In this paper, self-efficacy refers to a situationally specific type of confidence (Bandura, 1986; Feltz, 1992) even though self-efficacy (self-confidence) and perceived competence (perceived ability) are sometimes used interchangeably. In the literature, for example, Braten and Olaussen (1998) misinterpreted perceived ability as self-efficacy when citing the work of Elliott and Dweck (1988) to explain the relationship between self-efficacy and goal orientations in their study. However, it is clear that Elliott and Dweck (1988) proposed that the influence of goal orientation on subsequent behaviors depends on the level of an individual's perceived ability but not self-efficacy. The misuse of terms may lead to some misunderstandings among researchers.

Research from academic domains has indicated that individuals with high self-efficacy are more likely to choose challenging tasks, expend effort and persevere longer as compared to those who have low levels of self-efficacy. Self-efficacy has been found to be positively related to cognitive engagement in a task and will influence academic achievement directly and indirectly through the mediator variables---effort, persistence, and perseverance (Bandura, 1997; Pajares, 1996; Schunk, 1991).

A number of studies have been conducted on the issue of self-efficacy in sport and physical activity settings and there is ample evidence to support that self-efficacy is a significant predictor of performance accomplishments (e. g. Moritz, Feltz, Fahrback, & Mack, 2000). Researchers have also focused on the effect of various treatment methods for increasing an individual's self-efficacy beliefs, and findings have demonstrated that efficacy beliefs in sport

and physical activity settings can be enhanced (e. g. Feltz & Riessinger, 1990; Jourden, Bandura, & Banfield, 1991; Lirgg, George, Chase, & Ferguson, 1996; Martocchio, 1994).

Some research in physical activity settings has focused on the relationship between self-efficacy and other motivational patterns and the links among self-efficacy, motivational patterns, and performance or achievement (Feltz, 1992). For example, several studies have shown that conceptions of ability influence self-efficacy (Jourden, et al., 1991; Kasimatis, et al., 1996; Lirgg, et al., 1996; Martocchio, 1994; Wood & Bandura, 1989).

One notable study by Jourden, et al. (1991) examined the influence of conceptions of ability on self-efficacy in a pursuit-rotary task. In this study, college students' conceptions of ability were manipulated by assigning participants to one of two experimental groups. In an inherent ability condition, participants were led to believe that learning the pursuit-rotary task required innate ability. In the acquired ability condition, participants were instructed to believe that the pursuit-rotary task is a learnable skill through practice. The findings indicated that individuals in the acquired ability condition showed an increase in self-efficacy in the pursuit-rotor task over a series of trials, while those in the inherent ability condition showed no increase in self-efficacy.

Lirgg, et al. (1996) expanded previous research on self-efficacy by examining the impact of conceptions of ability and sex-type of task on male and female self-efficacy beliefs using a masculine task (Kung fu) and a feminine task (Baton twirling). Their findings were consistent with the Jourden et al. (1991) study, indicating that individuals in the acquired condition showed higher self-efficacy than those in the innate condition. Additionally, participants rating Kung fu as gender neutral in the acquired condition showed higher level of self-efficacy than those in the innate condition.

One limitation in both Jourden et al. (1991) and Lirgg et al. (1996) studies is that conceptions of ability were manipulated by instructing participants to believe that ability is fixed or malleable (Solmon, Lee, Belcher, & Harrison, 2000). To eliminate this limitation, Solmon et al. (2000) assigned female participants into three groups based on their current views of ability. In the acquired group, participants believed that a hockey skill could be learned with practice, while in the “acquired but ability helps” group, participants agreed that the task could be learned with practice but realized that natural ability helped. In the innate group, participants believed that the task was dependent on natural ability. Consistent with the Lirgg et al. (1996) study, findings indicated that individuals with an acquired conception of ability were more confident in their own ability to learn a specific hockey skill (Solmon, Lee, Belcher, & Harrison, 2000).

Hong, Chiu, and Dweck (1995) proposed that when compared to self-confidence beliefs, individuals’ conceptions of ability play a more fundamental role in predicting motivational patterns and achievement outcomes when they are faced with a challenging intellectual task. They also argued that students’ self-confidence about ability must be understood within the context of their conceptions of ability. It has been shown that the effects of conceptions of ability on performances are mediated through self-efficacy beliefs (Wood & Bandura, 1989; Jourden, et al., 1991), and self-efficacy beliefs exerted an influence on performance directly and indirectly through effective use of analytic strategies (Jourden, et al., 1991). As a result, self-efficacy is a critical variable that will mediate the effect of conceptions of ability on achievement. An investigation of the proposed conceptions of ability-self-efficacy-motivational patterns-achievement model is worthy of future research effort.

FACTORS AFFECTING STUDENTS’ CONCEPTIONS OF ABILITY

Research during the last decade has documented critical factors that impact an individual's conceptions of ability. There is an abundance of evidence supporting that characteristics in the learning situation (Dweck & Bempechat, 1983; Jagacinski & Nicholls, 1984; Thill & Brunel, 1995; Xiang, Lee, Willianson, 2001), feedback (Dweck, 2002; Kamins & Dweck, 1999; Mueller & Dweck, 1998; Solmon, Li, Lee, & Purvis, 2002), gender (Dweck, 1999, 2002), race (Dweck, 2002; Li, Harrison, & Solmon, 2002), teachers', parents', and evaluators' conceptions of ability (Dweck, 2002), and cross-cultural value (Dweck, 2002; Xiang, Lee, & Shen, 2001) as having important effects. It is important for practitioners to understand how group membership and their own teacher practices can promote different conceptions of ability.

Learning Situations

Dweck and Bempechat (1983) argue that characteristics of the learning environment such as the perceived motivational climate can exert a powerful influence on students' adoption of one conception of ability over the other. Jagacinski and Nicholls (1984) found that task-involving situations activated an incremental conception of ability because individuals in these situations generated the expectation that higher effort resulted in more mastery or learning. Ego-involving situations fostered an entity conception of ability because of emphasizing social comparison.

Based on the study by Jagacinki and Nicholls (1984), Thill and Brunel (1995) examined how ego-involving and task-involving situations would influence conceptions of ability, effort, and learning strategies among thirty-two professional soccer players. In ego-involving situations, interpersonal comparisons were emphasized. Subjects were encouraged to score higher than other players. In task-involving situations, subjects were instructed to try new things and explore the novel task. Findings demonstrated that subjects in the ego-involving situations were likely to hold a more differentiated conception of ability than those in the task-involving situations.

To date limited research on how learning situations affect students' conceptions of ability and how students' conceptions of ability will develop under the influence of learning situations has been done in physical activity. There is, however, evidence to confirm that a learning situation can be manipulated to promote the creation of either a task-involved or an ego-involved climate (Solmon, 1996; Theeboon, DeKmpop, & Weiss, 1995; Treasure & Roberts, 2001). Solmon (1996), for example, provided clear evidence that students' perceptions of the motivational climate will differ according to the task and ego involved conditions created by the teacher. In this study, students' perceptions reflected the motivational climates established by the teacher and students responded with more adaptive patterns of behavior. Additional research is needed to determine if different conceptions of ability can be made salient by manipulating learning environments in physical activity contexts to create a task or ego motivational climate.

Feedback

Feedback has been widely accepted as a factor influencing students' achievement motivation (Mueller & Dweck, 1998; Magill, 2001). Two broad categories of feedback were identified in the classroom literature: trait-related feedback versus process feedback. Trait-related feedback involves a global evaluation on the basis of performance or ability, while process feedback refers to a global assessment based on strategies or effort (Kamins & Dweck, 1999). Several experimental studies (Mueller & Dweck, 1998; Kamins & Dweck, 1999) have investigated how adults' feedback, whether praise or criticism, could promote different conceptions of ability in students. Results have indicated that trait-related feedback was more likely to foster an entity conception of ability in students as compared to process feedback, which produces a more incremental conception of ability.

Research has clearly shown that individuals with different goal involvement (e. g. task or ego) will focus on different information and attend to achievement events in different ways (e. g. Roberts, 2002; Solmon & Boone, 1993; Theeboom, et al., 1995). Butler (1992, 1993) has proposed that task- and ego-involved learning climates will also promote different patterns of information seeking. She reasoned that in task-involved conditions, people seek information conforming to their goal of learning a task and improving mastery. In contrast people in ego-involved conditions should favor social comparison information which evaluates their ability relative to others. A series of studies by Butler have demonstrated that people are active information seekers and that the kinds of information they prefer depend on their goal orientations (1992, 1993) and conceptions of ability (1999, 2000). Entity theorists are more attentive to normative feedback rather than temporal feedback, which give information about their own improving or declining performance. In contrast, incremental theorists were more likely to prefer temporal feedback rather than normative feedback

Augmented feedback has been most used in the motor learning and physical education pedagogical literature, and is more related to the type of feedback instructors give in real-world instruction settings. Knowledge of performance (KP) and knowledge of results (KR) reflect the nature and the content of the feedback. These motor learning constructs are different from the patterns of information seeking used in the Butler (1992, 1993, 2000) studies, but both can provide information relative to the role of implicit theories of ability in physical activity

To date one study (Solmon, et al., 2002) has examined the relationships between students' implicit theories of ability and the preferred type of augmented feedback. This study extended the knowledge base by providing information about the content and the nature of feedback rather than the reference point for comparative information used by Butler (1992, 1993,

2000). Students' conceptions of ability in tennis and their preference for the nature and content of feedback about their performance in tennis were measured. Results indicated that an entity theory of ability was negatively related to preference for KP, but an incremental theory of ability was not related to preference for either KR or KP. These findings suggest that teacher feedback could be an important variable to be used in creating an environment to enhance students' adaptive motivational patterns in physical education. To better understand the impact that teacher feedback can have, further study is needed to be done to determine how normative and temporary feedback, or KR and KP will influence students' conceptions of ability, and consequently their motivational patterns in achievement contexts in physical education settings.

