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# The Relationship Between Health-Related Fitness Knowledge, Perceived Competence, Self-Determination, and Physical Activity Behaviors of High School Students

Elizabeth Bailey Haslem  
Brigham Young University - Provo

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The Relationship Between Health-Related Fitness Knowledge, Perceived Competence, Self-Determination, and Physical Activity Behaviors of High School Students

Liz Haslem

A thesis submitted to the faculty of  
Brigham Young University  
in partial fulfillment of the requirements for the degree of  
Master of Arts

Carol Wilkinson, Chair  
Keven Prusak  
Todd Pennington

Department of Teacher Education

Brigham Young University

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## ABSTRACT

### The Relationship Between Health-Related Fitness Knowledge, Perceived Competence, Self-Determination, and Physical Activity Behaviors of High School Students

Liz Haslem

Department of Teacher Education, BYU

Master of Arts

The purpose of this study was (a) to test a hypothesized model of motivation grounded in the Self-Determination Theory within the context of conceptual physical education (CPE), and (b) to explore the strength and directionality of perceived competence for physical activity as a possible mediator for health-related fitness knowledge and actual physical activity behaviors. Participants were 280 high school students who were at the end of a CPE course. Participants completed the Behavioural Regulation in Exercise Questionnaire–2, the Godin Leisure–Time Exercise Questionnaire, the Perceived Competence Scale, and a Health-Related Fitness Knowledge Questionnaire. Structural equation modeling analysis was used to explore the relationships between the variables of health-related fitness knowledge, perceived competence, motivation, and physical activity. The analysis resulted in a modified model that showed a relationship between perceived competence and physical activity, mediated by introjected and identified regulation. Implications and recommendations for physical education professionals are made.

Keywords: Conceptual physical education, Self-Determination Theory, physical activity, structural equation modeling

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## DESCRIPTION OF STRUCTURE AND CONTENT

*The Relationship Between Health-Related Fitness Knowledge, Perceived Competence, Self-Determination, and Physical Activity Behaviors of High School Students*, is a masters thesis that has been prepared for submission to the *Journal of Teaching in Physical Education*. The *Journal of Teaching in Physical Education* features articles that discuss current topics of interest to physical educators as well as those that feature classroom studies and surveys.

The unique formatting of this thesis is attributed to its hybrid structure, which combines journal publication formatting with traditional thesis formatting in an effort to meet both the requirements for university submission as well as submission to educational journals. In addition, this document contains several appendices as well as two reference lists. An extended review of literature is included in Appendix A; Appendix B includes an expanded description of the methods section; Appendix C contains consent forms; Appendix D is the letter to principals; and Appendices E and F contain both questionnaires. Lastly, all references included in the journal-ready article are recorded in the first reference list. The second reference list contains all remaining citations mentioned in the Appendices.



## Introduction

Research in the last decade has established a link between sedentary lifestyles and obesity, which in turn have been linked to other chronic diseases including diabetes mellitus, hypertension, and coronary heart disease. As a result of this association between disease risk and sedentary lifestyles, the need for Americans to become physically active and achieve a healthy body weight is essential (Adams, Adams, & Graves, 2007).

The latest report from the Centers for Disease Control and Prevention states that approximately 17% (or 12.5 million) of children and adolescents aged 2-19 years are obese (Centers for Disease Control and Prevention, 2013). Experts in the health and fitness field believe participation in physical activity (PA) is crucial in preventing such conditions (Rogers, Morris, & Moore, 2008), and because nearly all American youth attend public schools, Sallis and McKenzie (1991) have suggested that school-based programs be the preferred method for promoting lifelong activity in the teen population. While physical education is the type of school-based program that should promote lifelong PA, traditional sports-based physical education has failed to achieve this goal (Dale & Corbin, 2000; Pangrazi, 2010).

To address this issue, many high school programs around the nation have replaced traditional sports-based physical education in some grades with other curricular models with a health promotion focus, one of which is conceptual physical education (CPE). Differing from traditional physical education, these CPE courses generally follow a curriculum that includes classroom lessons that teach important health and fitness concepts coupled with activity sessions that teach fitness programming, self-monitoring, and fitness assessments (Dale & Corbin, 2000). The premise of any conceptual approach to physical education lies in the notion that if students possess information about health-related fitness benefits, they will be more likely to make

informed decisions about exercise and fitness, develop more positive attitudes toward PA, and choose more active lifestyles than individuals not exposed to such information (Goldfine & Nahas, 1993). Ennis (2010) argues that teaching fitness knowledge in physical education is pivotal in promoting lifetime PA. CPE courses teach health-related fitness knowledge (HRFK) and exercise skills which are thought to help students understand and enjoy PA throughout their lifetime.

Fitness for Life (Corbin & Lindsey, 2005) is an example of one of many CPE courses that are being offered in high schools around the nation. The objective of the Fitness for Life course is to help students become informed consumers who can make effective decisions about fitness, health, and wellness (Corbin & Lindsey, 2005). The Fitness for Life textbook contains 18 chapters that cover the 5 components of fitness (muscular strength, muscular endurance, cardiovascular fitness, flexibility, and body composition), nutrition, self-management skills, goal setting, stress management skills, and personal program planning.

Researchers have examined the effectiveness of CPE courses by investigating how courses such as Fitness for Life relate to student PA behaviors, attitudes, and HRFK. Dale, Corbin, and Cuddihy (1998) compared CPE (all students took a CPE course in Grade 9) to traditional physical education and examined the effects on the PA behaviors of the same students in Grades 10-12. They found that boys in Grade 12 who had taken CPE in Grade 9 reported greater participation in moderate activity than boys in traditional physical education. Dale and Corbin (2000) performed a follow up study of the same group of students after they had completed their high school physical education program. It was found that men exposed to CPE programs reported more vigorous activity participation 12 months beyond graduation. Generally however, few significant findings were observed. Goldfine and Nahas (1993) studied CPE at the

high school level and found that CPE was related to more positive student attitudes towards PA and a better understanding of HRF concepts.

In the case of university CPE programs there seems to be significant relationships between students' attitudes towards exercise, PA patterns, knowledge of HRF concepts, and participation in the course. Researchers who studied university CPE programs found that alumni who had taken a CPE course not only had better attitudes towards exercise, but were significantly more physically active than alumni who had not taken CPE (see Adams & Brynteson, 1995; Brynteson & Adams, 1993; Slava, Laurie, & Corbin, 1984), and students who had enrolled in CPE had greater levels of HRFK (see Adams, Graves, & Adams, 2006; Downing, Masterson, & Hill, 2004; Nahas, 1992).

CPE courses at universities seem to encourage positive attitudes towards PA, increase student HRFK, and increase PA behaviors. On the other hand, research concerning high school CPE and its effectiveness in influencing students' PA behaviors is scarce and hasn't provided a conclusive link between HRFK and student PA behaviors for all high school CPE students.

Because no conclusive link has been found between knowledge and behavior change in CPE, the relationship between the two factors should be more deeply explored. Further research should focus on investigating factors that mediate, or play a role in, the relationship between HRFK and PA. It is possible that student perceived competence and motivation to engage in PA could be factors that are related to both HRFK and PA. Perceived competence and motivation towards PA can be addressed through the lens of the Self-Determination Theory (SDT).

Deci and Ryan's (1985) SDT has been used by researchers as a framework for studying and predicting student motivation in PA settings including physical education (e.g., Edmunds, Ntoumanis, & Duda, 2008; Standage, Duda, & Ntoumanis, 2003). SDT proposes that humans

are motivated either intrinsically (out of inherent interest or enjoyment), extrinsically (to achieve an outcome), or that they lack motivation (amotivation).

Ryan and Deci (2000) suggest that human motivation can be ordered on a continuum according to one's levels of intrinsic or extrinsic motivation. The self-determination continuum is arranged from left to right in terms of the degree to which one's motivations are self-determined. As individuals experience greater levels of internal regulation (or self-determined motivation), the theory suggests that they will likewise experience changes in behavior. Self-determination is the degree to which an individual believes they are in control of their behaviors and are capable of producing favorable outcomes. Individuals with low levels of self-determination generally exhibit low levels of motivation while individuals with high self-determination exhibit greater levels of motivation (Ryan & Deci, 2000).

Amotivation, at the far left of the continuum, "is the state of lacking the intention to act" (Ryan & Deci, 2000, p. 72). To the right of amotivation are four regulatory processes that vary in their type of extrinsic regulation. From left to right, they are external, introjected, identified, and integrated regulation. Externally regulated behaviors are those that are performed in order to satisfy an external demand or to obtain a reward (I do the activities in CPE but only for the grade). Introjected regulation involves behaving in a way that will avoid guilt or satisfy pride (I would feel guilty if I didn't participate in PA). Identified regulation is a more self-determined regulation and involves valuing a behavior as personally important (I participate because I value the health benefits). Integrated regulation is the most autonomous form of extrinsic motivation and occurs when individuals assimilate the behavior with their sense of self (I participate because PA is a part of who I am). The continuum of motivation ends with intrinsic motivation; motivation that stems from interest, enjoyment, or inherent satisfaction (Ryan & Deci, 2000).

According to SDT, an individual's level of self-determination depends on the satisfaction of three basic psychological needs. These are the needs for autonomy, competence, and relatedness. Ryan and Deci (2000) propose that these three needs are the basis for self-motivation and that they facilitate growth, integration, social development, and personal well-being. As these psychological needs are increasingly met, individuals are likely to experience higher levels of self-determination (Edmunds et al., 2008).

Perception of competence, or the feeling that one can achieve a desired outcome, is a critical need for students in every classroom. Research has suggested that as the psychological need to satisfy perceived competence is met, greater levels of intrinsic motivation and self-determination can be predicted (Ryan & Deci, 2000; Standage, Duda, & Ntoumanis, 2005). Further, Carroll and Loumidis (2001) found that greater levels of perceived competence are positively related with increases in PA behaviors.

According to the SDT, as one's self-determination profile changes, (or as individuals act on more self-determined motives), change in behavior is one expected outcome. While the goal of CPE programs is to elicit healthy student behaviors, it aims to do so primarily by increasing student HRFK. This increase in knowledge should lead to increases in perceived competence to engage in PA and more self-determined students who are physically active.

This study was designed to test the validity of hypothesized direct or indirect effects of HRFK on actual PA behaviors, but mediated by factors of the SDT of motivation using structural equation modeling (SEM). The hypothesized model (see Figure 1) posited that HRFK would have both direct and indirect effects (mediated by perceived competence and the self-determination profile; amotivation, external regulation, introjected regulation, identified regulation, and intrinsic motivation) on PA.

