THE YOUTH INTERPERSONAL BEHAVIORS QUESTIONNAIRE IN SPORT (Y-IBQ): INSTRUMENT CREATION AND TESTING OF THE PSYCHOMETRIC PROPERTIES

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PUBLIC ABSTRACT

There are many benefits youth can receive from participating in sport such as increased physical activity, self-esteem, well-being, and improved relationships with others. One factor that is important in retaining youth sport participants is athletes' motivation. Self-determination theory is a theory of motivation that has been used extensively in sport contexts. A smaller theory within the larger self-determination theory framework is basic psychological needs theory, which has been applied widely in youth sport. Basic psychological needs theory states that each person has three basic psychological needs of autonomy, competence, and relatedness. These needs can either be satisfied (i.e., fulfilled) or dissatisfied (i.e., thwarted). Coaches within youth sport have been shown to influence the satisfaction or thwarting of athletes' basic psychological needs, and ultimately, motivation in sport. However, the way in which scientists have measured the coach's influence on basic need satisfaction and thwarting in sport has been largely inconsistent. There is not a standard instrument that has been widely adopted to study this phenomenon. The Interpersonal Behaviors Questionnaire in Sport is a survey instrument that examines athlete perceptions of coach interpersonal behaviors that support or thwart an athlete's basic psychological needs. This instrument adequately addresses some of the previous measurement-related gaps reported in the literature. When using instruments to measure psychological constructs, reliability and evidence for validity must be provided to ensure quality measurement. While different sources of validity evidence for responses to the IBQ have been provided for adults, limited validity evidence for the IBQ has been provided with youth. In addition, some problems have been noted when using the IBQ instrument with youth participants. A measurement tool designed for youth sport participants is necessary to examine athlete perceptions of coach behaviors. The current project aims to establish an instrument to measure

youth athletes' perceptions of coach behaviors (i.e., youth version of the IBQ) that support or thwart basic psychological needs.

This project consists of three integrated studies contributing toward the establishment of a youth version of the IBQ. The purpose of Study 1 is to further examine use of the IBQ in Sport with youth athletes by examining validity for youth athletes' responses to the IBQ. Study 2 aims to identify and then modify problematic IBQ items to create the Youth Interpersonal Behaviors Questionnaire in Sport (Y-IBQ). The purpose of Study 3 is to examine and provide reliability and validity for the newly developed Y-IBQ in a youth athlete population. The completion of these study aims will provide initial evidence for use of the Y-IBQ instrument in a youth athlete population and thereby improve measurement of the coach's influence on athlete basic need satisfaction and need frustration in sport.

ABSTRACT

Participation in organized youth sport has been shown to have many positive benefits. Self-determination theory, and more specifically, basic psychological needs theory has been applied extensively to the youth sport context to examine the satisfaction and thwarting of athletes' three innate psychological needs (i.e., autonomy, competence, relatedness). Youth sport coaches have been shown to influence the satisfaction or thwarting of athletes' basic psychological needs, and ultimately, motivation in sport. However, measurement of the coach's influence on basic need satisfaction and thwarting in sport has been largely inconsistent, as there is not a standard instrument that has been widely adopted. The Interpersonal Behaviors Questionnaire in Sport is an instrument that examines athlete perceptions of coach interpersonal behaviors that support or thwart basic psychological needs. This instrument addresses some of the previous measurement-related gaps by measuring all three basic needs simultaneously and attributing athlete basic need satisfaction and thwarting directly to the coach's influence. While different sources of validity evidence (e.g., internal structure, relations to other variables) for responses to the IBQ have been provided for adults, only validity evidence for relations to other variables (e.g., coach-athlete relationship quality, intentions to continue sport participation) has been provided with youth. Moreover, potential problems with internal structure for youths' responses to the IBQ have recently been noted in the literature. To contribute to the growing body of literature examining the coach's influence on basic need satisfaction and motivation in youth sport, a measurement tool designed for youth sport participants is necessary. Thus, the current project aims to establish an instrument to measure youth athletes' perceptions of coach behaviors (i.e., youth version of the IBQ) that support or thwart basic psychological needs.