Gender

While the mediating influences of conceptions of ability seem clear (e. g. Dweck 1999) the research about gender differences in beliefs about physical activity is still somewhat limited. There is some evidence that in academic areas (Dweck, 2002) girls may hold more of an entity conception of ability than boys. Other research (Li, Lee, & Solmon, 2003) designed to examine gender differences in conceptions of ability in a physical education setting indicated that both male and female college students endorsed an incremental rather than an entity theory. When compared to females, however, males were more likely to embrace the notion of ability as a fixed construct. The picture is complex and additional studies of gender differences are needed, especially in physical activity. Recent research (Lee, Fredenburg, Belcher, & Cleveland, 1999) has suggested that the competence beliefs of students who have internalized stereotypical views about various physical activities are driven by a sense of gender appropriateness. In the American culture the sport curriculum typically offered in school physical education is clearly viewed as masculine and more appropriate for male participation (Lee, et al., 1999). Males are

stereotyped to be more athletically competent than females, and when students accept this stereotypical view they might be inclined to believe that their superiority is because of natural ability. Gender stereotypes have been passed on from one generation to another generation. All human beings are subject to assimilate the prevailing and often implicit knowledge of gender stereotypes (Eitzen & Sage, 1986). Therefore, gender stereotypes may shape females and males' ability belief systems through the process of socialization.

Race

There is evidence showing that African American college students are more likely to endorse an incremental conception of ability than did European Americans in academic settings although they have been often imaged as intellectually inferior (Aronson, Fried, & Good, 2003; Lewis, 1999). Dweck (2002) proposed that recent stereotype threat theory may provide a good approach to better understand why African Americans were more likely to hold a view that ability is malleable.

Stereotype threat theory suggests that people avoid accepting a negative attribute about their groups (Steele, 1997). People are born to be motivated to protect their positively valued personal and group attributes (Tajfel, 1982; Tajfel & Turner, 1986; Turner, 1982). When individuals face negative characteristics applied to their group, they seek to avoid them because these negative characterizations can potentially hurt their self-esteem. After individuals are exposed to negative stereotypes for a lifetime, they are likely to internalize an "inferiority anxiety" (Steele & Aronson, 1995, p. 797). Therefore, individuals would be likely to reject negative group stereotypes as attributes of themselves (Steele & Aronson, 1995). It has been stereotyped that African Americans are intellectually inferior to European Americans. When situations make it salient that people's fixed intelligence are being tested, African Americans

tend to maintain their self-esteem and avoid their negative group characteristics; and therefore, they were likely to endorse a view that intelligence is a malleable attribute due to “stereotype threat” (Steele & Aronson, 1995) even if they were often shown to perform worse than did European Americans (Aronson, et al., 2003).

In a physical education setting, Li et al. (2002) investigated racial differences in college students’ implicit theories of ability in sport under the framework of stereotype threat theory. These researchers asked students to indicate their racial identity and assessed their implicit theories of sport ability. On the basis of the previous research (e. g. Harrison, 2001; Steele & Aronson, 1995), two basic assumptions were made in this study. One was that asking participants to indicate racial identity on tests could activate racial stereotypes, and such indicators of racial stereotypes could engage stereotype threat. The second assumption was that having innate physical superiority may become a negative stereotype for African American because African Americans are generally viewed as physically superior in nature as compared to European Americans, and that innate superiority has been very closely linked to intellectual inferiority. The findings indicated that while both African Americans and European Americans expressed an incremental rather than an entity theory of ability, when compared to European Americans the African Americans were more likely to reject the notion of ability as a fixed construct. The authors concluded that this finding was due to “stereotype threat.” Research in this area is very limited and highly interesting; therefore, more work needs to be done in the future (Dweck, 2002).

Culture

Recent cross-cultural work has investigated the influence of different cultures on children’s conceptions of ability. Research evidence indicates that Asian cultures are different

from that of the United States. Asian cultures emphasize the importance of effort and see effort as the key to achievement, whereas the American culture emphasizes competition and individualism (Dweck, 2002; Xiang, Lee, & Shen, 2001). However, cultural differences do not mean that Asians have more of an incremental conception of ability than Americans (Dweck, 2002). For example, Xiang, Lee, and Shen (2001) examined differences in conceptions of ability between American and Chinese students from 4th-, 8th-, and 11th- grades. The results indicated that Chinese students from almost all grades were more likely to hold an entity conception of ability than American students.

Teachers', Parents', and Evaluators' Conceptions of Ability

A variety of recent studies in academic settings suggest that adults with different views of conceptions of ability tend to judge and treat children differently (Dweck, 2002). Butler (2000) conducted two studies to examine if implicit theories of ability moderate the effects of performance trends on inferences about ability. Results indicated that entity teachers were more likely to make judgments of students often on the basis of initial outcome, while incremental teachers were more likely to perceive final outcome as diagnostic of ability. Further, a recent study by Smiley, Coulson, and Van Ocker (2000) revealed that parents with an incremental conception of ability are more likely to prefer challenging tasks for their children than those with an entity view even if their children might fail in these challenging tasks.

This line of research has made great contributions to the literature by identifying the potential factors affecting the development of children's conceptions of ability. However, little is known about how children's conceptions of physical ability might be shaped by adults' different judgments, treatments, and expectations. From the literature reviewed it seems very possible that the ways teachers, parents, or other adults judge and treat children can shape their beliefs about

the nature of ability in all domains. Determining how children's conceptions of ability are shaped through their experiences with parents, teachers, peers, and friends is an area in need of further study. The goal is to find ways to create environments that will enhance students' adaptive behavioral patterns, thus improving their achievements throughout their lives.

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APPENDIX B
CONSENT FORM

1. Study Title: Effect of ability conceptions on intrinsic motivation, persistence, and performance
2. Performance Site: Louisiana State University and Agricultural and Mechanical College
3. Investigators: The following investigators are available for questions about this study, M-F, 8:00 a.m. - 4:30 p.m. Weidong Li 578-5714
4. Purpose of the Study: To investigate how individuals' conceptions of ability in object manipulation (hand-eye coordination) will affect their intrinsic motivation, persistence, and performance
5. Subject Inclusion: College students
6. Number of subjects: 152
7. Study Procedures: This study will be conducted in two phases. In the phase-one, upon the arrival, you will be told to work on a Lunastix novel task which is a test of object manipulation ability. Then you will be asked to complete a questionnaire called Conceptions of Ability in Object Manipulation. After completing the questionnaire, you will be presented the videotaped instructions and demonstrations of task. Following that, you will be given 10-minute independent practice time. Finally, intrinsic motivation questionnaire, one item assessing the task difficulty, and a skill test will be administered after the independent practice time. A week later, you will return for the phase-two study. On the experiment day, you will be told that they are going to work on a more difficult task called spin skill. Then you will be randomly assigned to two different treatment conditions. In each treatment condition, the instructors will show you the videotaped instructions and demonstrations of the spin skill, and the inductions of an entity or incremental conception of ability according to your pre-assigned conditions. Following that, you will have a fifteen-minute practice session. The treatment conditions will be enhanced every three minutes during the practice session. At the end of independent practice session, the intrinsic motivation questionnaire, one item assessing the difficulty of the spin skill as compared to the Lunastix skill, and a final skill test will be completed. Finally, the teacher will debrief the participants the purpose of the study through discussing their specific treatment condition.
8. Benefits: You will not get any benefit by participating in this study.
9. Risks: No known risks
10. Right to Refuse: You may choose not to participate or to withdraw from the study at any time without penalty or loss of any benefit to which you might otherwise be entitled.

11. Privacy: Results of the study may be published, but no names or identifying information will be included in the publication. Your identity will remain confidential unless disclosure is required by law.

12. Signatures:

The study has been discussed with me and all my questions have been answered. I may direct additional questions regarding study specifics to the investigators. If I have questions about subjects' rights or other concerns, I can contact Charles E. Graham, Institutional Review Board, (225) 578-1492. I agree to participate in the study described above and acknowledge the investigator's obligation to provide me with a signed copy of this consent form.