Therefore, the purposes of this study were (a) to test a hypothesized model of motivation grounded in SDT within the context of CPE, and (b) to explore the strength and directionality of perceived competence for PA as a possible mediator for HRFK and actual PA behaviors. A multi-step approach was used to test these relationships. First, the validity and reliability of the situational constructs of SDT (i.e., amotivation, external regulation, introjected regulation, identified regulation, and intrinsic motivation) were examined via confirmatory factor analysis (CFA). Second, to test a hypothesized model proposing the direct effects of HRFK on perceptions of competence, motivational indices, and PA patterns. Third, to explore alternative models for the purpose of identifying those for which the data displayed the best fit. It is hypothesized that there will be significant (a) direct effects of HRFK on PA and (b) indirect effects on PA mediated by perceived competence and motivational factors.

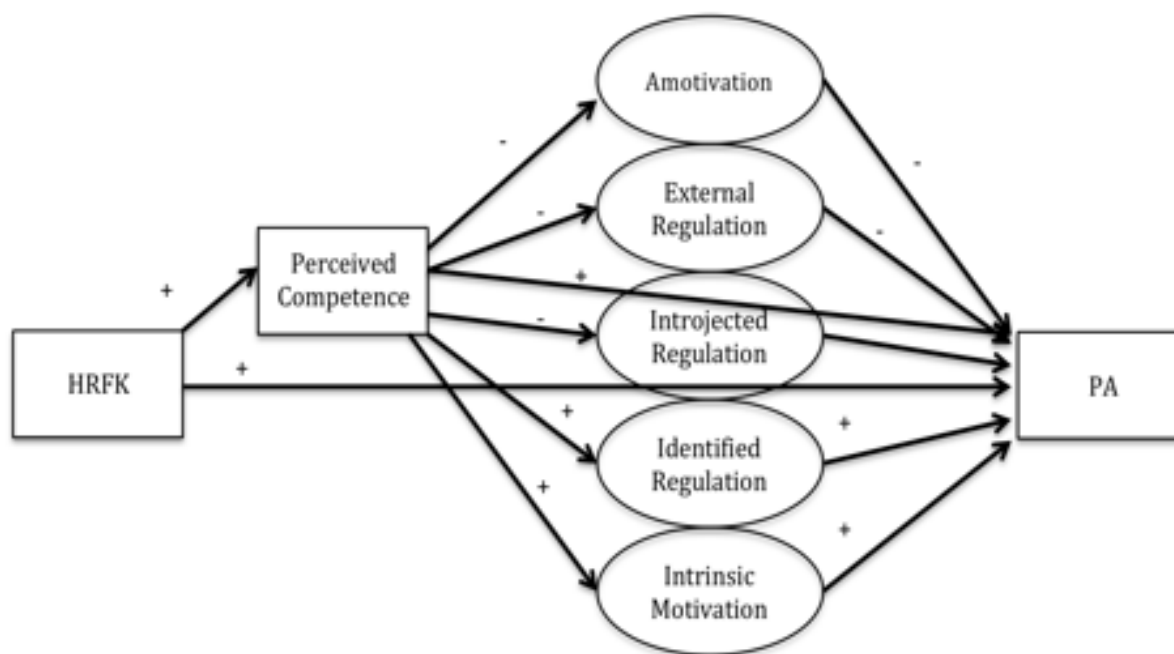


Figure 1. Hypothesized model of motivational processes in conceptual physical education.

## Method

### Participants

This study was conducted in a western state of the United States where high schools require all students to take Fitness for Life in grades 10-12. Students enrolled in Fitness for Life courses in five high schools in two school districts were asked to participate in this research study. The participants were 280 high school students (125 males and 155 females), who were nearing completion of a Fitness for Life course. The participants ranged in age from 14 to 18 years. As for race/ethnicity, participants were primarily Caucasian (n = 224), followed by Hispanic (n = 36), Asian (n = 8), Pacific Islander (n = 7), and African American (n = 5).

### Instruments

Four different instruments were used to assess student knowledge of health-related fitness, as well as student perceived competence, motivation, and physical activity behaviors.

**Health-Related Fitness Knowledge Questionnaire.** The Health-Related Fitness Knowledge Questionnaire (HRFKQ) included 22 multiple choice questions from the *Fitness for Life* test bank. School systems who use the *Fitness for Life* text have access to a test bank of questions pertaining to the five components of HRF: cardiovascular fitness, muscular endurance, muscular strength, flexibility, and body composition (Corbin & Lindsey, 2005). For example, “Which is a part of the principle of progression for flexibility?” and, “Which of the following is NOT a benefit of muscular endurance exercise?” Questions were selected by the principal researcher, were application based, and directly addressed the five components of HRF.

**Perceived Competence Scale.** The Perceived Competence Scale (PCS; Self-Determination Theory, n.d.) has been used to assess constructs within the SDT; namely competence. The PCS assesses the degree to which individuals feel competent about making

changes toward healthy behaviors (such as engaging in exercise). The questionnaire consists of four statements asking the students to indicate the level at which each statement was personally true on a Likert scale of 1 (not at all true) to 7 (very true). For example, “I feel confident in my ability to exercise regularly.” The four responses to the questionnaire were averaged to determine each individual’s level of perceived competence. The PCS was assessed using Cronbach’s  $\alpha$  where reliable scores are considered to be  $\geq .7$  (Cronbach, 1951). The PCS has been used reliably in previous studies, where it demonstrated an excellent internal consistency with a Cronbach alpha value between .80 and .87 (Williams & Deci, 1996; Williams, Wiener, Markakis, Reeve, & Deci, 1994).

**Behavioural Regulation in Exercise Questionnaire–2.** The Behavioural Regulation in Exercise Questionnaire–2 (BREQ–2; Markland & Tobin, 2004) is a 19 item 5 factor questionnaire that measures an individual’s level of self-determined motivation towards exercise. For example, “I don’t see why I should have to exercise.” Four of the items assess an individual’s amotivation, four assess external regulation, three assess introjected regulation, four assess identified regulation, and four assess intrinsic motivation. The BREQ – 2 uses a multidimensional scoring method (giving separate scores for each subscale), where mean scores for each set of items (i.e., amotivation, external regulation, introjected regulation, identified regulation, and intrinsic regulation) are calculated (Markland, 2007). The original BREQ (Mullan, Markland & Ingledew, 1997) assessed intrinsic motivation, extrinsic regulation, introjected regulation, and identified regulation. In 2004, Markland and Tobin created the BREQ–2, which has advantages over the original BREQ in that it includes measurements to assess amotivation. The BREQ–2 has factorial validity ( $\alpha > .76$ ; Markland & Tobin, 2004), and



previous research has also supported its reliability in distinguishing physically active groups from inactive groups (Landry & Solomon, 2004).

**Godin Leisure–Time Exercise Questionnaire.** The Godin Leisure–Time Exercise Questionnaire (GLTEQ), developed by Godin (1985), measures PA behavior by a 7–day recall self report. The questionnaire asks, “During a typical 7–day period (a week), how many times on the average do you do the following kinds of exercise for more than 15 minutes during your free time? The individual then records the number of times that they are mildly, moderately, and vigorously active during a typical week. Student responses were calculated to determine a weekly and total leisurely activity score. The three-item GLTEQ also has the advantage of brevity but has the disadvantage of any self-report questionnaire—individuals can misrepresent their actual PA behaviors. Several researchers have confirmed the validity of the GLTEQ and found reliability of  $\alpha > .74$  (e.g., Godin & Shephard, 1985; Sallis, Buono, Roby, Micale, & Nelson, 1993).

### **Procedures**

Before conducting this research study, permission was granted from the university’s Institutional Review Board, from both school districts, and from principals at the participating high schools. Before data were gathered, the Fitness for Life teachers involved in the study were asked to participate in a seminar where they were trained on their role in distributing consent/assent forms and in administering each of the questionnaires in their classrooms. Parental consent and child assent forms were obtained prior to the start of the study. Only students who volunteered for the research study completed the surveys.

Fitness for Life teachers administered the HRFKQ during the first week. The second questionnaire, which consisted of the PCS, BREQ–2, and GLTEQ, was administered one week

later. During the administration of the questionnaires, the principal investigator performed procedural checks by making random visits to the schools to make sure the questionnaires were being appropriately administered.

### **Data Analysis**

Data were screened for outliers, missing data, normality, and collinearity. Structural Equation Modeling (SEM) was used to test the hypothesized model using the analysis software Analysis of Moment Structures (AMOS), Version 21 (Arbuckle, 2006) combined with SPSS. In the first step of analysis, the latent factor structure of the BREQ-2 was examined via CFA. The next step focused on testing the relationships in the hypothesized model depicted in Figure 1. The maximum likelihood estimation was used to evaluate the fit of the structural model to the data. The model was assessed using path significance or standardized regression estimates. Alternate models were explored through an iterative process until the most robust fit indices were achieved. Overall model fit to the data was examined via the chi-square ( $\chi^2$ ), RMSEA, and CFI. A non-significant chi-square indicates that the model is an acceptable fit to the data. Root mean-square error of approximation (RMSEA), which represents a measure of absolute fit, was also used to examine closeness of fit. Values of approximately .08 reflect a close fit of the model (Schumacker & Lomax, 2010). The comparative fit index (CFI) was used to indicate the proportionate improvements in fit when comparing just-identified models to the hypothesized model. Schumacker and Lomax (2010) propose that CFI values of .95 or higher represent acceptable model fit.

The hypothesized model of motivation (see Figure 1) posited that perceived competence, as well as the SDT factors, would mediate the relationship between HRFK and PA. Because previous research supports a simplex pattern within the SDT (Markland & Tobin, 2004; Ryan &

Connell, 1989), and the ordering of SDT factors along a continuum, it was hypothesized that perceived competence would positively relate with intrinsic and identified motivation, and negatively relate with introjected regulation, external regulation, and amotivation. Based on previous research (Carroll & Loumidis, 2001) it was also hypothesized that greater levels of perceived competence would positively relate with increases in PA behaviors. Lastly, based on Standage et al. (2003), it was hypothesized that self-determined motivation could predict PA. More specifically, it was hypothesized that intrinsic motivation and identified regulation would positively relate to PA behaviors, that introjected regulation would not relate, and that external regulation and amotivation would negatively relate to PA behaviors.