This project consists of three integrated studies contributing toward the establishment of a

youth version of the IBQ. The purpose of Study 1 is to provide initial validity evidence for modification of the IBQ in Sport for youth by empirically examining the internal structure for youth athletes' responses to the IBQ. Study 2 aims to identify and then modify problematic IBQ items to create the Youth Interpersonal Behaviors Questionnaire in Sport (Y-IBQ). The purpose of Study 3 is to examine the psychometric properties of the newly developed Y-IBQ in a youth athlete population. The completion of these study aims will provide initial validity evidence for the Y-IBQ instrument in a youth athlete population and thereby improve measurement of the coach's influence on athlete basic need satisfaction in sport.

This dissertation is dedicated to my Spartan family. We are #Spartanstrong.

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CHAPTER I: GENERAL INTRODUCTION

The rationale for this project was guided by *Standards for Educational and Psychological Testing* (American Educational Research Association [AERA], American Psychological Association [APA], & National Council on Measurement in Education [NCME], 2014) which asserts, "Statements about validity should refer to particular interpretations for specified uses" (p. 11). Thus, when utilizing survey measures, various sources of validity evidence should be established for specific populations in which the measure is to be used. While there are many sources of validity evidence (e.g., relationships to other conceptually related variables, content-oriented, cognitive processes), the source of validity evidence discussed specifically in this project is internal structure (i.e., factor structure).

The Interpersonal Behaviors Questionnaire in Sport (IBQ; Rocchi, Pelletier, & Desmarais, 2017) is used to assess athletes' perceptions of coach behaviors that satisfy or thwart basic psychological needs of autonomy, competence, and relatedness. In adult populations, various sources of validity evidence for responses to the IBQ have been provided including relations to other variables and internal structure (Rocchi, Pelletier, & Desmarais, 2017). However, with youth respondents, validity evidence has only been established for relations to other variables (e.g., coach-athlete relationship quality; intentions to continue sport participation; Wekesser et al., 2021). Wekesser et al. (2021) also noted low internal consistency for some IBQ composite scores, indicating potential problems with the internal structure for youths' responses to the IBQ. The current paper seeks to extend the work of Wekesser et al. (2021) by improving the measurement of athlete perceptions of coach interpersonal behaviors in sport. This was achieved by: (a) comprehensively examining an additional source of validity evidence (i.e., internal structure) of youth athletes' responses to the IBQ guided by relevant conceptual theory,

(b) revising the IBQ instrument to address measurement concerns with youths, and (c) testing the psychometric properties of the revised instrument.

Theoretical Background

Self-determination theory (SDT; Deci & Ryan, 1985) is a broad theory of human motivation that has been used as a guiding framework to explain why individuals are driven to engage in certain behaviors. More specifically, SDT highlights different types of motivation and how each contributes to optimal well-being and healthy psychological development or alternatively, ill-being and pathology. As part of the SDT framework, basic psychological needs theory (BPNT; Ryan & Deci, 2000a) posits that each person has three basic psychological needs of autonomy, competence, and relatedness that must be fulfilled to experience self-motivation, healthy psychological development, and optimal well-being. *Autonomy* is the freedom to make one's own choices and having rationale for decision-making and task engagement. *Competence* involves feeling a sense of mastery over one's behavior. *Relatedness* is fostered by a sense of belonging and connection to others. The fulfillment of an individual's basic psychological needs contributes to greater internalization and more self-determined behavior. Therefore, when autonomy, competence, and relatedness are supported, behaviors or actions that are extrinsically motivating become more internalized and self-determined.