Signature of Subject

Date

APPENDIX C
RAW DATA

PHASE ONE

Obs age a1 a2 a3 a4 a5 a6 a7 a8 a9 a10 a11 a12 p1 p2 p3 p4 p5 p6 p7 p8 p9 p10 p11 p12 p13
p14 p15 p16 t1 t2 t3 LD persis

1 22 2 5 1 4 5 3 3 5 5 5 3 5 5 3 5 4 5 5 7 5 3 5 1 4 5 3 3 4 23
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2 19 2 4 2 3 4 4 2 4 3 2 2 3 4 3 5 4 3 5 5 5 4 3 3 4 5 3 3 5 15
13 29 5 574
3 20 1 5 1 4 5 4 2 5 5 2 1 4 5 5 5 3 2 6 5 5 1 1 2 5 5 5 3 3 3
12 5 4 562
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14 50 4 586
5 21 2 5 2 2 4 4 4 5 3 2 2 4 3 1 6 6 6 6 3 7 2 6 2 2 2 2 2 6 27
12 38 5 564
6 22 3 5 2 3 4 4 2 4 4 2 2 4 4 5 5 5 5 5 5 4 5 4 3 5 4 4 3 3 50
50 50 4 587
7 22 2 4 2 3 4 4 3 4 4 2 2 4 3 3 4 3 3 5 3 3 3 3 4 3 3 3 5 5 35
22 50 5 600
8 20 2 4 2 3 4 3 3 4 4 4 2 4 4 4 5 4 3 5 5 4 3 3 3 5 5 4 3 4 16
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50 21 3 582
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2 24 6 593
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0 5 4 600
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10 6 5 600
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30 15 6 600

21 24 1 5 1 1 5 5 1 5 5 1 1 5 6 4 6 5 5 6 6 6 5 5 1 4 3 4 1 5 50
 36 50 5 600
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 50 50 5 600
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 15 30 5 568
 33 19 2 5 2 3 4 3 2 4 4 4 2 3 5 5 5 5 3 5 5 5 3 3 2 5 5 5 2 2 50
 50 50 2 600
 34 22 3 5 2 2 4 4 3 5 4 4 2 4 6 6 6 5 1 7 7 7 1 7 1 6 6 4 1 1 50
 50 50 4 594
 35 18 1 5 2 4 4 2 4 4 2 4 3 2 5 1 6 5 5 5 6 6 6 4 1 3 1 1 1 6 50
 37 8 5 580
 36 22 1 5 1 2 4 4 2 4 4 2 2 5 5 5 5 5 3 5 5 5 1 1 1 5 5 5 2 2 50
 50 50 4 559
 37 20 1 5 1 1 5 5 1 5 5 1 1 5 4 2 6 4 3 6 6 6 5 4 1 1 2 1 3 7 9
 50 18 5 600
 38 21 2 4 2 4 4 3 4 4 4 2 4 2 3 3 5 3 3 4 4 5 3 3 4 5 4 3 3 3 22
 13 20 6 457
 39 21 3 4 2 4 4 3 3 5 4 3 3 4 3 1 5 3 5 5 3 4 5 5 3 3 3 3 4 7 1
 1 7 7 557
 40 18 3 5 1 4 5 4 2 5 5 3 2 5 1 4 5 4 1 4 1 1 1 1 3 4 7 3 6 4 34
 50 46 2 566
 41 21 1 5 1 1 5 5 3 5 5 2 1 5 7 4 7 7 1 7 7 7 1 1 1 4 7 3 1 4 17
 18 9 5 600
 42 31 2 4 2 2 4 4 2 4 4 4 2 4 6 5 5 5 5 5 6 6 2 2 2 5 5 5 1 1 19
 3 42 5 581
 43 24 3 4 2 3 4 3 3 4 3 3 3 3 4 3 4 4 5 3 4 5 3 3 3 4 3 3 3 4 50
 4 50 4 600

44 20 2 5 2 3 4 4 3 4 4 2 3 4 5 3 5 4 3 5 5 5 3 3 2 4 5 3 3 5 11
 19 2 4 577
 45 20 2 5 2 2 4 4 2 4 4 3 2 4 4 4 6 4 3 5 4 4 3 3 3 4 5 4 4 4 50
 50 50 3 559
 46 22 2 4 2 4 4 2 4 3 2 3 3 2 5 4 5 5 5 5 5 6 3 3 3 4 3 3 3 4 50
 16 50 6 587
 47 23 5 5 5 5 5 2 5 5 2 5 5 2 5 3 5 5 3 5 5 4 3 3 3 3 4 3 3 5 28
 21 9 5 578
 48 22 2 4 3 3 4 4 2 4 5 3 4 4 4 5 3 4 2 2 5 4 2 2 5 6 6 4 3 2 50
 50 50 2 499
 49 20 4 4 3 4 4 3 3 4 4 3 4 3 3 3 4 3 3 4 4 4 4 4 5 3 5 2 5 5 17
 18 29 6 570
 50 27 2 4 2 4 3 2 3 4 4 2 2 3 6 4 4 5 3 4 6 5 3 3 3 4 5 3 3 3 50
 50 50 4 590
 51 21 2 5 2 2 5 5 1 4 5 1 1 4 4 4 5 4 3 5 4 5 4 3 2 5 4 1 4 4 50
 50 50 4 497
 52 21 2 5 2 2 5 4 2 5 4 2 2 4 7 4 7 7 3 7 7 7 3 5 1 4 5 4 1 1 50
 17 10 4 600
 53 22 3 4 2 4 4 3 2 4 4 4 2 4 5 2 5 4 4 5 5 5 2 5 3 3 3 3 3 5 27
 50 40 5 600
 54 21 4 4 2 3 4 4 3 3 4 2 2 4 5 4 5 5 5 4 4 5 5 5 2 5 4 4 5 3 50
 50 43 4 588
 55 22 1 5 1 2 5 3 2 4 4 2 1 4 3 3 5 5 5 5 3 5 5 5 2 3 5 3 5 5 22
 10 8 5 592
 56 20 2 5 2 4 4 4 2 4 4 2 2 4 5 5 4 5 3 5 5 5 3 3 3 6 5 5 4 3 50
 50 50 2 521
 57 22 1 5 2 3 4 4 3 5 4 2 2 4 6 6 4 5 1 3 6 6 1 1 1 7 5 5 3 2 50
 50 50 3 559
 58 25 2 4 2 4 4 4 4 5 4 4 4 4 5 2 5 3 4 5 5 5 2 2 2 2 4 3 6 6 20
 14 10 5 556
 59 35 4 5 2 4 5 5 4 5 5 2 2 5 6 2 7 7 5 7 7 7 4 4 1 3 4 1 1 7 10
 25 3 5 569
 60 21 2 4 3 2 4 4 2 4 4 2 2 4 1 1 4 3 5 5 2 3 4 5 4 1 1 1 7 7 50
 29 1 5 520
 61 20 2 4 2 2 4 4 2 4 4 2 2 4 4 2 5 4 3 5 4 5 3 4 2 3 3 2 3 7 8
 17 24 6 572
 62 38 2 4 2 2 5 4 2 5 4 2 2 4 6 3 6 5 4 6 6 6 5 5 2 4 3 3 2 5 50
 8 5 5 582
 63 21 2 4 1 2 5 4 3 4 4 2 2 4 5 4 5 4 5 5 5 5 2 2 2 5 4 4 2 3 50
 9 21 4 569
 64 21 2 5 2 2 5 4 2 5 4 2 2 4 5 5 6 6 6 7 6 6 3 5 1 5 2 5 2 2 50
 50 50 3 600
 65 22 2 4 2 4 4 2 4 4 2 3 3 2 5 5 5 5 2 5 6 6 3 3 2 5 4 5 1 1 50
 50 50 1 592
 66 21 3 4 3 4 4 4 4 4 4 4 3 4 5 4 5 5 3 5 5 5 3 3 3 4 5 3 3 5 6
 12 9 5 516