In path analysis, dependent and independent variables are categorized as exogenous or endogenous or both since it is possible for a variable to exert both direct (exogenous) or mediating (endogenous) effects. Generally, however, scores on the HRFKQ were independent variables (exogenous), perceived competence scores via PCS (both), BREQ-2 (both), and PA scores via GLTEQ dependent only (exogenous). Additionally, observed and latent variables were measured as follows: PCS (4 items–one factor), BREQ-2 (19 items–four factors), and PA (4 items–1 factor). Factor scores were the simple average of their associated observed variable scores. For the purposes of this study, mean perceived competence and PA scores were considered only as observed exogenous variables.

## **Results**

The following section presents descriptive statistics, scale reliabilities, confirmatory factor analysis (CFA) of the BREQ-2, and SEM of the hypothesized model.

## Descriptive Statistics and Scale Reliabilities

Descriptive statistics (mean subscale scores) and alpha coefficients (Cronbach, 1951) for all measures are presented in Table 1 and from .77 to .94 were deemed acceptable based on  $\alpha = .70$  (Nunnally & Bernstein, 1994). It appears that students believe they are highly competent for PA ( $M = 6.18, SD = 33.17$ ) and that they are fairly active ( $M = 68.26, SD = 33.17$ ).

Additionally, bivariate correlations analyzed the relationships among the SDT factors suggesting a simplex pattern (Markland & Tobin, 2004; Ryan & Connell, 1989), which supports Deci and Ryan's (1985) SDT.

Table 1

### *Descriptive Statistics and Internal Consistency for Each Measure*

Variable	<i>M</i>	<i>SD</i>	Skewness	Kurtosis	$\alpha$
HRFK	13.49	3.83	-.515	.033	--
Perceived Competence	6.18	1.54	-.715	-.019	.94
PA	68.26	33.17	1.803	6.999	--
Amotivation	1.41	.63	1.671	2.820	.82
External Regulation	2.14	.85	.656	.036	.77
Introjected Regulation	2.81	1.09	.140	-.706	.82
Identified Regulation	3.95	.79	-.790	.528	.78
Intrinsic Motivation	3.94	.90	-.970	.764	.90

*Note:* HRFK points possible = 22. Perceived competence (via PCS) 1-7 scale, 1 (not at all true) to 7 (very true). PA (via GLTEQ) responses were calculated as a total leisurely activity score. Amotivation, external regulation, introjected regulation, identified regulation, and intrinsic motivation interpreted via BREQ-2 and scored on a 5-point scale ranging from 0 = "not true for me" to 4 = "very true for me." Mean subscale scores were reported.

The correlation matrix is presented in Table 2. Correlations indicated that HRFK and PA scores were negatively and weakly associated with amotivation. PA scores were positively and weakly associated with increasing levels of self-determination and perceived competence. Perceived competence was negatively and moderately associated with amotivation, and negatively and weakly associated with external regulation.

Additionally, perceived competence was positively and weakly associated with introjected regulation and positively and strongly associated with identified regulation and intrinsic motivation. Correlations between amotivation and all other SDT factors (see Table 2) indicate an increasingly inverse relationship, which not only supports the simplex pattern and the ordering of these constructs along the continuum (Ryan & Connell, 1989), but provides support for exploring the indirect relationship between perceived competence and the motivational factors of the SDT.

Table 2

*Bivariate Correlations Among Study Variables*

Variable	1	2	3	4	5	6	7	8
1. HRFK	—							
2. PA	-.03	—						
3. Amotivation	-.16**	-.13**	—					
4. External regulation	.08	-.02	.31**	—				
5. Introjected regulation	-.03	.04	-.25**	.16**	—			
6. Identified regulation	.11	.24**	-.50**	-.07	.48**	—		
7. Intrinsic Motivation	.11	.23**	-.50**	-.22**	.37**	.75**	—	
8. Perceived competence	.07	.32**	-.47**	-.18**	.25**	.67**	.66**	—

*Note.* Correlations among the motivational subscales suggest they generally conform to the simplex pattern (Ryan & Connell, 1989), where distal items are increasingly inversely related.

\*\* $p < .01$

## Confirmatory Factor Analysis

Prior to the analysis of the hypothesized relationship between the BREQ-2 motivational measure and the observed measures (HRFK and perceived competence), the latent factor structure of the BREQ-2 was examined via CFA. Based on the results from the CFA ( $\chi^2 = 322.8$ ,  $df = 142$  and  $p < .001$ ; CFI = .93; RMSEA = .07), the BREQ-2 appears to be suitable for use in this study (see Figure 2). The ratio of items to participants in the CFA was 15:1 which exceeded the recommendation of 10:1 (Nunnally, 1978). Although there was some limited evidence of skewness and kurtosis among the BREQ-2 items, the sample size for these ( $N = 280$ ) was sufficient to argue for the appropriateness of the goodness-of-fit measure and for the asymptotic normality of the factor loading and other coefficients (Amemiya & Anderson, 1990; Anderson & Amemiya, 1998).

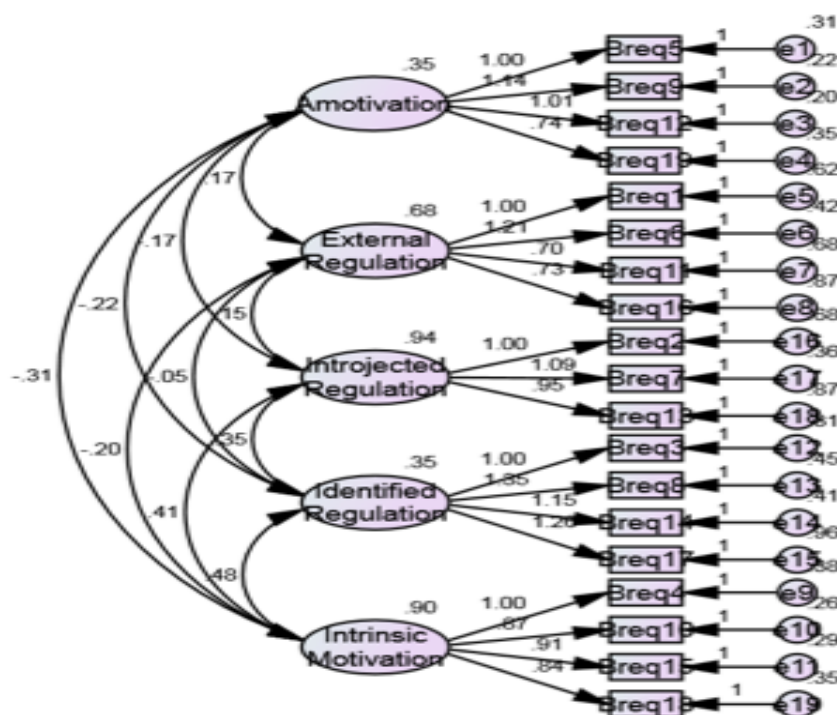
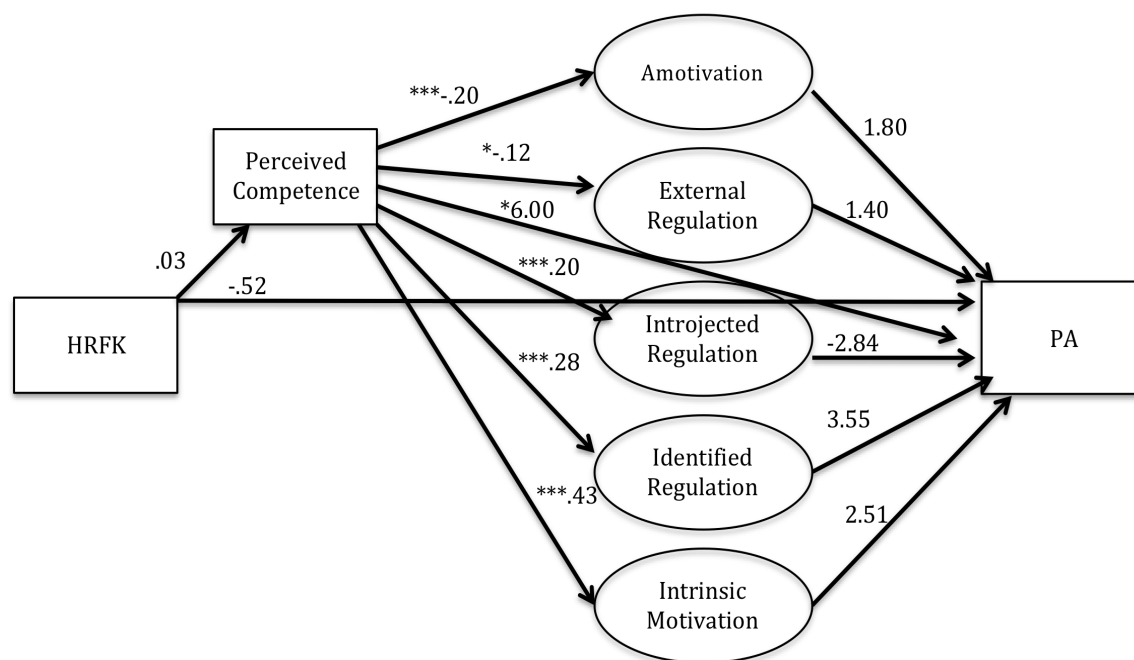


Figure 2. Confirmatory factor analysis results of the BREQ-2 motivational instrument. Fit indices suggest good fit of the proposed model:  $\chi^2 = 322.8$ ,  $df = 142$  and  $p < .001$ ; CFI = .93; RMSEA = .07.

## Structural Equation Modeling

The hypothesized model illustrated in Figure 1 was tested for goodness of fit using AMOS software within the SPSS statistical analysis software. Results showed that the hypothesized model displayed a *reasonable* fit but one that showed room for further refinement,  $\chi^2 = 644.3$ ,  $df = 199$  and  $p < .001$ ; CFI = .85; RMSEA = .09 (see Figure 3) As recommended by Kline (2011), alternative model fits were then considered by dropping non-significant paths one-by-one and resulting models were tested for goodness of fit. Non-significant paths were continually dropped as long as the fit indices improved or were not harmed.



*Figure 3.* Hypothesized model of motivational processes in CPE (with data). The figure does not illustrate the relationship between each latent construct and each item from the BREQ-2. This has been illustrated in Figure 2 and has been omitted for brevity. The coefficients on the straight lines between each variable are the standardized regression weights. Fit indices suggest good fit of the hypothesized model:  $\chi^2 = 644.3$ ,  $df = 199$  and  $p < .001$ ; CFI = .85; RMSEA = .09. \* $p < .05$  \*\*\* $p < .001$

The proposed simplified model (see Figure 4) is the result of removing non-significant paths and the fit indices suggested the revised model to adequately fit the data,  $\chi^2 = 424.88$ ,  $df = 193$  and  $p < .001$ ; CFI = .92; RMSEA = .07. The non-significant paths were removed from the model, included paths between external regulation and PA, intrinsic motivation and PA, and amotivation and PA. Further, HRFK was not shown to be mediated through perceived competence, nor was it significantly related to PA, but in the presence of perceived competence, HRFK remains significantly related to amotivation and external regulation.