The Coach's Influence on Motivation

Factors in the socio-contextual environment can play a key role in facilitating or undermining motivation (Ntoumanis, 2012). For example, the coach is an influential stakeholder in the youth sport environment that spends considerable time interacting with athletes at games, practices, and team activities. Research shows coaches play a key role in shaping athletes' motivation (Mageau & Vallerand, 2003) and psychological experiences in sport settings (Horn,

2008). Thus, the coach is an important person of interest in the study of basic need satisfaction and thwarting. A series of studies examining coach behaviors in youth sport found that athlete perceptions of coach autonomy-supportive behaviors predicted athlete psychological need satisfaction and sport engagement while perceptions of controlling behaviors predicted need thwarting and disaffection (Curran et al., 2014; Curran et al., 2016). Further, Bartholomew, Ntoumanis, Ryan, Bosch, et al. (2011) found that coach autonomy-supportive behaviors contributed to athlete need satisfaction which led to feelings of vitality and positive affect whereas controlling coach behaviors led to athlete need thwarting and feelings of depression, negative affect, and burnout. Together, these studies demonstrate the coach's influential role in supporting or thwarting athlete basic needs and how those contribute to athlete outcomes.

Measuring Basic Need Support in Sport

As demonstrated above, much of the empirical work examining basic need satisfaction in sport has focused on autonomy-supportive coaching behaviors and environments (Ntoumanis, 2012; Rocchi et al., 2013; Sparks et al., 2017) with less attention given to competence- and relatedness- supportive and thwarting behaviors. Rocchi et al. (2013) suggest this disparity may stem from lack of a measurement tool to assess these constructs. In fact, there has been considerable variation in the measurement of need supportive and thwarting behaviors in sport. For example, the Controlling Coach Behaviors Scale (Bartholomew et al., 2010) and Health Care Climate Questionnaire (Williams et al., 1996) have examined specific coach behaviors that are supportive or thwarting of needs but have focused on the autonomy dimension only. Other measures such as the Basic Psychological Need Satisfaction in Sport Scale (Ng et al., 2011) and Basic Psychological Need Thwarting Scale (Bartholomew, Ntoumanis, Ryan, Bosch, et al., 2011), examine satisfaction or frustration of all three basic needs simultaneously but do not

attribute satisfaction or frustration of needs directly to the coach's influence. This distinction must be established because when basic need satisfaction and frustration are assessed generally, it is uncertain whether basic need satisfaction or frustration is stemming from coach behaviors or other social influences such as parents, teammates, or the broader sport environment.

Until recently, no measurement instrument has adequately assessed the coach's influence in supporting and thwarting all three basic psychological needs simultaneously. Rocchi, Pelletier, and Desmarais (2017) filled this gap by developing the IBQ in Sport to assess athlete perceptions of coach interpersonal behaviors in six areas including autonomy-support, autonomy-thwarting, competence-support, competence-thwarting, relatedness-support, and relatedness-thwarting. In the initial validation studies, strong internal structure, internal consistency, and evidence of relations to other variables for responses to the IBQ were found for adult populations (Rocchi, Pelletier, Cheung, et al., 2017; Rocchi, Pelletier, & Desmarais, 2017). In youth populations, use of the IBQ has been limited. Rocchi and Pelletier (2018) used the IBQ with athletes aged 14 and older and reported adequate reliability for all six subscale composite scores ($\alpha > .83$). However, a recent study utilizing the IBQ with athletes ages 11 to 16 indicated low internal reliability for composite scores on some subscales (Wekesser et al., 2021). It was suggested that this was likely due to differences in cognitive development between younger and older athletes affecting how they interpreted and responded to the measure. Due to possible psychometric issues found when surveying athletes of younger ages, Wekesser et al. (2021) recommended that further testing of the IBQ should be conducted specifically with athletes ages 14 and younger to ensure appropriate interpretation of the scores in younger populations. Therefore, the IBQ may not be an appropriate measurement tool for youth populations until further testing of its psychometric properties have been conducted or the measure is modified to be more developmentally

appropriate for youth.

There is great utility in studying coaching behaviors that support or thwart youth athletes' basic psychological needs because more autonomous forms of motivation are important for continued sport participation (Rottensteiner et al., 2015). This is especially significant in youth sports where there are low retention rates in adolescence (Gould, 2019). Considering the wide range of benefits youth sports can provide such as opportunities to be physically active, improve overall physical health, increase feelings of self-esteem, and promote positive social relationships (Côté & Fraser-Thomas, 2007), it should be of upmost importance to keep youth involved across their lifetime, and motivation is a key factor in continued participation. While the IBQ in its current format may be unsuitable for youth populations, the development of a revised measure could assist researchers in studying the coach's role in fostering or hindering youth athlete motivation.