67 19 4 4 1 3 4 4 3 4 4 2 4 4 4 3 5 3 5 5 4 3 3 5 3 3 3 3 3 5 6
7 26 5 570
68 22 2 5 2 3 4 4 2 4 4 2 2 4 5 3 5 5 3 3 5 5 3 3 3 3 5 3 3 5 13
11 16 4 579
69 21 4 4 2 4 4 4 4 4 4 2 3 4 3 4 5 5 3 5 3 3 3 3 3 5 5 3 3 5 12
49 34 3 560
70 44 3 4 2 3 4 3 3 4 4 3 3 3 4 1 5 4 5 5 5 5 5 4 3 3 4 1 3 7 16
11 13 5 543
71 21 3 5 2 4 5 4 3 4 4 3 3 3 3 3 4 6 3 4 5 6 3 4 3 6 6 6 2 2 4
50 50 3 600
72 20 2 5 2 3 4 3 2 4 4 4 2 4 4 3 5 5 6 6 5 4 1 6 1 4 1 3 3 5 12
50 14 4 600
73 31 2 4 2 2 4 4 4 4 4 4 2 4 5 6 6 6 3 6 5 5 3 5 1 6 3 5 3 3 43
50 50 4 600
74 23 2 4 2 4 4 2 2 4 3 3 4 2 5 4 6 5 5 6 5 6 3 3 3 4 3 4 2 3 50
50 41 5 587
75 19 4 4 4 3 4 5 2 5 5 2 1 5 5 3 5 4 2 5 6 6 1 1 3 4 5 2 2 5 0
4 16 4 529
76 21 2 4 2 3 4 4 2 4 4 2 2 4 5 6 6 6 3 6 6 6 3 3 2 6 6 6 2 2 50
50 50 2 600
77 22 2 5 1 2 4 3 4 5 5 2 2 2 4 3 5 4 5 5 4 3 5 5 3 3 3 3 4 4 50
50 36 5 593
78 20 4 5 2 4 4 4 3 4 4 2 3 4 5 4 5 4 3 4 5 5 3 3 3 5 3 4 3 5 50
38 21 5 569
79 20 2 5 2 2 4 4 2 4 4 2 2 4 4 3 7 5 3 7 5 6 2 2 2 5 5 3 3 5 46
48 7 4 600
80 20 2 5 2 4 4 4 4 4 4 2 4 4 6 6 5 6 3 5 6 6 3 4 3 5 5 5 2 3 50
50 50 2 483
81 21 2 4 2 2 4 4 2 4 4 2 2 4 6 6 6 5 3 5 6 6 4 4 3 5 4 5 3 3 50
35 14 3 600
82 20 2 4 1 3 4 2 3 5 3 3 2 3 6 5 5 6 4 6 6 6 4 4 1 5 4 5 2 2 50
50 41 4 600
83 20 3 4 2 4 4 2 4 4 4 2 4 4 5 5 5 5 3 5 5 5 3 3 3 5 4 4 3 3 50
50 50 3 600
84 23 2 4 2 3 4 4 2 5 4 3 3 4 6 4 6 5 4 6 7 7 3 5 1 4 3 3 1 3 8
32 50 5 600
85 22 2 4 2 4 4 4 3 4 4 3 4 3 6 5 4 5 5 5 5 5 4 5 3 5 3 5 3 3 50
11 9 4 600
86 20 2 4 2 4 4 3 2 4 4 4 3 4 5 4 5 5 3 5 4 5 3 3 3 5 4 4 3 3 50
50 50 4 582
87 20 3 5 2 2 3 3 4 4 4 3 2 3 5 6 5 5 2 5 5 4 3 4 3 5 4 5 6 2 50
50 50 1 548
88 18 2 4 2 3 4 4 2 4 4 2 2 4 3 2 5 5 5 5 5 5 5 5 3 3 2 2 3 5 5
42 12 5 558
89 30 2 4 2 3 4 4 3 5 4 2 2 4 7 4 7 5 5 7 7 6 5 6 2 4 3 3 1 4 40
25 13 6 549

```

90 22 2 4 2 3 4 4 2 4 4 3 2 4 5 5 5 3 3 4 5 5 3 3 3 5 5 5 3 3 50
50 50 2 548
91 21 1 5 1 3 5 3 2 5 3 4 4 4 5 5 6 5 5 5 5 4 4 5 3 6 3 5 3 2 50
50 50 3 595
92 20 2 1 1 3 4 4 3 5 4 4 2 4 7 5 6 6 1 6 7 7 1 1 1 6 6 5 2 1 50
50 50 2 532
93 19 3 4 3 4 4 3 3 4 4 3 4 3 4 3 5 4 4 5 4 5 4 5 3 3 3 3 3 5 26
12 37 4 600
94 20 2 4 2 4 4 3 2 4 3 3 2 3 4 3 4 4 5 5 5 5 3 5 4 3 3 4 5 5 39
50 40 5 586
95 22 2 4 2 4 4 4 3 4 4 3 4 4 5 3 6 5 4 6 5 4 2 3 3 3 5 3 5 5 50
50 50 4 572
96 21 1 2 2 2 4 4 2 4 4 1 2 4 3 3 3 3 5 3 3 5 5 5 3 5 5 3 5 3 50
50 50 4 534
97 22 2 4 2 4 4 4 4 4 4 2 2 4 3 4 4 3 3 3 4 4 3 3 4 5 5 4 4 4 13
41 37 4 589

```

PHASE TWO

```

obs trt perf age a1 a2 a3 a4 a5 a6 a7 a8 a9 a10 a11 a12 cond1 cond2 p21 p22
p23 p24 p25 p26 p27 p28 p29 p210 p211 p212 p213 p214 p215 p216
dlc persis

```

```

1 0 16 22 2 5 1 4 5 3 3 5 5 5 3 5 3 4 4 3 5 5 5 5 5 4 3 4 2 4 4
3 3 5 3 878
2 1 24 20 1 5 1 4 5 4 2 5 5 2 1 4 4 4 5 5 5 5 3 5 5 5 2 2 2 5 6
5 3 3 1 862
3 0 14 20 2 4 2 4 4 3 2 4 2 3 2 2 2 4 5 4 6 4 3 5 5 5 2 4 2 4 5
4 2 3 1 900
4 0 14 21 2 5 2 2 4 4 4 5 3 2 2 4 1 4 5 4 6 3 5 6 6 6 4 5 2 4 3
4 2 5 1 839
5 1 12 22 3 5 2 3 4 4 2 4 4 2 2 4 2 5 5 5 5 6 5 5 5 4 5 5 1 5 3
5 3 3 2 900
6 1 7 22 2 4 2 3 4 4 3 4 4 2 2 4 4 2 3 3 4 3 5 5 5 3 3 3 3 3 3
3 3 5 3 885
7 0 0 20 2 4 2 3 4 3 3 4 4 4 2 4 4 3 4 4 5 5 3 5 4 3 3 3 3 4 5
4 3 5 3 900
8 0 1 21 3 5 1 3 4 4 3 3 4 4 2 4 1 2 3 2 4 4 5 4 3 4 4 4 4 1 3
1 5 6 3 849
9 0 25 21 1 4 2 2 4 4 2 4 4 4 3 4 4 5 6 6 5 4 5 5 6 6 5 5 2 6 3
5 3 3 1 875
10 1 4 20 2 4 2 3 3 4 3 4 4 4 3 4 4 2 4 1 6 5 4 6 4 5 6 6 1 1 3
1 3 7 4 809
11 1 25 22 3 4 2 4 4 3 4 4 3 2 4 3 4 4 6 5 6 6 3 5 5 4 3 3 3 5 5
5 3 3 3 788
12 0 7 33 3 4 2 2 4 4 4 2 2 2 2 4 3 4 5 3 5 5 4 5 5 5 3 3 3 3 5
7 2 1 4 877

```

13 0 6 24 3 4 2 3 4 4 3 3 4 4 3 3 2 4 5 4 6 4 3 6 6 6 4 4 3 5 5
 4 3 4 2 874
 14 1 5 20 2 4 2 4 4 3 4 4 4 4 3 3 2 4 5 4 5 3 3 5 5 5 3 3 3 5 5
 4 3 4 3 791
 15 1 12 23 2 4 2 4 4 2 3 4 4 4 3 3 4 4 3 3 5 5 5 5 3 4 5 5 3 4 3
 3 3 5 3 742
 16 0 8 20 2 4 2 2 4 3 2 5 3 3 2 4 2 5 6 5 7 6 4 7 6 5 3 1 1 5 5
 5 1 4 3 878
 17 0 8 20 1 5 1 2 5 5 2 5 5 1 2 5 2 3 6 5 7 7 6 7 6 5 5 3 1 5 3
 5 1 3 1 900
 18 1 18 24 1 5 1 1 5 5 1 5 5 1 1 5 1 5 6 6 6 4 3 5 6 6 4 4 1 6 6
 6 3 3 1 891
 19 1 6 21 3 5 1 4 5 4 3 5 4 2 4 4 5 2 6 5 7 4 6 7 7 5 5 5 2 5 3
 5 3 4 3 895
 20 0 18 37 2 4 2 2 4 4 2 4 4 3 2 4 3 4 4 5 5 5 5 5 5 5 4 5 3 5 5
 4 5 3 3 885
 21 1 14 20 2 4 2 4 4 4 2 4 4 2 2 4 4 2 6 6 6 6 3 6 6 6 3 3 3 6 5
 5 3 3 3 833
 22 1 12 20 2 4 2 2 4 3 2 4 4 2 2 4 2 5 6 6 6 6 4 5 5 5 4 5 1 5 4
 5 1 3 3 879
 23 1 16 21 4 4 4 3 4 4 4 4 4 4 3 4 5 2 6 6 6 6 6 6 6 6 4 3 3 5 5
 5 3 3 3 808
 24 0 6 22 2 4 2 3 4 4 2 4 4 2 2 4 2 4 4 3 5 4 5 5 4 5 4 5 3 3 3
 3 5 5 3 890
 25 0 16 19 2 5 2 3 4 3 2 4 4 4 2 3 2 4 5 5 5 5 4 5 5 5 4 4 3 5 4
 4 3 3 3 887
 26 1 28 22 3 5 2 2 4 4 3 5 4 4 2 4 4 5 5 4 5 5 4 6 6 6 1 5 1 4 6
 4 6 4 3 889
 27 1 17 18 1 5 2 4 4 2 4 4 2 4 3 2 4 2 5 3 7 5 5 7 6 5 5 5 1 3 3
 1 1 5 3 861
 28 0 30 22 1 5 1 2 4 4 2 4 4 2 2 5 4 4 5 5 6 6 2 6 6 6 1 1 1 6 6
 6 1 1 3 819
 29 1 10 20 1 5 1 1 5 5 1 5 5 1 1 5 4 4 4 4 6 5 5 5 4 5 5 5 1 2 2
 2 5 5 4 900
 30 0 13 21 1 5 1 1 5 5 3 5 5 2 1 5 2 5 7 5 7 7 1 7 7 7 1 4 1 7 7
 5 1 1 2 890
 31 1 15 31 2 4 2 2 4 4 2 4 4 4 2 4 4 4 5 5 5 5 4 5 5 5 2 4 1 5 5
 5 4 1 2 872
 32 1 28 22 2 4 2 4 4 2 4 3 2 3 3 2 4 3 4 4 5 5 5 5 4 5 3 3 3 5 3
 4 3 4 3 887
 33 1 10 23 5 5 5 5 5 2 5 5 2 5 5 2 5 2 5 1 7 6 3 6 5 5 2 5 1 2 6
 1 2 7 3 874
 34 0 17 27 2 4 2 4 3 2 3 4 4 2 2 3 3 3 5 3 4 4 3 4 5 5 3 3 3 3 4
 3 3 4 3 751
 35 1 0 21 2 5 2 2 5 4 2 5 4 2 2 4 5 2 6 3 5 6 5 5 7 7 4 3 3 3 4
 3 3 6 4 890