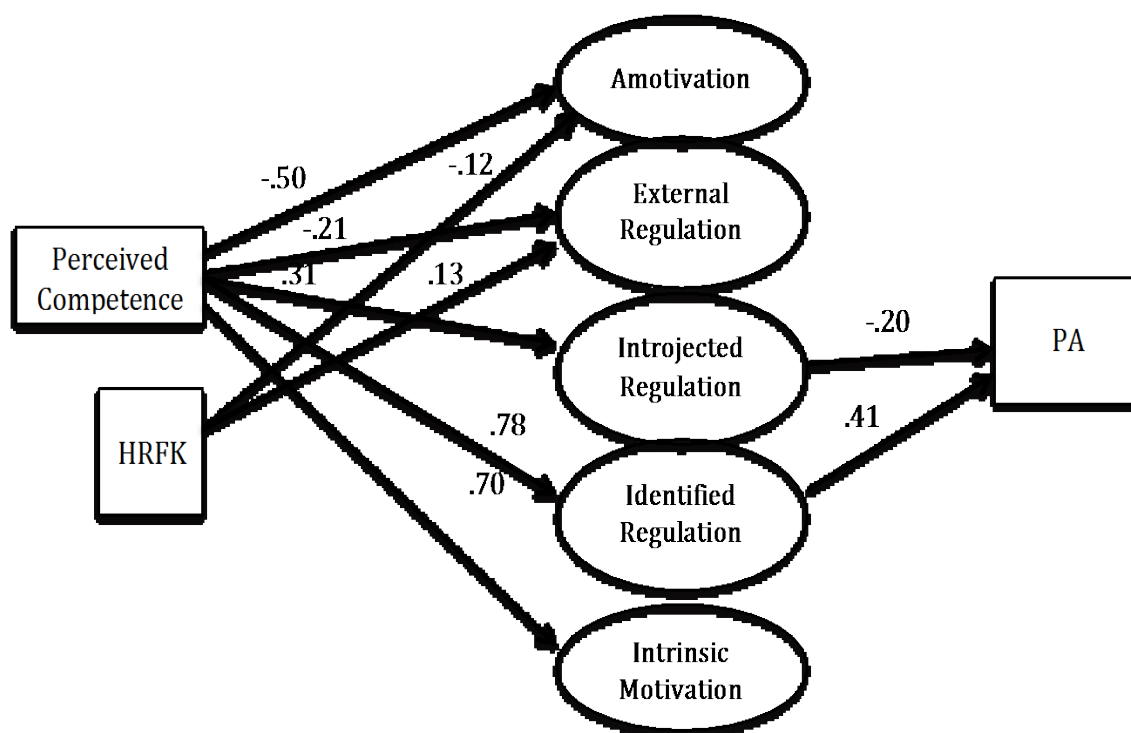


Figure 4. The proposed model of best-fit. Fit indices suggest good fit of the proposed model:  $\chi^2 = 424.88$ ,  $df = 193$  and  $p < .001$ ; CFI = .92; RMSEA = .07. All paths represented in the figure are significant (i.e.,  $p < .05$ ).

The model indicates that the effect of perceived competence on PA was statistically significant ( $p = .0155$ ). The relationship between perceived competence and PA was evaluated by allowing a comparison of the direct and indirect effects of perceived competence on PA.



In order to compare the direct effect of perceived competence with the combined indirect effects of perceived competence on PA, a bootstrap approach was used and 1,000 bootstrap replication samples were drawn with replacement from the data set. Results show that the majority of the total effects of perceived competence on PA can be explained by either the direct effect or the indirect effect of PC on PA through the motivational factors, but retaining both the direct and indirect paths is redundant. While the direct effect between perceived competence and PA is all that is needed to adequately explain PA, this direct correlation overlooks any theoretically relevant meaning that may have been extracted by observing the indirect effects, including the mediating effects of the SDT factors in predicting PA. Therefore, the direct effect was removed and the resulting model of best fit (see Figure 4) experienced no loss of goodness of fit. In the absence of the direct effect of perceived competence and PA, the model is theoretically rich. It includes the effects of the motivational factors (amotivation, external regulation, introjected regulation, identified regulation, and intrinsic motivation), which allows for interpretation of the relationship between perceived competence and PA within the context of the SDT. This interpretation is important in understanding *how* competence is related to changes in PA.

### **Discussion**

Despite the fact that CPE courses are being required in schools around the nation with the intention of measuring HRFK and promoting PA, there has been little published research as to the effectiveness of such courses in secondary level schools. The findings of this study offer practical insight into the role of motivation in the relationship between HRFK, perceived competence, and PA.

The aim of this study was to explore the relationships among high school students' knowledge of health and fitness concepts, perceptions of competence, motivation for PA, and actual reported PA behaviors. A hypothesized model, grounded in the SDT, was created to explore these relationships. The results of this study provide additional support for the tenets of SDT in CPE (Deci & Ryan, 1985; Ryan & Deci, 2000), and reveal a strong link between perceived competence for PA and motivation for PA. In addition, results from the CFA provide evidence of the reliability and suitability of the BREQ-2 for use in the high school CPE context.

This study addressed two main hypotheses. The first hypothesis was that HRFK would have a direct effect on PA behaviors. It seemed reasonable to believe that students' knowledge of health and fitness concepts would have an effect on their PA behaviors either directly, or indirectly (mediated by perceived competence and motivational factors). Surprisingly, this was not the case, as HRFK was directly related to neither PA, nor perceived competence. The lack of a significant effect suggests that knowledge does not increase competence nor does it motivate us to change our behaviors. However, in the presence of perceived competence in the model, HRFK did have a negative effect on amotivation, suggesting that students who have greater knowledge of health and fitness concepts are less likely to be amotivated whereas students with lower levels of HRFK are more likely to be amotivated. HRFK was also significantly and positively related to external regulation, suggesting that students likely participate in PA because they feel controlled to do so by the structures of the class.

It may be interesting to note that the more self-determined levels of motivation (introjected regulation, identified regulation, and intrinsic motivation) were not related to student HRFK. CPE instructors teach HRFK with the hope that students will experience greater levels of motivation towards activity, but the lack of a relationship between HRFK and PA poses the

question, “Is CPE being taught as the Fitness for Life authors intended?” Although all cooperating teachers in this study taught self-monitoring skills (e.g., PA logs and pedometers) to try to help the students apply the principles of HRFK outside of class, the knowledge itself is not helping students feel motivated, but rather they feel controlled. This suggests that having students keep PA logs or track their activity with pedometers is not having a positive effect on student attitudes towards PA. It seems that students are not internalizing the value of HRFK, and having HRFK is not helping them feel self-determined.

The second hypothesis was that perceived competence would be indirectly related to PA, mediated by the motivational factors of SDT. Supporting this hypothesis, the psychological need of perceived competence emerged as a strong predictor for increasing levels of self-determination. Consistent with previous research in physical education (Ferrer-Caja & Weiss, 2000; Goudas & Biddle, 1994; Ntoumanis, 2001; Standage et al., 2003), these findings suggest that perceived competence is crucial in predicting self-determined motivation. The negative relationship between competence and amotivation is also in-line with the findings of Ntoumanis (2001) and Standage et al. (2003), that is, students who feel competent to exercise are not amotivated.

While the above findings provide partial support for the original hypothesis that perceived competence would be mediated by factors of the SDT, only introjected regulation and identified regulation emerged as predictors of PA. Introjected regulation (I would feel guilty if I didn't participate in PA) was shown to negatively predict PA, whereas the more self-determined behavior, identified regulation (I participate in PA because I value the health benefits), was shown to positively predict PA. This latter result is supported by Wilson, Sabiston, Mack, and Blanchard (2012), who found identified regulation to be the strongest motivational predictor of

PA in adults. Other researchers also suggest a link between more self-determined forms of motivation and greater PA behaviors (e.g., Mullan & Markland, 1997; Silva et al., 2010). It seems that when students perceive they are competent to engage in PA, they are more likely to experience greater levels of self-determination (i.e., introjected, identified, or intrinsic).

The importance of the above finding should be emphasized. Students are more likely to be physically active if they feel competent but only if they value being active. Physical educators should create an environment that supports perceived competence, and in CPE courses they should teach in such a way as to make the material engaging to their students, with the hope of supporting a relationship between increased HRFK and increased levels of perceived competence, self-determined attitudes towards PA, and PA participation. To accomplish this, teachers may consider regularly assessing how students value HRFK and PA, and facilitating the value of this knowledge by allowing it to be applied to classroom and out of school activities. Teachers can help students develop a true commitment to, and value of, lifelong PA participation by helping students identify obstacles to exercise, instructing students on how to deal with these obstacles, helping students design a personalized exercise program, and by serving as role models for PA (Jewett, Bain, & Ennis, 1995). Self-monitoring is often done through PA logs and use of pedometers. However, because the findings of this study suggest that self-monitoring may be causing some students to feel controlled, teachers should carefully consider how to effectively implement such assignments.

Overall, the purpose of this study was to determine how HRFK, perceived competence, and PA were best related in a model of motivation grounded in the SDT. The findings in this study expand on existing knowledge concerning factors that influence PA in high school CPE students. The key finding in this study is that perceived competence is the greatest indicator of

PA and that introjected and identified regulation mediate the relationship. Findings suggest that as students feel greater competence towards exercise, they also experience higher levels of self-determination.

Additionally, the significant and positive relationship between HRFK and external regulation suggests that, despite being taught self-monitoring techniques, students feel controlled. It is recommended that physical educators find ways to help their students' value the concepts and skills that are being taught in CPE.

Future research should continue to investigate the effects of gaining HRFK in CPE courses, including the application of that knowledge in the use of self-monitoring techniques. In addition, future research ought to explore the various methods of CPE instruction to find out how CPE taught in the classroom, the gym, or a combination of both impacts HRFK, perceived competence, and the motivation factors of SDT.

One limitation for this study is that some of the questionnaires were in the form of self-report. For example, actual PA scores may be different from reported scores. A second limitation is that this study purposely did not address the quality of teacher instruction in *Fitness for Life* classes so that the naturally occurring environment could be measured without intervention. Further research is suggested to see if the implementation of specifically prescribed CPE affects the model.