Developmental Considerations in Measurement

Various sources of validity evidence should be provided for the population in which a measure is being used (AERA et al., 2014). Relations to other variables is the only source of validity evidence that has been provided for youth athletes' responses to the IBQ. Therefore, a critical gap that must be fulfilled involves establishing other sources of validity evidence for this population, including internal structure. Simultaneously, many developmental factors should be considered when seeking to establish sources of validity evidence. Children's cognitive and social development, as well as reading skill, can impact how they comprehend and report on survey measures (Arthur et al., 2017; Borgers et al., 2000). Thus, Arthur and colleagues (2017) recommended that the form of questions should be matched to the target population's cognitive, language/reading, and social/moral abilities. Borgers et al. (2000) describe specific milestones

that can be used as a guide when surveying youth. From about eight years of age, children can respond to surveys, given they are specifically developed for that age group regarding reading skills and language development. Age 12 has been identified as a milestone where children's language development is shaped and drastically improves, making them capable of completing instruments designed for adults. By age 16, youth have developed strong cognitive abilities and can mostly be considered as adults when responding to survey measures (Borgers et al., 2000). In sum, when surveying children, it is important to account for children's stages of cognitive development, specific ages where survey responses may be affected, and variation among children in rates of development to minimize measurement error.

Indeed, a child's cognitive development is a key factor that should be considered when children answer survey items. Tourangeau (1984) describes four cognitive steps involved in the question answering process which include: comprehension of the question, retrieval from memory, judgment process, and response process. Comprehension involves reading the survey item, interpreting its meaning, and understanding what is being asked. Retrieval includes accessing memories, experiences, or information relevant to the question. The judgment process involves forming a decision about the question based upon making inferences or combining information gathered during retrieval. Last, the response process occurs when a person selects a response to the item based upon their prior judgments (Tourangeau, 1984). These cognitive steps further justify the need for developmentally appropriate survey items because each cognitive step influences subsequent steps. When children respond to survey items, error can occur within any of the four cognitive steps outlined in the question-answering process. For example, when surveying children, a variety of comprehension challenges have been well-documented in the literature including vocabulary words or a reading level that is too difficult, item ambiguity, use

of double negatives, and precondition binds (Arthur et al., 2017; Borgers et al., 2000; Silva et al., 2019). Based on these challenges, comprehension is an important first step to be considered in survey development and testing processes. For this reason, Woolley et al. (2004) recommend that surveys should be pretested via cognitive interviewing before being distributed to youth to identify any developmental concerns that may influence responses and compromise data quality.

Current Project

Reflecting upon the developmental factors that must be considered when surveying youth, a developmentally appropriate measure is necessary to adequately assess youth athletes' perceptions of coach behaviors that support or thwart their psychological needs. Moreover, considering the suggestion for continued psychometric testing of the IBQ in youth populations (Wekesser et al., 2021) and the standard to accumulate multiple sources of validity evidence for the specific population in which the instrument will be used (AERA et al., 2014), further investigation of youths' responses to the IBQ is justified. The current project has three major aims which will be investigated across three studies. The purpose of Study 1 is to empirically examine the internal structure for youth athletes' responses to the IBQ. The purpose of Study 2 is to identify and then modify problematic IBQ items to create the Youth Interpersonal Behaviors Questionnaire in Sport (Y-IBQ). The purpose of Study 3 is to examine the psychometric properties of the newly revised Y-IBQ. Accomplishing the three purposes outlined in the current project will contribute toward three major outcomes. Purpose 1 will address the recommendation by Wekesser et al. (2021) to conduct further psychometric testing of the IBQ with youth populations. Achieving Purpose 2 will address possible reasons for psychometric issues while providing a modified version of the IBQ (i.e., the Y-IBQ) that will undergo pilot testing with youth. Finally, accomplishing Purpose 3 will provide reliability and validity evidence (as

recommended by AERA et al., 2014) for the newly revised Y-IBQ to assess youth athletes' perceptions of coach behaviors that influence basic need satisfaction and thwarting.