36 0 14 22 3 4 2 4 4 3 2 4 4 4 2 4 3 4 5 4 6 4 5 6 5 5 3 5 1 5 3
 4 1 3 4 852
 37 1 14 21 4 4 2 3 4 4 3 3 4 2 2 4 2 4 5 5 4 6 5 4 5 6 3 5 3 5 4
 5 3 3 3 752
 38 0 9 22 1 5 1 2 5 3 2 4 4 2 1 4 2 4 4 3 5 5 3 5 4 5 3 3 3 5 5
 4 3 3 2 641
 39 1 16 20 2 5 2 4 4 4 2 4 4 2 2 4 4 3 4 5 3 5 3 4 5 5 3 3 4 5 5
 4 5 3 4 699
 40 1 36 22 1 5 2 3 4 4 3 5 4 2 2 4 4 3 6 5 4 5 1 2 7 6 1 1 6 7 6
 6 4 1 2 658
 41 0 16 25 2 4 2 4 4 4 4 5 4 4 4 4 4 3 2 5 2 5 5 3 3 5 5 2 2 3
 2 2 5 3 838
 42 0 1 35 4 5 2 4 5 5 4 5 5 2 2 5 5 1 6 2 7 6 3 7 6 7 7 7 1 1 3
 1 1 7 4 855
 43 0 11 20 2 4 2 2 4 4 2 4 4 2 2 4 2 3 4 3 5 4 3 6 5 5 3 4 3 3 5
 2 3 5 3 725
 44 1 0 38 2 4 2 2 5 4 2 5 4 2 2 4 5 4 3 2 3 1 4 5 4 5 4 4 3 1 3
 1 3 7 4 782
 45 0 23 21 2 4 1 2 5 4 3 4 4 2 2 4 2 4 5 5 5 5 4 5 5 4 3 4 3 5 4
 4 3 3 1 894
 46 0 19 21 2 5 2 2 5 4 2 5 4 2 2 4 1 5 7 7 7 7 7 7 7 7 5 6 1 7 3
 7 3 2 1 807
 47 0 25 22 2 4 2 4 4 2 4 4 2 3 3 2 4 4 5 5 5 5 4 5 5 5 4 4 4 5 5
 5 4 4 2 813
 48 0 1 21 3 4 3 4 4 4 4 4 4 4 3 4 4 2 5 2 7 4 3 6 6 4 3 3 1 3 4
 3 3 5 3 537
 49 0 13 19 4 4 1 3 4 4 3 4 4 2 4 4 2 4 4 3 5 3 5 5 4 5 4 5 3 3 3
 3 4 5 2 701
 50 1 21 21 4 4 2 4 4 4 4 4 4 2 3 4 4 2 4 5 3 3 3 3 5 5 3 3 5 5 5
 5 3 3 1 727
 51 0 0 44 3 4 2 3 4 3 3 4 4 3 3 3 4 2 5 7 1 5 5 6 5 5 6 4 1 1 4
 1 3 7 4 832
 52 1 10 21 3 5 2 4 5 4 3 4 4 3 3 3 3 5 6 5 5 6 3 6 5 6 1 1 1 6 5
 6 2 6 3 835
 53 1 16 20 2 5 2 3 4 3 2 4 4 4 2 4 4 4 6 5 5 5 3 5 5 5 3 3 3 4 5
 4 1 3 1 815
 54 1 9 31 2 4 2 2 4 4 4 4 4 4 2 4 4 4 5 5 6 4 3 6 5 5 3 5 2 5 5
 4 3 3 3 869
 55 0 13 23 2 4 2 4 4 2 2 4 3 3 4 2 4 5 5 4 5 5 5 3 5 5 3 3 3 5 3
 4 3 3 3 894
 56 1 1 19 4 4 4 3 4 5 2 5 5 2 1 5 5 2 3 3 5 4 3 5 5 5 3 3 3 3 5
 2 3 5 4 861
 57 1 28 21 2 4 2 3 4 4 2 4 4 2 2 4 4 4 6 6 6 6 6 6 6 6 4 5 1 5 5
 5 1 2 3 862
 58 0 16 22 2 5 1 2 4 3 4 5 5 2 2 2 3 4 4 4 4 3 3 4 4 4 3 3 3 5 5
 5 5 3 2 826

59 0 10 20 4 5 2 4 4 4 3 4 4 2 3 4 5 3 4 4 5 5 3 5 5 5 3 3 2 4 4
 4 1 4 4 777
 60 1 12 20 2 4 1 3 4 2 3 5 3 3 2 3 4 4 5 4 4 5 4 4 5 5 4 4 2 4 4
 4 2 4 3 879
 61 0 22 20 3 4 2 4 4 2 4 4 4 2 4 4 4 4 5 5 6 5 5 5 6 7 3 3 3 5 4
 3 2 2 1 890
 62 1 23 23 2 4 2 3 4 4 2 5 4 3 3 4 4 4 6 5 7 5 3 7 6 6 5 3 1 4 3
 4 1 3 3 880
 63 1 16 22 2 4 2 4 4 4 3 4 4 3 4 3 4 4 5 5 5 5 5 5 5 5 4 5 3 5 4
 4 3 3 4 889
 64 0 15 20 2 4 2 4 4 3 2 4 4 4 3 4 2 4 5 4 5 4 3 5 5 5 3 3 3 5 4
 3 3 3 3 878
 65 1 20 20 3 5 2 2 3 3 4 4 4 3 2 3 4 3 5 5 6 6 3 6 5 5 3 5 3 5 4
 5 3 3 3 855
 66 0 22 18 2 4 2 3 4 4 2 4 4 2 2 4 4 4 5 3 5 5 5 5 5 5 3 5 3 3 3
 3 3 5 1 786
 67 0 35 22 2 4 2 3 4 4 2 4 4 3 2 4 2 4 4 5 5 4 3 5 5 5 3 3 3 5 5
 5 4 3 2 864
 68 0 28 21 1 5 1 3 5 3 2 5 3 4 4 4 2 5 5 5 6 6 3 6 5 3 3 3 3 5 4
 4 3 3 3 867
 69 1 33 20 2 1 1 3 4 4 3 5 4 4 2 4 5 3 6 6 6 7 1 6 6 6 1 1 1 7 7
 6 1 1 3 831
 70 1 15 19 3 4 3 4 4 3 3 4 4 3 4 3 4 4 4 4 5 4 5 5 5 5 5 5 3 3 3
 3 3 5 2 895
 71 1 10 22 2 4 2 4 4 4 3 4 4 3 4 4 5 1 4 4 5 4 3 5 4 4 1 1 1 5 5
 5 5 3 3 777
 72 1 9 22 2 4 2 4 4 4 4 4 4 2 2 4 3 4 3 4 4 4 3 5 3 3 3 3 3 5 5
 5 4 3 3 900

APPENDIX D
SAS PROGRAMS

PHASE ONE

```
Goptions htitle=1.8 htext=1.8 ftitle=swiss ftext=swiss noprompt;
Title1 'data analysis for phase one';
data three;
set two;
p116=8-p16;
p111=8-p11;
p55=8-p5;
p115=8-p15;
p19=8-p9;
p110=8-p10;
intr=(p1+p7+p8+p115)/4;
Com=(p2+p12+p14+p116)/4;
Eff=(p3+p4+p6+p111)/4;
Ten=(p55+p19+p110+p13)/4;
mov=(intr+com+eff+ten)/4;
ety=(a1+a3+a4+a7+a10+a11)/6;
inc=(a2+a5+a6+a8+a9+a12)/6;
inc1=6-ety;
ability1=(inc+inc1)/2;
perf1=(t1+t2+t3)/3;
run;

proc sort data=three;
by ability1 mov;
run;
proc chart data=three;
hbar ability1;
run;

title2 'reliability analysis';
proc corr alpha data=three;
var p1 p7 p8 p115;
run;
proc corr alpha data=three;
var p2 p12 p14 p116;
run;
proc corr alpha data=three;
var p3 p4 p6 p111;
run;
proc corr alpha data=three;
var p55 p19 p110 p13;
run;
proc corr alpha data=three;
var a1 a3 a4 a7 a10 a11 a22 a55 a66 a88 a99 a112;
```

```

run;
proc corr alpha data=three;
var a1 a3 a4 a7 a10 a11;
run;
proc corr alpha data=three;
var a2 a5 a6 a8 a9 a12;
run;

title 'correlations between com,intr,eff,and ten';
proc corr data=three;
var com intr eff ten ability1 mov;
run;
title 'correlation between ety and inc';
proc corr data=three;
var ety inc;
run;
title 'plot ety and inc';
proc gplot data=three;
plot ety*inc;
run;

title 'regression analysis of intrinsic motivation on ability conceptions';
proc reg data=three;
model mov=ability1;
run;

proc means data=three;
var com eff ten ability1 mov age ety inc intr persis perf1;
run;
data one;
set three;
abil=ability1-3.7405498;
movv=mov-4.5418814;
abilmovv=abil*movv;
run;

proc corr data=one;
var abilmovv abil movv;
run;
title 'Persis regression analysis: persistence vs ability conception and intrinsic motivation ';
proc reg data=one all lineprinter;
model persis=abil movv abilmovv/all collin partial influence;
output out=next1 p=yhat r=e;
plot residual. *predicted. /Vref=0;
run;
proc plot data=next1;