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## APPENDIX A

### Review of Literature

Research in the last decade has established an undeniable link between sedentary lifestyles and obesity. Obesity has likewise been linked to many chronic diseases including diabetes mellitus, hypertension, and coronary heart disease. As a result of this association between disease risk and sedentary lifestyles, the need for Americans to become physically active and achieve a healthy body weight is essential (Adams, Adams, & Graves, 2007).

The latest report from the Centers for Disease Control and Prevention states that approximately 17% (or 12.5 million) of children and adolescents aged 2–19 years are obese (Centers for Disease Control and Prevention, 2012). In order to address the obesity problem, and because American youth must attend school, experts have suggested that school-based programs should be the preferred method for promoting lifelong activity in the teen population (Sallis & McKenzie, 1991). While physical education is the type of school-based program that should promote lifelong activity, traditional sports-based physical education has failed to achieve this goal (Dale & Corbin 2000; Pangrazi, 2010).

In an effort to reform traditional physical education, many high school programs around the nation are putting greater focus on teaching health-related fitness knowledge (HRFK; Dale, Corbin, & Cuddihy, 1998). While physical educators around the world agree that the purpose of physical education is to prepare students to be physically active for a lifetime, Ennis (2010) argues that fitness knowledge within physical education content is pivotal in promoting lifetime physical activity (PA). She proposes that physical education programs that focus on fitness knowledge are necessary in helping students understand, value, and enjoy PA throughout their lives.

Miller and Housner's (1998) study of in-service teachers supports Ennis's argument. They observed that in-service teachers had either forgotten or never acquired HRFK, and concluded that prospective teachers must understand fitness content because physical education courses must teach the principles of HRF that will allow students to develop healthy lifetime habits.

### **Conceptual Physical Education**

HRFK is being taught in conceptual physical education (CPE). The philosophy of CPE is that when students possess information about HRF benefits, they will be more likely to make intelligent decisions about exercise and fitness, develop more positive attitudes toward PA, and choose more active lifestyles than individuals not exposed to such information (Goldfine & Nahas, 1993). CPE is physical education that combines HRF lessons with activity sessions that teach self-monitoring, fitness programming, and fitness assessment (Dale & Corbin, 2000) with the aim of promoting lifelong PA.

Ayers (2004) used principles from Mohnsen's (1998) "Concepts of Physical Education: What every student needs to know" to create an assessment of CPE. Students were given a multiple choice test covering the areas of motor development, exercise physiology, social psychology, biomechanics, aesthetic experiences, motor learning, and historical perspectives. Test scores from over 3,000 students were summarized and findings suggest that, "those who possess more conceptual knowledge ... may be in a better position to act on the dimensions of being physically educated" (Ayers, 2004, p. 286). The "conceptual knowledge" that Ayers refers to is lacking in many traditional physical education programs.

CPE courses go beyond traditional physical education by teaching the principles of HRF and by providing meaningful activities and experiences that connect the lesson with a related

activity. According to Corbin and Laurie (1978), the philosophy of CPE courses is that students should be taught why they exercise, what their exercise needs are, and how they should exercise to meet those needs. Students who possess knowledge of HRF benefits are more likely to make intelligent decisions about exercise and fitness, develop positive attitudes towards PA, and choose more physically active lifestyles (Goldfine & Nahas, 1993).

**University CPE courses.** CPE courses were developed in the 1960's and gained wide acceptance among universities in the 1970's (Goldfine & Nahas, 1993). Since then, researchers have examined the relationship between CPE and student PA attitudes, behaviors, and HRFK.

Slava, Laurie, and Corbin (1984) compared alumni who had taken CPE to alumni who had taken activity-based physical education. They found that CPE alumni were significantly more active and had better attitudes towards PA than alumni from activity-based physical education.

Brynteson and Adams (1993) compared the attitudes and exercise habits of alumni from four different colleges. They concluded that alumni from colleges with required CPE programs exercised more frequently and placed more value on exercise. In a similar study, Adams and Brynteson (1995) found that alumni who had participated in CPE reported better attitudes towards fitness and significantly greater PA levels than alumni who had participated in activity-based physical education.

Each of the above listed studies support a relationship between CPE and PA attitudes and behaviors. However, these researchers did not exam the actual HRFK of students following the completion of a CPE course.

Nahas (1992) examined factors that would increase PA among low-fit college women. His findings suggest that college students who were educated and attended lectures concerning

HRF concepts retained the knowledge they learned and had better attitudes towards PA. He suggested that because knowledge and attitude are predisposing factors to behavior, physical education teachers should promote the understanding of HRF concepts. Adams et al. (2006) and Downing et al. (2004) found similar findings to Nahas (1992) and concluded that students in CPE courses develop greater HRFK. Adams et al. (2006), Downing et al. (2004), and Nahas (1992), and did not examine the relationship between actual HRFK and PA behaviors of students who had taken CPE.

University CPE research supports a relationship between CPE courses and the PA behaviors and attitudes of students, and CPE courses and student retention of HRFK. Research in this field has not yet linked CPE courses to both the HRFK and PA behaviors of students.

**High school CPE.** After their implementation in universities, CPE programs were also introduced in high schools. *Fitness for Life* (FFL) is a type of CPE course that is being taught in many high schools around the nation. The objective of the FFL course is to help students become informed consumers who can make effective decisions about fitness, health, and wellness (Corbin & Lindsey, 2005). The FFL textbook contains 18 chapters that cover the five components of fitness (muscular strength, muscular endurance, cardiovascular fitness, flexibility, and body composition), nutrition, self-management skills, goal setting, stress management skills, and personal program planning. Each chapter in the FFL text contains self-assessment exercises and activities, and schools that implement this program gain access to a host of materials including lesson plans, DVDs, CDs, an online study guide, and other supplemental resources for both students and educators (Corbin & Lindsey, 2013). Corbin and Lindsey (2005) created the FFL program and have made its successful implementation as easy as possible in the hopes that

the course will prepare and motivate students to be healthy and active for a lifetime (Corbin & Lindsey, 2013).

Goldfine and Nahas (1993) were among the first to study the effects of implementing CPE at the high school level. A pre and post-test to measure HRFK, PA attitudes, and PA behaviors were given to students before and after their participation in one of three 12-week physical education courses (two of which were CPE). In accordance with university research the results of their study found that students exposed to HRF concepts developed significantly more positive attitudes towards PA (Adams & Brynteson, 1995; Brynteson & Adams, 1993; Slava et al., 1984) and greater levels of HRFK (Adams et al., 2006; Downing et al., 2004; Nahas, 1992). However, students in CPE courses did not show higher PA levels than students in traditional physical education.

In what they entitled, "*Project Active Teens*," Dale et al., (1998) compared CPE to traditional physical education and examined the effects of each course on the PA behaviors of high school freshman. They concluded that CPE courses in a one-year high school physical education program can discourage sedentary lifestyles but that generally there is not a significant difference in the PA levels of students in CPE and traditional physical education. In a follow-up study, Dale and Corbin (2000) gave the same PA questionnaire to *Project Active Teens* graduates 1-3 years after their exposure to CPE or traditional physical education. The results showed no significant difference within either cohort group for PA participation.

CPE courses at universities seem to encourage positive attitudes towards PA, increase PA behaviors, and increase student HRFK. Nevertheless, high school CPE courses have not been shown to influence students PA behaviors, and research is scarce as to CPE's effectiveness in increasing student HRFK. Further research concerning CPE is needed to identify mediating



factors involved in the relationship between student HRFK and PA behaviors. It seems important to examine the relationship between HRFK, motivation towards PA, and PA behavior. Motivation towards PA can be addressed through the lens of the SDT.

### **Self-Determination Theory**

Deci and Ryan's (1985) Self-Determination Theory (SDT) has been used for the study of human motivation and personality and is often cited by educational researchers who seek to understand student motivation. According to SDT, behavior is motivated according to one's position along a graded continuum of regulation ranging from being more controlling in nature to being highly self-determined and therefore, autonomous (Ryan & Deci, 2000). Amotivation, at the far left of the continuum, is the "state of lacking the intention to act." To the right of amotivation are four regulatory processes of extrinsic motivation that vary in their relative autonomy (doing an activity to achieve a separate outcome). From left to right, they are external regulation, introjected regulation, identified regulation, and integrated regulation. Externally regulated behaviors are those that are performed in order to satisfy an external demand or to obtain a reward (I participate in PE because I have to). Introjected regulation involves behaving in a way that will avoid guilt or satisfy pride (I would feel guilty if I didn't participate in PA). Identified regulation is more self-determined and involves valuing a behavior as personally important (I participate because I value the health benefits). Integrated regulation is the most autonomous form of extrinsic motivation and it occurs when individuals assimilate the behavior with their sense of self (I participate because PA is a part of who I am) (Ryan & Deci, 2000). Intrinsic motivation lies on the far right of the continuum and can be defined as motivation that stems from interest, enjoyment, or inherent satisfaction. Individuals are more likely to adopt

behaviors for the long-term when those behaviors are intrinsically motivated (Deci & Ryan, 1985).

Low levels of self-determination correspond with low levels of motivation. With progression along the continuum, greater levels of self-determination are experienced and individuals are more likely to adopt new behaviors (Deci & Ryan, 1985).

Physical educators have used the SDT as a framework for studying student motivation toward PA. Specifically, how student motivation in physical education predicts PA intentions (Standage et al., 2003), and how physical education teaching styles influence behavioral responses to exercise (Edmunds et al., 2008).

**Psychological need satisfaction.** According to SDT, an individual's level of self-determination depends on the satisfaction of three basic psychological needs, which are the needs for autonomy, competence, and relatedness. Autonomy is the feeling of being in control of one's actions, competence is the belief that one can efficaciously interact with the environment, and relatedness is the development of secure and connected relationships with others in one's social context. These psychological needs are the basis for self-motivation and as they are met, individuals progress towards more autonomously motivated behaviors, and they are likely to experience higher levels of self-determination (Ryan & Deci, 2000).

Researchers have used the framework of SDT to study how psychological need satisfaction affects students' motivation to be physically active. Ntoumanis (2005) found that students who had high satisfaction of autonomy, competence, and relatedness in physical education were more likely to participate in optional physical education the next school year. His research highlights the relationship between need satisfaction and voluntary participation in physical education, which essentially, is voluntary participation in PA.