CHAPTER II: REVIEW OF THE LITERATURE

Participation in organized sports is a popular activity for many youths in the United States. According to the National Survey of Children's Health (2019), parent reports showed 55.1% of children aged six to 17 years participated in organized sports. When organized youth sport programming is implemented appropriately, youth sport participation has been shown to be associated with numerous positive outcomes. From a physical standpoint, youth participating in organized sports have been shown to have increased levels of physical activity (Marques et al., 2016; Pfeiffer & Wierenga, 2019). Youth sport participation has also been shown to contribute to psychosocial outcomes. Some psychosocial outcomes include increases in competence, self-esteem, confidence, and well-being, positive adult and peer relationships, and improved social skills (Côté & Fraser-Thomas, 2007; Eime et al., 2013; Holt et al., 2016). Despite the widespread benefits of youth sport participation, attrition (i.e., dropout) is common. The National Alliance for Youth Sports (2016) reported that approximately 70% of children drop out of organized sports by age 13. Considering the high attrition rates, those invested in organized youth sport should consider how to maintain motivation for continued involvement to better retain youths' participation in organized sport.

Motivation in Sport

Motivation is a broad term that has been used to understand human behavior. Indeed, Roberts and colleagues (2007) argued that the term *motivation* is overused and vague, as researchers have provided numerous definitions and theories over time to define and explain motivation. While many scholars have proposed different understandings and perspectives of motivation, one idea most scholars agree on is that motivation is a process (Roberts, 2012). Maehr and Zusho (2009) put forth a definition of motivation that embraces this perspective, stating that

motivation can be defined as the process that influences the initiation, direction, magnitude, perseverance, continuation, and quality of goal-directed behavior. While there is great complexity surrounding the conceptualization and understanding of motivation, many youth sport scholars have taken interest in this topic, as motivation has been shown to influence youth athletes' persistence and attrition in sport (Alvarez et al., 2012; Balish et al., 2014; Rottensteiner et al., 2015).

Weiss (2019) purports that four major theories have guided motivation research in youth sport including achievement goal theory (Nicholls, 1984), competence motivation theory (Harter, 1978), expectancy-value theory (Eccles et al., 1983), and self-determination theory (SDT; Deci & Ryan, 1985). These theories share many similarities in the ways they explain youths' participation motives in sport – to feel competent, to experience social connection, and for enjoyment reasons (Weiss, 2019). Together, these companion theories have advanced the body of knowledge in youth sport motivation. While each of these theories have guided research and discourse within youth sport, this project specifically investigates SDT for its practicality and extensive application in youth sport settings.

Self-Determination Theory

SDT provides a broad framework for studying human motivation and personality (Deci & Ryan, 1985). SDT is an organismic theory, meaning it considers humans as having innate, growth-oriented tendencies that are influenced by one's environment (Ryan & Deci, 2002). Further, there is an interaction between human nature and social contexts where social-contextual factors can either enable or forestall one's growth tendencies. More broadly, SDT examines individuals' quality of motivation (i.e., intrinsic, extrinsic), ways in which motivation contributes to healthy psychological development and well-being, and social-contextual factors that can

support or undermine one's motivation. SDT is considered a macro theory because it is comprised of six smaller mini theories including the following: cognitive evaluation theory, organismic integration theory, causality orientations theory, basic psychological needs theory, goal contents theory, and relationships motivation theory. Each of these mini theories addresses a different component of motivation. Two of the mini theories relevant to the current study include organismic integration theory and basic psychological needs theory.