```

```
plot e*Yhat/vref=0;
```

```
Title 'full model: residual analysis';  
proc univariate data=next1 normal plot;  
var e;  
run;
```

```
proc reg data=one all lineprinter;  
model perf1=abil movv abilmovv/all collin partial influence;  
output out=next3 p=yhat r=e;  
plot residual. *predicted. /Vref=0;  
run;  
proc plot data=next3;  
plot e*Yhat/vref=0;
```

```
Title 'full model: residual analysis';  
proc univariate data=next3 normal plot;  
var e;  
run;
```

```
ods output modobstats=resid;  
proc reliability data=one;  
distribution normal;  
model perf1=abil movv abilmovv/covb obstats;  
run;  
goptions reset=symbol;  
proc reliability data=resid;  
distribution normal;  
probplot resid/noconf nofit noinset nogrid;  
symbol C=black v=dot L=1 W=3 H=1;  
run;
```

```
ods output modobstats=resid2;  
proc reliability data=one;  
distribution normal;  
model engtime1=abil movv abilmovv/covb obstats;  
run;  
goptions reset=symbol;  
proc reliability data=resid2;  
distribution normal;  
probplot resid/noconf nofit noinset nogrid;  
symbol C=black v=dot L=1 W=3 H=1;  
run;
```

```
proc reg data=one;
model engtime1=abil movv abilmovv;
output out=next3 p=yhat r=e rstudent=s;
run;
```

```
goptions reset=symbol;
proc gplot data=next3;
plot e*Yhat/HAXIS=AXIS1 VAXIS=AXIS2;
AXIS1 LABEL=('Predicted Value') ORDER=10 TO 60 BY 15;
AXIS2 LABEL=(a=90 'Residual') ORDER=-30 TO 30 BY 15;
symbol C=black v=dot L=1 W=3 H=1;
run;
```

```
proc reg data=one;
model engtime1=abil movv abilmovv;
output out=next2 p=yhat r=e rstudent=sresid;
run;
goptions reset=symbol;
proc gplot data=next2;
plot e*Yhat/HAXIS=AXIS1 VAXIS=AXIS2;
AXIS1 LABEL=('Predicted Value');
AXIS2 LABEL=(a=90 'residual') ORDER=-0.25 TO 0.05 BY 0.05;
symbol C=black v=dot L=1 W=3 H=1;
run;
```

```
proc univariate data=one;
histogram movv/cfill=ltgray;
run;
```

```
proc robustreg data=one fwls method=lts;
model perf1=abil movv abilmovv/diagnostics leverage;
output out=roboutl r=resid sr=stdres p=predl;
run;
```

```
proc robustreg data=one fwls method=lts;
model engtime1=abil movv abilmovv/diagnostics leverage;
output out=roboutl r=resid sr=stdres p=predl;
run;
```

PHASE TWO

```
title 'data analysis for phase two';
data four;
set two;
p1216=8-p216;
p1211=8-p211;
p1215=8-p215;
p125=8-p25;
p129=8-p29;
p1210=8-p210;
intr2=(p21+p27+p28+p1215)/4;
com2=(p22+p212+p214+p1216)/4;
Eff2=(p23+p24+p26+p1211)/4;
Ten2=(p125+p129+p1210+p213)/4;
mov2=(intr2+com2+eff2+ten2)/4;
condinc=6-cond2;
condety=(cond1+condinc)/2;
ety=(a1+a3+a4+a7+a10+a11)/6;
inc=(a2+a5+a6+a8+a9+a12)/6;
inc1=6-ety;
ability2=(inc+inc1)/2;
run;

proc sort data=four;
by ability2 mov2;
run;
proc chart data=four;
hbar ability2;
run;

proc means data=four;
var age ability2 mov2 perf engtime2 eff2 intr2 ten2 condety ety inc;
run;
proc sort data=four;
by trt;
run;
proc means data=four;
var ability2 mov2 perf engtime2 eff2 intr2 ten2 condety ety inc;
by trt;
run;
title 'new data set';
data five;
set four;
abil2=ability2-3.7210648;
movv2=mov2-4.6970486;
```

```

abilmovv2=abil2*movv2;
abiltrt=abil2*trt;
abiltrtmovv2=abil2*trt*movv2;
trtmovv2=trt*movv2;
run;
title 'regressing persistence on treatment coded as dummy variables, ability, and intrinsic
motivation';
proc reg data=five all;
model mov2=abil2 trt abiltrt/ all collin partial influence;
output out=next4 p=yhat r=e;
plot residual. *predicted. /Vref=0;
run;
proc plot data=next4;
plot e*Yhat/vref=0;

```

```

Title 'full model: residual analysis';
proc univariate data=next4 normal plot;
var e;
run;

```

```

title 'regressing persistence on treatment coded as dummy variables, ability, and intrinsic
motivation';
proc reg data=five all;
model persis=abil2 movv2 trt abilmovv2 abiltrt abiltrtmovv2 trtmovv2 / all collin partial
influence;
output out=next8 p=yhat r=e;
plot residual. *predicted. /Vref=0;
run;
proc plot data=next8;
plot e*Yhat/vref=0;

```

```

Title 'full model: residual analysis';
proc univariate data=next8 normal plot;
var e;
run;

```

```

title 'regressing performance on treatment coded as dummy variables, ability, and intrinsic
motivation';

```

```

proc reg data=five all;
model perf=abil2 movv2 trt abilmovv2 abiltrt abiltrtmovv2 trtmovv2 /all collin partial influence;
output out=next6 p=yhat r=e;
plot residual. *predicted. /Vref=0;
run;
proc plot data=next6;
plot e*Yhat/vref=0;

```

```
Title 'full model: residual analysis';
proc univariate data=next6 normal plot;
var e;
run;
```

```
title 'treatment manipulation check';
proc glm data=four;
class trt;
model condety=trt;
run;
```

```
ods output modobstats=resid1;
proc reliability data=five;
distribution normal;
model mov2=abil2 trt abiltrt/covb obstats;
run;
goptions reset=symbol;
proc reliability data=resid1;
distribution normal;
probplot resid/nonconf nofit noinset nogrid;
symbol C=black v=dot L=1 W=3 H=1;
run;
```

```
ods output modobstats=resid2;
proc reliability data=five;
distribution normal;
model perf=abil2 movv2 trt abilmovv2 abiltrt abiltrtmovv2 trtmovv2/covb obstats;
run;
goptions reset=symbol;
proc reliability data=resid2;
distribution normal;
probplot resid/nonconf nofit noinset nogrid;
symbol C=black v=dot L=1 W=3 H=1;
run;
```

```
ods output modobstats=resid3;
proc reliability data=five;
distribution normal;
model engtime2=abil2 movv2 trt abilmovv2 abiltrt abiltrtmovv2 trtmovv2/covb obstats;
run;
goptions reset=symbol;
proc reliability data=resid3;
distribution normal;
probplot resid/nonconf nofit noinset nogrid;
symbol C=black v=dot L=1 W=3 H=1;
```

```

run;

proc reg data=five;
model mov2=abil2 trt abiltrt;
output out=next3 p=yhat r=e rstudent=s;
run;
goptions reset=symbol;
proc gplot data=next3;
plot e*Yhat/HAXIS=AXIS1 VAXIS=AXIS2;
AXIS1 LABEL=('Predicted Value') order=(4.1 to 5.4 by 0.1);
AXIS2 LABEL=(a=90 'Residual');
symbol C=black v=dot L=1 W=3 H=1;
run;

proc reg data=five;
model perf=abil2 movv2 trt abilmovv2 abiltrt abiltrtmovv2 trtmovv2;
output out=next8 p=yhat r=e rstudent=sr;
run;
goptions reset=symbol;
proc gplot data=next8;
plot e*Yhat/HAXIS=AXIS1 VAXIS=AXIS2;
AXIS1 LABEL=('Predicted Value');
AXIS2 LABEL=(a=90 'Residual') ;
symbol C=black v=dot L=1 W=3 H=1;
run;

proc reg data=five;
model engtime2=abil2 movv2 trt abilmovv2 abiltrt abiltrtmovv2 trtmovv2;
output out=next7 p=yhat r=e rstudent=sr;
run;
goptions reset=symbol;
proc gplot data=next7;
plot e*Yhat/HAXIS=AXIS1 VAXIS=AXIS2;
AXIS1 LABEL=('Predicted Value');
AXIS2 LABEL=(a=90 'Residual') ;
symbol C=black v=dot L=1 W=3 H=1;
run;

data six;
set five;
if trt=0 then treatment='Incremental';
if trt=1 then treatment='entity';
run;
goptions reset=symbol;
PROC Gplot DATA=six;
PLOT engtime2*movv2=treatment / HAXIS=AXIS1 VAXIS=AXIS2;