In a similar study of psychological need satisfaction in physical education, it was found that the perceived satisfaction of student needs facilitated self-determined motivation, which in turn, “strongly predicted intrinsic motivation towards PE” (Standage, et al., 2005, p. 425). The results of these studies suggest that as psychological needs are satisfied, individuals become more autonomously motivated and have stronger intentions to exercise during leisure time.

**Perceived competence.** Educators must find strategies to facilitate student needs for autonomy, competence, and relatedness. Perceived competence, or the feeling that one can achieve a desired outcome, is a critical need for students in every classroom. Niemiec and Ryan (2009) found that educators support student competence when they provide optimally challenging activities that allow students’ to expand their capabilities, and that students only engage and personally value activities that they can understand and master. Deci and Ryan (1985) further suggest that one’s motivation varies according to changes in perception of competence.

In the area of physical education, Standage et al. (2005) state that programs that support student competence are essential in promoting intrinsic motivation and positive engagement. They found that perceptions of competence were supported in classrooms that provided improvement indicators or self-reference standards in place of competitive evaluation outcomes. When students perceive themselves as being competent in physical education, they will participate in more PA with higher levels of intensity than those who perceive themselves to be less competent in physical education (Carroll & Loumidis, 2001). CPE programs aim to promote competence by providing personalized self-assessment tools and by providing a supportive environment that will foster positive attitude toward activity and exercise and encourage students to adopt a physically active way of life (Dale & Corbin, 2000).

## Summary

The array of literature in this review provides a comprehensive contextual background in the areas of CPE and SDT. Research in universities indicates a positive relationship between CPE, HRFK, and PA behavior, while high school CPE courses have not been shown to influence students' PA behaviors, and research is scarce as to CPE's effectiveness in increasing student HRFK. Further research concerning CPE is needed to identify other missing factors involved in the relationship between student HRFK and PA behaviors. Research grounded in SDT indicates a relationship between perceived competence and self-determination, and a relationship between perceived competence and student engagement in PA. So, perceived competence and self-determination could be factors that are related to both HRFK and PA. Hence, this study will more closely examine the connection between student HRFK and PA behaviors by observing students' levels of perceived competence and self-determination and how each relates to PA participation.

## APPENDIX B

### Methods

#### Context

Research for this study was conducted in a western state where high schools require students to take FFL. Students enrolled in FFL courses in five high schools in two school districts were asked to participate in this research study.

#### Participants

Approximately 610 students, male and female, ages 15–18, who were nearing completion of a FFL course, were asked to volunteer to participate in this study. This body of students represented different racial, ethnic, and socioeconomic backgrounds.

The principal investigator obtained approval to conduct the study from the university International Review Board, and from each principal and school district. Assent forms were signed by students who were willing to have their responses included in the study, and informed consent forms were signed by their parents. English and Spanish consent forms were provided.

#### Instruments

**Health-Related Fitness Knowledge Questionnaire (HRFKQ).** The HRFKQ included 22 multiple choice questions from the FFL test bank (see Appendix E). The questions pertained to the five components of HRF: cardiovascular fitness, muscular endurance, muscular strength, flexibility, and body composition (Corbin & Lindsey, 2005).

**Perceived Competence Scale (PCS).** The PCS assesses the degree to which individuals feel competent about making changes toward healthy behaviors (such as engaging in exercise). The questionnaire consisted of four statements, asking the students to indicate the level at which each statement was personally true on a Likert scale of 1 (not at all true) to 7 (very true) (see

Appendix F). The four responses to the questionnaire were averaged to determine each individual's level of perceived competence. The measure of internal consistency for the PCS had an alpha value of .80 and an alpha reliability of .90 (Williams & Deci, 1996; Williams, Freedman, & Deci, 1998). The PSC has often been used by researchers studying perceived competence and it has the advantages of brevity and adaptability (the scale can be adapted as needed for studying other behaviors).

**Behavioural Regulation in Exercise Questionnaire-2 (BREQ-2).** The BREQ-2 is a 19 item 5-factor questionnaire that predicts an individual's level of self-determined motivation for exercise (see Appendix F). Four of the items assess an individual's amotivation, four assess external regulation, three assess introjected regulation, four assess identified regulation, and four assess intrinsic motivation. The BREQ-2 uses a multidimensional scoring method where the mean scores for each set of items relating to each motivational variable is calculated (Markland, 2007). The original BREQ (Mullan, Markland & Ingledew, 1997) assessed intrinsic motivation, extrinsic regulation, introjected regulation, and identified regulation. In 2004, Markland and Tobin created the BREQ-2, which has advantages over the original BREQ in that it includes measurements to assess amotivation. The BREQ-2 has factorial validity ( $\alpha > .76$ ; Markland & Tobin, 2004), and previous research has also supported its reliability in distinguishing physically active groups from inactive groups (Landry & Solomon, 2004).

**Godin Leisure-Time Exercise Questionnaire (GLTEQ).** The GLTEQ measures PA behavior (see Appendix F). Student responses were calculated to determine a weekly and total leisurely activity score. The three-item GLTEQ also has the advantage of brevity but has the disadvantage of any self-report questionnaire—individuals can misrepresent their actual PA

behaviors. Several researchers have confirmed the validity of the GLTEQ (e.g., Godin & Shephard, 1985; Sallis, Buono, Roby, Micale, & Nelson, 1993) and found reliability of ( $\alpha > .74$ ).

### **Design**

This study was designed to test the validity of a hypothesized model of the direct or indirect effects of HRFK on actual PA behaviors within the SDT of motivation using structural equation modeling (SEM). Kline (2011) outlined recommended steps for conducting an SEM analysis including the a priori specification and identification of a hypothesized model, selection of measure, assessing goodness-of-fit of the data to the proposed model, interpretations of results, and alternative model exploration.

The hypothesized model (see figure Figure 1) posited that one's HRFK *could* have direct effects on one's PA but was more likely to be mediated through one's perceived competence and self-determination profile (amotivation, external regulation, introjected regulation, identified regulation, and intrinsic motivation). Further, SEM allows for the simultaneous testing of both the psychometric properties of the measures as well as the strength and directionality of the proposed relationships within the hypothesized model.

### **Procedures**

Following the approved proposal of the research study, the principal investigator obtained approval from Brigham Young University's International Review Board, from both school districts, and from principals at the selected high schools. The FFL teachers from each of these high schools was contacted by the principal investigator and asked for their support in allowing their students to be surveyed. Before data were gathered, the FFL teachers involved in the study were be asked to participate in a training seminar at Brigham Young University. The professional development part of the meeting was directed by the student teaching coordinator in

the PETE department. The principal investigator conducted the portion of the meeting where the teachers were trained on their role in distributing consent/assent forms and in administering each of the questionnaires in their classrooms.

Near the beginning of April, teachers distributed consent forms to each of the students in their FFL courses so that parental permission could be attained. Students that are willing to participate were asked to complete assent forms. Only students who volunteered for the research study were part of the study. During the week of April 8<sup>th</sup>, the teachers administered the HRFKQ. They read aloud to their students the scripted instructions given to them from the principal investigator. Students then had 10-15 minutes to complete the questionnaire. One week later, the teacher administered the second questionnaire. They read aloud the instructions for completing the questionnaire and read out loud the question and possible answer for each of the 26 items. Questionnaire #2 took approximately 10-15 minutes to complete. During the administration of the questionnaires, the principal investigator performed manipulation checks by making random visits to the schools to make sure the questionnaires were being appropriately administered. Questionnaires were gathered by the teachers and collected by the principal investigator.

### **Data Analysis**

Before SEM analysis began, data were screened for outliers, missing data, normality, and collinearity. The SEM analysis software AMOS combined with SPSS was used to test the goodness-of-fit of the data to the proposed model. Alternate models were explored through an iterative process until the most robust fit indices were discovered.

In path analysis, dependent and independent variables are categorized as exogenous or endogenous or both since it is possible for a variable to exert both direct or mediating effects.



Generally, however, scores on the HRFKQ were independent variables (exogenous), perceived competence scores via PCS (both), BREQ-2 (both), and PA scores via GLTEQ dependent only (endogenous). Additionally, observed and latent variables were measured as follows: PCS (4 items–one factor), BREQ-2 (19 items–4 factors), and PA (4 items–1 factor). Factor scores were the simple average of their associated observed variable scores. For the purposes of this study, mean perceived competence and PA scores were considered only as observed variables.

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## APPENDIX C

### Consent Forms

#### Parental Permission for a Minor to Participate in Research

##### **Introduction**

This research is being conducted by Liz Haslem, a graduate student at Brigham Young University, as well as professors Carol Wilkinson, Keven Prusak, and Todd Pennington. They are conducting a research study about the relationship between health-related fitness knowledge, perceived competence, motivation to exercise, and physical activity behaviors of students enrolled in a *Fitness for Life* course. The principal investigator, Liz Haslem, is inviting your child to take part in the research because (he/she) is currently enrolled in *Fitness for Life*. You are receiving this form because in order for your child to participate in this study, we are required to obtain parental permission.

##### **Procedures**

If you agree to let your child participate in this research study, the following will occur: On one day in April, your child will be given a questionnaire to test their health-related fitness knowledge. On a different day, they will be given a questionnaire to determine their perceived competence and motivation to exercise, and physical activity behaviors. Each questionnaire will take approximately 10-15 minutes to complete. Your child's responses to both questionnaires will be used for research purposes and will not be given to the teacher of your child's *Fitness for Life* class. Aside from completing the two questionnaires, no additional requirements will be asked of your child. If your child chooses not to participate in the research, they will continue to receive their regularly scheduled curriculum activities.

##### **Risks**

There are minimal risks in participating in this study. One potential discomfort of this study is that students will be asked to give personal information regarding their physical activity behaviors and motivation to be physically active. Your child can skip any questions that they do not want to answer.

##### **Confidentiality**

Confidentiality of participants will be achieved by keeping all data in a secure locked office. Once data is collected from the teachers, only the researchers involved in the study will have access to it and it will be kept on a password-protected computer during analysis. The data will be securely stored in a locked office until the results of the study are published. Data will then be destroyed.

##### **Benefits**

There are no direct benefits to your child for participating in this study. This study may benefit society by giving insight into factors that motivate individuals to be physically active.

##### **Compensation**

There will be no compensation for participation in this study.

##### **Participation**

Participation in this research study is voluntary. Your child can decide to participate in this study or not. Your child can participate in this study only if you provide permission for him/her to do so. Your child can also decide to stop participating anytime. You may withdraw your child from participation in this study at any time.