Organismic Integration Theory

Within SDT, Ryan and Deci (2000b) describe different types of motivation, which are considered to be on a continuum and can be classified as amotivation, extrinsic, or intrinsic. These types of motivation vary in the extent to which a person's behaviors are autonomous (i.e., self-determined) versus controlled. Amotivation is when a person lacks intention to act. Amotivation may occur when a person does not value an activity or feel competent in performing it. When a person engages in a behavior for reasons external to oneself or to attain some external outcome (e.g., to appease others, gain a reward), that person is extrinsically motivated. Within the motivational continuum, the complexity of extrinsic motivation is addressed by organismic integration theory (OIT; Ryan & Deci, 2000b), which subdivides extrinsic motivation into different forms (i.e., regulatory styles), varying in the degree to which they are internalized and, ultimately, self-determined. On the motivational continuum, *external regulation* is the least self-determined form of extrinsic motivation; a person experiencing external regulation may engage in a behavior to satisfy external pressures (e.g., compliance), obtain an externally imposed reward, or avoid punishment. *Introjected* regulation is a controlled form of motivation involving internalization of external controls, which are then applied through self-imposed pressures to avoid guilt or maintain self-esteem. *Identified* regulation is moving

toward internalization on the continuum, where a person's actions are influenced by their values and the personal importance the behaviors have to the individual. *Integrated* regulation is the most self-determined form of extrinsic motivation. A person with integrated regulation will engage in a behavior because it is congruent with their sense of self. Finally, when a person engages in a behavior for the enjoyment and inherent satisfaction it brings rather than an external reason, that person is intrinsically motivated. In sum, amotivation is the least self-determined form of motivation, intrinsic is the most self-determined form of motivation, and extrinsic motivation (and its different forms) fall between them (Ryan & Deci, 2000b).

Basic Psychological Needs Theory

Basic psychological needs theory (BPNT; Deci & Ryan, 2000a) states that humans have three innate, basic psychological needs (BPN) that are essential to experience psychological development, optimal functioning, growth, and well-being. The three BPN include autonomy, competence, and relatedness. Ryan (1995) provides an overview of each need. *Autonomy* involves having opportunities for choice in situations and having a lack of external controls. *Competence* refers to feelings of mastery over one's behavior. *Relatedness* is the need for belongingness or connectedness to others (Ryan, 1995). When individuals have their BPN fulfilled, they tend to experience greater internalization, self-determined behavior, enhanced health, and well-being (Deci & Ryan, 2000). In the sport context, several studies have shown that athletes' BPN satisfaction is associated with intrinsic motivation and more self-determined forms of extrinsic motivation (e.g., Jõesaar et al., 2011; Matosic & Cox, 2014; Stenling et al., 2015). Yet, when individuals' BPN are thwarted, or actively undermined, individuals are expected to experience diminished motivation, and well-being. In the sport context, studies have shown that need thwarting is a significant predictor of athlete burnout (Jowett et al., 2016; Morales-Sánchez

et al., 2020).

Application of SDT to the Youth Sport Context

SDT posits that a person's innate growth-oriented tendencies are influenced by social contextual factors (Ryan & Deci, 2000a; Ryan & Deci, 2002). This tenet is directly applied in BPNT where a person's BPN can be influenced by significant others within the social-contextual environment. Dorsch and colleagues (2022) proposed an integrated model of the youth sport system highlighting the interacting persons (i.e., parents, coaches, peers, siblings) and contexts (i.e., organizations, communities, societies) that can influence youth athletes. Within the team subsystem, the coach is one of the primary persons who influences youth athlete experiences (Dorsch et al., 2022). Indeed, coaches and athletes form a dyadic relationship, and thus, fostering effective coach-athlete relationships is an important part of the sport experience (Jowett, 2017). Jowett and Poczwardowski (2007) define the coach-athlete relationship as, "a situation in which a coach's and an athlete's cognitions, feelings, and behaviors are mutually and causally interrelated relationships" (p. 4). One model that has been applied to assess coach-athlete relationship is the 3C's + 1 model in which the elements of closeness, commitment, complementarity, and co-orientation are used to define high quality coach-athlete relationships (Jowett & Ntoumanis, 2004).