```

```

AXIS1 LABEL=('Intrinsic Motivation') ORDER=-1.7 TO 2.7 BY 1;
AXIS2 LABEL=(a=90 'Persistence') ORDER=0.6 TO 1 BY 0.2;
SYMBOL1 C=black v=square I=r L=1 W=2 H=1;
SYMBOL2 C=black v=dot I=r L=3 W=2 H=1;
RUN;
goptions reset=symbol;

proc gplot data=six;
plot mov2*abil2/HAXIS=AXIS1 VAXIS=AXIS2;
AXIS1 LABEL=('Intrinsic Motivation');
AXIS2 LABEL=(a=90 'Incremental Conceptions') ;
SYMBOL2 C=black v=dot I=r L=1 W=2 H=1;
RUN;

proc robustreg data=five fwls method=lhs;
class trt;
model engtime2=abil2 movv2 abilmovv2 abiltrt abiltrtmovv2 trtmovv2/diagnostics leverage;
output out=roboutl r=resid sr=stdres p=predl;
run;

```

APPENDIX E
INSTRUMENTATIONS

Conceptions of Ability in Object Manipulation Questionnaire

Name _____ Age _____

Please carefully read each statement below, and indicate which of the responses best represent your belief about object manipulation skills and activities. There are no right or wrong answers.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

1. You are born with a certain level of ability in object manipulation and you can not really do much to change that.
2. If you practice regularly, you can learn techniques and skills you need to be successful in activities that involve object manipulation.
3. No matter how hard you try, the level of success you can reach in activities that involve object manipulation will change very little.
4. You need to have a certain amount of natural talent to be good at activities that involve object manipulation.
5. If you work hard, you can learn to be good at activities that involve object manipulation.
6. In activities that require object manipulation, if you work hard at it, you will always get better.
7. To be good at activities that involve object manipulation, you need to be born with basic qualities that will enable you to be successful.
8. To reach a high level of performance in activities that involve object manipulation, you must go through periods of learning and practice.
9. How good you are in activities that involve object manipulation will always improve if you work at it.
10. Even if you work hard, making a big change (improvement) in how good you are at activities that involve object manipulation is very difficult.
11. To be good at activities that involve object manipulation you need to be naturally talented.
12. If you put enough effort into it, you will always get better in activities that involve object manipulation.

Intrinsic Motivation Index

Please carefully read each statement below, and indicate which of the responses best represent your belief. There are no right or wrong answers.

Very Strongly Disagree 1	Strongly Disagree 2	Disagree 3	Neutral 4	Agree 5	Strongly Agree 6	Very Strongly Agree 7
--------------------------------	---------------------------	---------------	--------------	------------	------------------------	-----------------------------

1. I enjoyed the activity very much.
2. I think I am pretty good at the activity.
3. I put a lot of effort into the practice session.
4. It was important for me to do well at this task.
5. I felt tense while practicing.
6. I tried very hard while practicing.
7. This activity was fun.
8. I would describe this activity as very interesting.
9. I felt pressured while practicing the task.
10. I was anxious while practicing the task.
11. I didn't try very hard to learn the spin skill.
12. After practicing for a while, I felt pretty competent.
13. I was very relaxed while practicing.
14. I am pretty skilled at the spin skill.
15. This activity did not hold my attention.
16. I could not do the spin skill very well.

Items for Assessing the Difficulty Level of Skills

Phase One

Please indicate the difficulty level of this Lunastix skill by circling the number from 1 to 7 that corresponds to your perceptions.

1	2	3	4	5	6	7
Very Easy		Easy	Moderate	Difficult		Very Difficult

Phase Two

Please rate the difficulty of the spin skill as compared to the original lunastix skill. As compared to the lunastix skill you practiced last week, how does this spin skill compare:

- A. Spin skill is easier than the lunastix skill
- B. Spin and lunastix skills are of equal difficulty
- C. Spin skill is a little more difficult than lunastix
- D. Spin skill is a lot more difficult than lunastix

Manipulation Check Questionnaire

Please answer each question below carefully. There is no right or wrong answer. Please check one for each question that best represents your belief.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

1. Individual differences in performance on this spin skill are due to the level of natural object manipulation ability they were born with.
2. Individual differences in performance on this spin skill are dependent on how hard they work.

APPENDIX F
TREATMENT COMMENTS SCRIPT

Effort Condition

1. Remember “practice makes perfect.” Just keep trying.
2. Effort/practice has a lot to do with this skill. With more effort/practice you will get better.
3. Effort/practice is the key to perform well on this skill.
4. Your performance on this skill is dependent on how much effort you put into it.

Ability Condition

1. This skill takes a lot of object manipulation ability. If you get it, you get it. If you don't, you don't.
2. The level of object manipulation ability you were born with determines how well you will do on this skill.
3. You have to be naturally coordinated to perform well on this skill.
4. Your performance on this skill is due to the level of object manipulation ability you were born with.

APPENDIX G
PILOT STUDY

The purpose of this study was to explore how individuals' intrinsic motivation, initial perceived competence, and performance differ with regard to their dispositional ability conceptions. Based the existing literature, it was hypothesized that individuals with incremental conceptions of ability would be more intrinsically motivated, show higher levels of competence, interest, and effort, experience lower levels of tense, and perform better than those with entity conceptions of ability.

METHOD

Participants

The participants in this study were 68 female college students (5 African Americans and 63 European Americans) in the southeastern United States enrolled in four Kinesiology classes. The students' ages ranged from 18 to 36 years ($M = 21.68$, $SD = 3.39$). Informed consent was obtained from all participants.

Research Personnel

Seven people (3 graduate students and 4 faculty members) were recruited and trained to administer the final skill test.

Experimental Task

Lunastix, which is a measure of individuals' object manipulation ability, was used in this experiment because it was a novel task for all participants in this study. Lunastix required participants to lift a baton off the ground, catching and releasing between the control handles in a back and forth manner. In the ready phase, participants rested one end of the baton on the ground, locked their wrist, kept their elbows flexible, and pulled upward releasing the baton from one handle and catching it with the other in a back and forth manner. When getting comfortable

with the rhythm and the feel of Zen Lunastix, participants lifted the baton off the ground, catching and releasing between control handles.

Instrumentation

Self-report data were collected at different times throughout the study. The Conceptions of Natural Ability Questionnaire and Experience and Ability Rating form for object manipulation items were distributed after introducing the concepts of fundamental motor skills including object manipulation skill, locomotor skills, and nonlocomotor skills. After the independent practice session, the Intrinsic Motivation Index questionnaire was given to all participants.

The Conceptions of Natural Athletic Ability Questionnaire (CNAAQ-2; Wang & Biddle, 2001) was used to assess students' conceptions of ability in object manipulation. This questionnaire is composed of two subscales: incremental conception of ability (6 items) and entity conception of ability (6 items). The item "you need to have a certain "gift" to be good at object manipulation" represents an entity conception of ability, whereas the item "in object manipulation, if you work hard at it, you will always get better" reflects an incremental conception of ability. The response scales range from "strongly disagree" to "strongly agree."

The Intrinsic Motivation Inventory (McAuley, Duncan, & Tammen, 1989), which consists of 16 7-point Likert-type items, was used to assess students' intrinsic motivation with regard to the Lunastix activity. The response scales range from "very strongly agree" to "very strongly disagree." The 16-item measure includes four subscales: interest-enjoyment (4 items), perceived competence (4 items), effort-importance (4 items), and tension-pressure (4 items). For example, the item "I enjoyed playing the activity very much" represents the interest-enjoyment dimension; the item "I think that I am pretty good at the activity" reflects a perceived competence dimension; the item "I tried very hard while practicing" assesses the dimension of

effort-importance; and the item “I was very relaxed while practicing” measures the subscale of tension-pressure.

One 10-point item was developed to assess participants’ experience in object manipulation. The statement read “Please indicate the level of your experience in object manipulation by circling the one number that corresponds to your level of experience.” The response scale ranged from “No experience” to “A lot of experience.”

One 10-point item was designed to assess participants’ ability level in object manipulation. The statement said “How do you rate your object manipulation ability?” The response scale ranged from “very poor” to “excellent.”

A final skill test was administered to all participants, allowing each student three trials to perform the task. The total number of successful counts from each trial was recorded by the research personnel on a score sheet. If participants kept catching and releasing the baton between the two handle sticks 50 times, then they would be asked to stop to begin the next trial. Each trial, therefore, could yield zero to 50 points. If participants dropped the baton or held the baton and two handle sticks together, then they would be stopped to start the next trial. An average score from the three trials was calculated to assess participants’ skill performance.