### **Questions about the Research**

You can contact Liz Haslem anytime by phone: (435) 901-0671 or email: [lizbailey22@byu.edu](mailto:lizbailey22@byu.edu) to inquire about any aspect of your child's participation in this study. You may also contact Carol Wilkinson by phone: (801) 422-8779 or email: [Carol\\_Wilkinson@byu.edu](mailto:Carol_Wilkinson@byu.edu).

You can also contact the IRB Administrator, Office of Research and Creative Activities (ORCA), A-285 ASB, Brigham Young University, Provo, UT 84602, Phone: (801) 422-1461, Fax: (801) 422-0620, Email: [irb@byu.edu](mailto:irb@byu.edu)

If you would like a copy of this parental permission form, please contact one of the researchers using the contact information provided above.

I give permission for my child to participate in this research project and for the researchers to use my child's responses to the questionnaires for research purposes.

Child's Name: \_\_\_\_\_

Parent Name: \_\_\_\_\_ Signature: \_\_\_\_\_ Date: \_\_\_\_\_

## Permiso de los Padres para un Menor de Edad a Participar en una Investigación

### **Introducción – Propósito del Estudio:**

Este investigación está siendo realizada por Liz Haslem, una estudiante graduada en la Universidad Brigham Young, juntos con los profesores Carol Wilkinson, Keven Prusak y Todd Pennington. Están llevando a cabo un estudio de investigación sobre la relación entre la salud de los conocimientos relacionados con la aptitud, competencia percibida, la motivación para hacer ejercicio, y la actividad física de los estudiantes inscritos en un curso *Fitness for Life*. El investigador principal, Liz Haslem, está invitando a su hijo/a a tomar parte en este investigación porque (él / ella) está inscrito actualmente en *Fitness for Life*. Usted está recibiendo esta forma porque para que su hijo/a participe en este estudio, tenemos la obligación de obtener el permiso de los padres.

### **Procedimientos:**

Si está de acuerdo que su hijo participe en este estudio de investigación, ocurrirá lo siguiente: En un día en abril, su hijo recibirá un cuestionario para probar su conocimiento relacionado con la salud física. En un día diferente, se les dio un cuestionario para determinar su percepción de competencia y la motivación para hacer ejercicio y la actividad física. Cada cuestionario le tomará aproximadamente 10-15 minutos. Las respuestas de su hijo/a a los dos cuestionarios serán utilizados para fines de investigación y no se le dará a la maestra de la aptitud de su hijo para *Fitness for Life*. Además de completar los dos cuestionarios, no requisitos adicionales se le pedirá a su hijo/a. Si su hijo/a decide no participar en la investigación, continuarán recibiendo sus actividades regulares del currículo.

### **Los riesgos:**

Hay riesgos mínimos para participar en este estudio. Una molestia potencial de este estudio es que los estudiantes se les pedirá que dan información personal sobre sus comportamientos de actividad física y la motivación para ser físicamente activo. Su hijo/a puede saltarse cualquier pregunta que no quiera contestar.

### **Confidentiality:**

La confidencialidad de los participantes se logra manteniendo todos los datos en una oficina segura. Una vez que los maestros coleccionan los datos, sólo los investigadores involucrados en el estudio tendrá acceso a ellos y se va a mantener en un equipo protegido por contraseña durante el análisis. Los datos se almacenan de forma segura en una oficina cerrada hasta que los resultados del estudio se han publicado. Los datos entonces se destruirán.

### **Beneficios:**

No hay beneficios directos a su hijo por participar en este estudio. Este estudio puede beneficiar a la sociedad, dando información sobre los factores que motivan a las personas a ser físicamente activos.

### **Compensación:**

Ni usted ni su hijo/a recibirán algún tipo de pago por su participación en este estudio.

**Participación:**

La participación en este estudio de investigación es voluntaria. Su hijo/a puede decidir participar en este estudio o no. Su hijo/a puede participar en este estudio sólo si usted da permiso para que él / ella puede hacerlo. Su hijo también puede decidir dejar de participar en cualquier momento. Usted puede retirar su hijo/a de participar en este estudio en cualquier momento.

**Preguntas acerca del estudio:**

Puede ponerse en contacto con Liz Haslem en cualquier momento en su teléfono: (435) 901-0671 o correo electrónico: lizbailey22@byu.edu para solicitar información sobre cualquier aspecto de la participación de su hijo en este estudio. También puede comunicarse con Carol Wilkinson al teléfono: (801) 422-8779 o correo electrónico: Carol\_Wilkinson@byu.edu. También puede comunicarse con el administrador del IRB, Oficina de Investigación y Actividades Creativas (ORCA), A-285 ASB, Brigham Young University, Provo, UT 84602, Teléfono: (801) 422-1461, Fax: (801) 422 a 0,620, Email: irb@byu.edu

Doy permiso para que mi hijo participe en este proyecto de investigación y de los investigadores a utilizar las respuestas de mi hijo a los cuestionarios para la investigación.

Nombre del Niño/a en letra de molde: \_\_\_\_\_

Nombre del padre: \_\_\_\_\_

Firma del padre/madre o tutor legal: \_\_\_\_\_

Fecha: \_\_\_\_\_

## Youth Assent (15-17 years old)

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### **What is this study about?**

My name is Liz Haslem and I am from Brigham Young University. I would like to invite you to take part in a research study. Your parent(s) know we are talking with you about the study. This form will tell you about the study to help you decide whether or not you want to be in it.

In this study, we want to explore the ways in which this course, *Fitness for Life*, influences students' desire to be physical active.

### **What am I being asked to do?**

If you decide to be in the study, your teacher is going to give you two questionnaires. The first will assess your knowledge of the health and fitness concepts you have been taught in your Fitness for Life class and will take about 10-15 minutes to complete. The second questionnaire will also take about 10-15 minutes to complete and will ask you about the types of physical activities you participate in during the week, how you feel about exercising, and how confident you feel to be physically active.

### **What are the benefits to me for taking part in the study?**

Taking part in this research study may not help you in any way, but it might help us learn how students' knowledge of health and fitness can influence their physical activity behaviors.

### **Can anything bad happen if I am in this study?**

We think there are minimal risks to you for being in the study. Some kids might worry about what their teacher will think of their responses, or nervous about talking about their physical activity behaviors. You don't have to answer any of the questions you don't want to answer.

### **Who will know that I am in the study?**

We won't tell anybody that you are in this study and all the information that we have about you will be kept private. Before you can participate in this study, your parents must give permission for you to participate. When we tell other people or write articles about what we learned in the study, we won't include your name or that of anyone else who took part in the study.

### **Do I have to be in the study?**

You can decide if you want to participate in this study or not. You can change your mind anytime if you decide you don't want to be in the study anymore. Choosing not to participate will not affect your grade in the class. If you decide not to participate in this study, you will be given an alternative assignment by your teacher.

### **What if I have questions?**

If you have questions at any time, you can ask us and you can talk to your parents about the study. If you want to ask questions about the study, contact Liz Haslem at (435) 901-0671 or Lizbailey22@byu.edu.

Before you say yes to be in this study what questions do you have about the study?

If you want to be in this study, please sign and print your name.

Name (Printed): \_\_\_\_\_ Signature \_\_\_\_\_ Date \_\_\_\_\_

## Teacher Consent to Participate in Research

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### **Introduction**

This research study is being conducted by Liz Haslem, Ed.D, Carol Wilkinson, Ed.D, Keven Prusak, Ph.D, and Todd Pennington, Ph.D. at Brigham Young University. The purposes of this study are: a) to test a hypothesized model of student motivation in cognitive physical education, and b) to explore the relationship of perceived competence for exercise, student health-related fitness knowledge, and student physical activity behaviors. You were invited to participate because you currently teach Fitness for Life (FFL) classes.

### **Procedures**

If you agree to participate in this research study, the following will occur:

- You will be asked to attend research training, which will be part of a regular professional development seminar at BYU. You will be contacted by the principal researcher as to a date and time for this meeting. The meeting will occur sometime during the last two weeks of March at BYU and BYU will pay for a sub for you that day.
- At the research training, you will be given envelopes containing the questionnaires, assent forms, consent forms, and scantrons for questionnaire #1, and given specific instruction for distributing these forms.
- You will be asked to sign a teacher consent form to participate in this research study.
- You will be responsible for distributing parental permission consent and youth assent forms to all the students and their parents in your classes and gathering signed assent forms. Only students who have returned parental permission forms and signed assent forms will be involved in the study. All other students will receive their regularly scheduled curriculum activities.
- You will read aloud the instructions from the classroom announcement script.
- You will administer hard copies of the Health-Related Fitness Knowledge Questionnaire (HRFKQ) during the week of April 8<sup>th</sup> and read out loud the instructions for this questionnaire.
- Then you will administer Questionnaire #2 during the week of April 15<sup>th</sup>. You will read the instructions and each item on Questionnaire #2 out loud to the students.
- Each questionnaire will take approximately 10-15 minutes to complete.
- Completed questionnaires will be gathered from the students by you, placed into labeled envelopes, and later collected by the researcher.



-While students in the study are completing Questionnaire #2, you are responsible for providing an alternate activity that students not involved in the study can do quietly on their own.

### **Risks/Discomforts**

There are minimal risks in participating in this study. You will be required to attend a training session that will be held during the school period. BYU will pay for a substitute teacher to cover instruction time that you will miss.

### **Benefits**

There are no direct benefits for participating in this study. This study may benefit society by giving insight into factors that motivate individuals to be physically active.

### **Confidentiality**

Confidentiality of your students will be achieved by keeping all data in a secure locked office. Once you have collected the data, only the researchers involved in the study will have access to it and it will be kept on a password-protected computer during analysis. The data will be securely stored in a locked office until the results of the study are published. Data will then be destroyed.

### **Compensation**

There will be no compensation for participation in this study.

### **Participation**

Participation in this research study is voluntary. You can withdraw or refuse to participate without affecting your employment or standing at the school.

### **Questions about the Research**

If you have questions about the study, contact Liz Haslem at (435) 901-0671 or [Lizbailey22@byu.edu](mailto:Lizbailey22@byu.edu). You may also contact Carol Wilkinson by phone: (801) 422-8779 or email: [Carol\\_Wilkinson@byu.edu](mailto:Carol_Wilkinson@byu.edu).

### **Questions about Your Rights as Research Participants**

If you have questions regarding your rights as a research participant contact IRB Administrator at (801) 422-1461; A-285 ASB, Brigham Young University, Provo, UT 84602; [irb@byu.edu](mailto:irb@byu.edu).

### **Statement of Consent**

I have read, understood, and received a copy of the above consent and desire of my own free will to participate in this study.