Procedure

Upon arrival, the primary researcher introduced the basic concepts of three categories of fundamental motor skill: object manipulation skills, locomotor skills, and nonlocomotor skills. Object manipulation skills were described as a category of physical activity that includes throwing, catching, kicking, and striking and these are used in many team and individual sport activities. Object manipulation or hand-eye coordination is also important for success in many activities such as frisbee, baton twirling, and juggling. Locomotor skills were defined as running,

jumping, skipping, and hopping. These are necessary ingredients for success in many team sport activities and individual sports such as tennis and track and field. Nonlocomotor and rhythmic skills were explained as body movements needing balance, body control, creativity, and expressive responses needed for activities such as gymnastics and dance. Following the introduction, the Conceptions of Athletic Ability in Object Manipulation Questionnaire was distributed. The researcher told the participants that all of us vary in our experiences with these different types of fundamental skill activities, and asked participants to indicate their levels of experience in each of the 3 types of fundamental skills and rate their level of object manipulation ability.

The researcher told participants that they were going to learn an object manipulation skill called Lunastix that would be validated as a measure of object manipulation ability. The video-taped instructions and demonstration of Lunastix were shown to all participants. After watching the video, participants were given a 20-minute independent practice time to practice the task. They were allowed to practice as much or as little as they desired during the practice session. It was also emphasized that no feedback would be provided by teachers or researchers. However, some general useful cues were provided to all the participants to help improve their skill.

After the 20-minute independent practice time, the Intrinsic Motivation Index questionnaire was administered to participants. Finally, the skill test was given to all participants. A video camera was situated to record participants' actions during the independent practice session.

Data Analysis

Simple correlations were used to assess the relationships between experience rating and ability ratings before the practice session. Since these two variables [$r(68)=0.71, p<0.0001$] were

highly correlated to each other, they were recoded and averaged to form a single measure of initial perceived competence.

Internal consistency reliability for all subscales from both conceptions of ability and intrinsic motivation index questionnaires was assessed using Cronbach's (Cronbach, 1951) coefficient alpha. All subscales from the Intrinsic Motivation Index questionnaire demonstrated above average acceptable levels of internal consistency ranging from 0.83-0.88. However, the internal consistency reliability coefficients for the two subscales from the Conceptions of Ability in Object Manipulation questionnaire were minimally acceptable (0.64 for both subscales). After dropping three items from each subscale, the coefficients improved to 0.68 for the entity conception of ability subscale and 0.88 for the incremental conception of ability. Therefore, points from the remained three items for each subscale were used to assess participants' conceptions of ability in object manipulations. The aggregate scores were calculated by summing all responses for each item and dividing by the relevant number of items per subscale.

Simple correlations were conducted to examine the relationships between entity ability conceptions, incremental ability conceptions, intrinsic motivation, tension/pressure, effort/importance, interest/enjoyment, perceived competence, initial perceived competency, and performance.

The generalized linear models using the Proc Genmod procedure with DIST=NEGBIN and LINK=LOG were used to assess if performance would be predicted by the variables of interest. The first model was composed of four independent variables: entity and incremental conceptions of ability, initial perceived competence, and intrinsic motivation. The second model consisted of seven predictors: entity and incremental conceptions of ability, initial perceived competence, interest/enjoyment, effort/importance, tension/pressure, and perceived competence.

RESULTS

Means and standard deviations for entity and incremental conceptions of ability, intrinsic motivation, interest/enjoyment, effort/importance, tension/pressure, perceived competence, initial perceived competence, and performance are presented in Table 1.

Table 1. Means and Standard Deviations for Entity and Incremental Conceptions of Ability, Initial Perceived Ability, Intrinsic Motivation, Perceived competence, Tension/Pressure, Effort/Importance, Interest/Enjoyment, and Performance

Variable	Mean	Standard Deviation
Entity Ability Conceptions	2.21	0.62
Incremental Ability Conceptions	3.44	0.86
Initial perceived competence	6.60	1.60
Intrinsic Motivation	4.62	0.61
Perceived competence	4.15	0.90
Interest/Enjoyment	4.98	1.10
Tension/Pressure	4.39	1.06
Effort/Importance	4.96	0.77
Performance	37.44	14.52

The correlations between entity ability conceptions (ENT), incremental ability conceptions (INC), initial perceived competence (IPC), intrinsic motivation (IM), perceived competence (PC), interest/enjoyment (IE), tension/pressure (TP), effort/importance (EI), and performance (PER) are reported in Table 2.

Correlational analyses indicated that there was no significant linear relationship between the entity and incremental conceptions of ability [$r(68) = -0.05, p > 0.71$] as measured on the

CNAAQ-2, which is inconsistent with the theoretical prediction, and also at odds with the classroom literature.

Table 2. Correlation Matrix Between Variables for All Participants

Variable	1	2	3	4	5	6	7	8	9
Participants (N=68)									
1.ENT	--	-.05	-.32*	-.36*	-.36*	-.27*	-.24*	-.06	-.08
2.INC		--	.02	.16	.15	.12	.14	-.01	.22
3. IPC			--	.21	.32*	.13	.09	.02	.24*
4.IM				--	.83**	.81**	.56**	.45**	.47**
5.PC					--	.57**	.46**	.16	.47**
6.IE						--	.13	.53**	.22
7.TP							--	-.30*	.39*
8.EI								--	.13
9.PER									--

* $p < 0.05$; ** $p < 0.0001$

Theoretical predictions suggest that individuals oriented toward entity beliefs tend to display less adaptive motivational patterns as compared to those who are oriented toward incremental ability conceptions. The data in this study provided partial evidence supporting the theoretical predictions, indicating that participants who were more oriented toward entity beliefs were less intrinsically motivated, felt tenser and less competence, and showed less interest as compared to those who were less oriented toward entity beliefs. However, the data in this study did not produce any significant relationships between these variables and incremental ability conceptions.

Consistent with theoretical predictions, the data in this study indicated that participants who felt more competent experienced less tension/pressure and had more enjoyment during the learning session. Participants who felt relaxed were more interested in the task and less willing to exert effort during the learning session.

The literature has demonstrated that perceived competence and intrinsic motivation significantly predict performance. Regressing performance on entity and incremental ability conceptions, intrinsic motivation, and initial perceived competence indicated that participants' performance scores were significantly predicted by their levels of intrinsic motivation ($\chi^2(1, N=68)=14.62, p<0.0001$). Specifically, when participants were intrinsically motivated, they had better performance scores on the final skill test. However, entity and incremental conceptions of ability, and pre-perceived ability would not significantly predict performance. The regression of performance on entity and incremental ability beliefs, initial perceived competence, perceived competence, effort/importance, tension/pressure, and interest/enjoyment showed that perceived competence ($\chi^2(1, N=68)=4.17, p<0.05$) and tension/pressure ($\chi^2(1, N=68)=5.81, p<0.05$) significantly predicted performance. Participants who felt more competent and less tension/pressure had better performance scores.

DISCUSSION

An understanding of the relationships between dispositional ability conceptions, initial perceived competence, performance and intrinsic motivation is critical to being able to design optimal motivational climates for students. By integrating theoretical perspectives, the results of this study provide some insight into how these variables interact, but at the same time demonstrate the complex nature of investigating this process. The correlational analysis suggests that when individuals believe ability is a fixed construct, they are likely to have lower initial

perceived competence when presented with a novel learning task. They are also less likely to be intrinsically motivated and feel competent and relaxed during the practice when they believe their ability in an activity cannot be improved with practice. The regression analysis indicated that individuals who were more intrinsically motivated and felt more competent had better performance scores. The results suggest that perceived competence and intrinsic motivation are crucial for understanding individuals' achievement behaviors. Taken together, these findings have important implications for teaching practice. They provide evidence that beliefs about the nature of ability affect individuals' achievement strivings during a learning activity and suggest that it is important for researchers and physical educators to gain a clearer understanding of students' ability conceptions in order to structure an instructional environment that will foster active engagement. They also support the notion that, to foster intrinsic motivation, it is important to design activities that allow students to experience success and gain confidence.

SUGGESTED MODIFICATIONS

First, modifications on the Conceptions of Ability in Object Manipulation

Ability Questionnaire should be made to improve the reliability of both the incremental and entity scales. Second, the Lunastix was an easy task, and participants easily mastered the task after the 20-minute practice. It is suggested that the length of the practice session be reduced to obtain a broad range of performance scores. Finally, it was observed that some participants stayed off the task during the independent practice session. Persistence is an important motivational aspect; therefore, it is suggested that next study include this variable that will be assessed by the time students engaged in task.

VITA

Weidong Li received his bachelor of science degree from Nanjing Normal University at Nanjing in June of 1996, and his master of education degree in sports social science from Beijing University of Physical Education in June of 1999 in People's Republic of China.

In the Fall of 1999, Weidong began his doctoral program in sports pedagogy and master program in applied statistics at Louisiana State University. He received his master of science degree in applied statistics in August of 2003. Weidong expects to complete his doctoral degree in May 2004.

Weidong holds memberships in many professional organizations such as American Statistical Association (ASA), American Alliance of Health, Physical Education, Recreation and Dance (AAHPERD), American Education Research Association (AERA), and Louisiana Alliance of Health, Physical Education, Recreation and Dance (LAPHERD). He was the recipients of the Corbett Summer Research Scholarship, LSU Graduate School Scholars Assistantship Enhancement Awards, Graduate School Travel Awards, and AERA Graduate Student Awards.

Weidong's primary research focuses on motivation and achievement. He has devoted his career to understanding how individuals' self-theories of ability affect their motivational patterns and achievement from both dispositional and situational perspectives. His work has been disseminated through presentations at the American Educational Research Association and the American Alliance of Health, Physical Education, Recreation, and Dance Annual conferences.