Name (Printed): \_\_\_\_\_ Signature \_\_\_\_\_ Date \_\_\_\_\_

## APPENDIX D

### Letter to Principals

My name is Liz Haslem and I am a graduate student at Brigham Young University. I am conducting a research study about the effects of health-related fitness knowledge on perceived competence and motivation to exercise, and physical activity behaviors of students enrolled in *Fitness for Life* courses. I have obtained approval from your school district to conduct this study and I am hoping to work with **teachers name** at your school.

If the teacher at your school gives consent to participate in the research study, the following will be asked of them:

- They will be asked to attend a research training, which will be part of a regular professional development seminar at BYU. The research training will take approximately 45 minutes and will take place during their normally scheduled course instruction time. The teachers will be contacted by the principal researcher as to a date and time for this meeting. The meeting will occur sometime during the last two weeks of March at BYU and BYU will pay for a half day sub for them that day.
- At the research training, they will be given envelopes containing the questionnaires, assent forms, consent forms, and scantrons for questionnaire #1, and given specific instruction for distributing these forms.
- They will be responsible for distributing parental permission consent and youth assent forms to all of the students in their classes and gathering signed assent and consent forms. Only students who have returned parental permission forms and signed assent forms will be involved in the study. Students who have not volunteered for the study, or who have not returned parental approval forms will receive their regularly scheduled curriculum activities.
- They will administer hard copies of the Health-Related Fitness Knowledge Questionnaire (HRFKQ) during the week of April 8<sup>th</sup> and read out loud the instructions for this questionnaire.
- They will administer Questionnaire #2 during the week of April 15<sup>th</sup>. They will read the instructions and each item on Questionnaire #2 out loud to the students.
- Each questionnaire will take approximately 10-15 minutes to complete.

- Completed questionnaires will be gathered from the students by the teacher, placed into labeled envelopes, and later collected by the researcher.
- While students in the study are completing Questionnaire #2, the teacher is responsible for providing an alternate activity that students not involved in the study can do quietly on their own.

### **Risks**

There are minimal risks in participating in this study.

### **Confidentiality**

Confidentiality of your students will be achieved by keeping all data in a secure locked office. Once you have collected the data, only the researchers involved in the study will have access to it and it will be kept on a password-protected computer during analysis. The data will be securely stored in a locked office until the results of the study are published. Data will then be destroyed.

### **Benefits**

There are no direct benefits to your students for participating in this study but we hope it will help us learn how students' knowledge of health and fitness can influence their physical activity behaviors.

### **Compensation**

There will be no compensation for participation in this study.

### **Questions about the Research**

You can contact Liz Haslem anytime by phone: (435) 901-0671 or email: [lizbailey22@byu.edu](mailto:lizbailey22@byu.edu) to inquire about any aspect of this study. You may also contact Carol Wilkinson by phone: (801) 422-8779 or email: [Carol\\_Wilkinson@byu.edu](mailto:Carol_Wilkinson@byu.edu).

You can also contact the IRB Administrator, A-285 ASB, Brigham Young University, Provo, UT 84602, Phone: (801) 422-1461, Email: [irb@byu.edu](mailto:irb@byu.edu)

### **Participation**

Participation in this research study is voluntary.

I really appreciate your support as I try to contribute research that will help explain how students are motivated to be physically active.

Liz Haslem

## APPENDIX E

### Health-Related Fitness Knowledge Questionnaire

Name: \_\_\_\_\_

Gender (Circle one): Male Female

Ethnicity (Circle one):

Age: \_\_\_\_\_

African American

Asian

Hispanic

Native American

Pacific Islander

White

1. According to the Fit formula, you should engage in moderate activity
  - a. **On all or most day of the week**
  - b. 3-5 days per week
  - c. 2-3 days per week
  - d. 1 day per week
2. Experts suggest that you should get your moderate activity in bouts of
  - a. At least 30 minutes at a time
  - b. **At least 10 minutes at a time**
  - c. At least 2 minutes at a time
  - d. It really doesn't matter
3. Active aerobics and active recreation are especially good at
  - a. Building flexibility
  - b. Building muscular endurance
  - c. **Building cardiovascular endurance**
4. For cardiovascular fitness, moderate to vigorous exercise must elevate your heart rate
  - a. Above normal
  - b. Once a week
  - c. **Into the target fitness zone**
  - d. Into the high performance zone
5. National guidelines state that teenagers should engage in vigorous activity for
  - a. 20 minutes, once a week
  - b. 60 minutes daily
  - c. 60 minutes, 1 or 2 times per week
  - d. **20 minutes, 3 or more times per week**

6. Muscular endurance is the
  - a. **Muscles ability to work for long periods without tiring**
  - b. Same as cardiovascular fitness
  - c. Amount of force a muscle can exert
  - d. Same as body strength
7. When weight training for muscular endurance, you should increase weight when you can easily do
  - a. 3 sets of 11 reps
  - b. **3 sets of 25 reps**
  - c. 9 sets of 11 reps
  - d. 11 sets of 25 reps
8. Muscle fibers used in endurance activities are
  - a. Fast twitch
  - b. **Slow twitch**
  - c. Moderate twitch
  - d. Non-twitch
9. Which of the following is NOT a benefit of muscular endurance exercise?
  - a. **Increased resting heart rate**
  - b. Decreased body fat
  - c. Ability to work longer without tiring
  - d. Stronger bones
10. Of the following, the term that is least closely related to the others is
  - a. Muscular endurance
  - b. Cardiovascular endurance
  - c. Strength
  - d. **Balance**
11. The BEST balanced exercise program includes
  - a. Strength exercises of overstretched muscle
  - b. Strength exercises only
  - c. **Strength and flexibility exercises**
  - d. Flexibility exercises only
12. A sport in which athletes train to develop well-defined muscles is
  - a. Weightlifting
  - b. Powerlifting
  - c. Circuit weight training
  - d. **Body building**
13. Your 1RM represents the
  - a. **Maximum weight a group of muscles can lift at one time**
  - b. Power resulting from our weight training
  - c. Type of exercise to improve muscular strength
  - d. Exertion of near maximal muscular force
14. Static stretching is
  - a. Quick, gentle bouncing or bobbing motions
  - b. The amount of movement a joint can make

- c. Slow stretching without pain, for several seconds**
15. Which is a part of the principle of progression for flexibility?
- Start with a few hyperextended stretches
  - Stretch for the longest period you can tolerate
  - Stretch muscles until they feel tired
  - Stretch a little farther each day**
16. Static stretching
- Always builds the most flexibility for an athlete
  - Increases flexibility**
  - Causes back injuries
  - Causes muscle cramps in the legs
17. In general, to build flexibility you should stretch until
- 1 minute passes
  - The muscle feels loose
  - The muscle feels a little uncomfortable**
  - It feels painful
18. Body mass index is calculated by using
- Height and bone width
  - Weight and waist size
  - Skinfold measurements
  - Height and weight**
19. What is essential body fat?
- Fat in the arms and legs
  - The maximum fat a person should have
  - The same as ideal weight
  - The minimum fat a person should have**
20. Body fat is important for all of the following reasons except
- Cleaning out arteries**
  - Helping to absorb important vitamins
  - Acting as a shock absorber
  - Insulating the body from heat and cold
21. How many fewer calories should be eaten in order to lose 1 pound?
- 1,250
  - 2,500
  - 3,500**
  - 5,000
22. Which of the following does NOT help you maintain an ideal body fatness?
- Active sports
  - Aerobic activities
  - Specific body part exercises**
  - Lifestyle exercises

## APPENDIX F

### Questionnaire 2

Name: \_\_\_\_\_

Gender (Circle one): Male Female

Ethnicity (Circle one):

Age: \_\_\_\_\_

African American

Asian

Hispanic

Native American

Pacific Islander

White

#### WHY DO YOU ENGAGE IN EXERCISE?

We are interested in the reasons underlying peoples' decisions to engage, or not engage in physical exercise. Using the scale below, please indicate to what extent each of the following items is true for you. Please note that there are no right or wrong answers and no trick questions. We simply want to know how you personally feel about exercise. Your responses will be held in confidence and only used for our research purposes.

	Not true for me	1	Sometimes true for me	2	3	Very true for me	4
1. I exercise because other people say I should	0	1	2	3	4		
2. I feel guilty when I don't exercise	0	1	2	3	4		
3. I value the benefits of exercise	0	1	2	3	4		
4. I exercise because it's fun	0	1	2	3	4		

5. I don't see why I should have to exercise	0	1	2	3	4
6. I take part in exercise because my friends/family/partner say I should	0	1	2	3	4
7. I feel ashamed when I miss an exercise session	0	1	2	3	4
8. It's important to me to exercise regularly	0	1	2	3	4
9. I can't see why I should bother exercising	0	1	2	3	4
10. I enjoy my exercise sessions	0	1	2	3	4
11. I exercise because others will not be pleased with me if I don't	0	1	2	3	4
12. I don't see the point in exercising	0	1	2	3	4
13. I feel like a failure when I haven't exercised in a while	0	1	2	3	4
14. I think it is important to make the effort to exercise regularly	0	1	2	3	4
15. I find exercise a pleasurable activity	0	1	2	3	4
16. I feel under pressure from my friends/family To exercise	0	1	2	3	4
17. I get restless if I don't exercise regularly	0	1	2	3	4
18. I get pleasure and satisfaction from participating in exercise	0	1	2	3	4
19. I think exercising is a waste of time	0	1	2	3	4



Please indicate the extent to which each statement is true for you, assuming that you were intending either to begin now a permanent regimen of exercising regularly or to permanently maintain your regular exercise regimen. Use the following scale:

1      2      3      4      5      6      7

Not at all true      Somewhat true      Very true

- |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|
| 1. I feel confident in my ability to exercise regularly.    | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. I now feel capable of exercising regularly.              | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. I am able to exercise regularly over the long term.      | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. I am able to meet the challenge of exercising regularly. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

1. During a typical **7-day period** (a week), how many times on the average do you do the following kinds of exercise for **more than 15 minutes** during your free time (write on each line the appropriate number).

	Times per week
<b>STRENOUS EXERCISE</b> <b>(Heart Beats Rapidly)</b> (e.g., running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling)	_____
<b>MODERATE EXERCISE</b> <b>(Not Exhausting)</b> (e.g., fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, popular and folk dancing)	_____
<b>MILD EXERCISE</b> <b>(Minimal Effort)</b> (e.g., yoga, archery, fishing from river bank, bowling, horseshoeing, golf without using a cart, snow-mobiling, easy walking)	_____