Jowett (2017) argues that without quality coach-athlete relationships, there cannot be effective coaching. While many scholars have attempted to describe and/or determine what constitutes coaching effectiveness, these definitions have varied greatly and are not cohesive (Côté & Gilbert, 2009). In response, an integrative definition of coaching effectiveness and expertise was proposed, which consolidates relevant conceptual theory and offers a common language. Côté and Gilbert (2009) defined coaching effectiveness as, "The consistent application

of integrated professional, interpersonal, and intrapersonal knowledge to improve athletes' competence, confidence, connection, and character in specific coaching contexts" (p. 316). This proposed definition of coaching effectiveness is in alignment with the competence and relatedness (i.e., connection) components of basic psychological needs theory, and states the important role of the coach in fulfilling one's basic psychological needs. Indeed, Ryan and Deci (2000a) suggest that coaches can enhance intrinsic motivation by supporting autonomy, competence, and relatedness. Further, they state that to explain causes of diminished functioning, one's immediate social context should be examined to determine if athletes' needs are actively being or have been undermined.

Coach Interpersonal Behaviors

Considering the prominent role of coaches in the youth sport system (Dorsch et al., 2022) and their significant contributions to athlete motivational outcomes (Ryan & Deci, 2000a), it is important to identify specific coaching behaviors that may support or frustrate athletes' basic psychological needs. The coaching behaviors drawn from SDT are need-specific and can be subdivided into six dimensions including: autonomy-supportive, competence-supportive, relatedness-supportive, autonomy-thwarting, competence-thwarting, and relatedness-thwarting.

Coaches exhibit autonomy-supportive behaviors when they acknowledge athletes' perspectives, provide athletes with meaningful choices and rationale for decision-making, and minimize external pressure and demands (Mageau & Vallerand, 2003; Rocchi, Pelletier, Cheung, et al., 2017) On the contrary, coaches exhibit autonomy-thwarting behaviors when they make demands of athletes, use intimidating language, pressure or coerce athletes to behave in certain ways, implement tangible rewards to manipulate behavior, or devalue athlete perspectives (Bartholomew et al., 2009; Deci & Ryan, 1985). Coach competence-supportive behaviors

include providing constructive feedback, encouraging learning, acknowledging improvement, and believing athletes can achieve their goals (Bhavsar et al., 2019; Rocchi, Pelletier, Cheung, et al., 2017). In contrast, competence-thwarting behaviors involve drawing attention to one's faults or mistakes, doubting athletes' abilities, being overly critical, and conveying negative competence information (Bhavsar et al., 2019; Sheldon & Filak, 2008). Coach relatedness-supportive behaviors involve caring for athletes, showing warmth, demonstrating interest in athletes' activities, and providing support (Bhavsar et al., 2019; Rocchi, Pelletier, Cheung, et al., 2017). Last, relatedness-thwarting behaviors include excluding athletes from activities, showing disinterest, rejecting athletes, and being inattentive or unavailable (Rocchi, Pelletier, Cheung, et al., 2017; Skinner et al., 2008).

Coach's Influence on Motivation

Considering coaches' positioning in the youth sport system and their important role in forming quality coach-athlete relationships, it is critical to consider how coaches may influence athlete outcomes such as motivation. For example, coaches have been shown to have a prominent influence on motivation (Vallerand, 2007) and motivational outcomes in youth sport (e.g., enjoyment and dropout; Gardner et al., 2016, 2017). Vallerand's (2007) Hierarchical Model of Intrinsic and Extrinsic Motivation (HMIEM) has been used to account for the complexity of human motivation and the different types of social factors that can influence basic need satisfaction and motivation levels. One of the model corollaries purports that, "The impact of social factors on motivation is mediated by perceptions of competence, autonomy, and relatedness" (Vallerand, 2007, p. 63). Vallerand et al. (2008) contended that the way individuals (e.g., the coach) behave toward others in the environment (e.g., athletes) has a significant impact on their motivation. For example, coaches who engage in supportive behaviors have been shown

to promote athlete need satisfaction (e.g., Adie et al., 2008; Hollembeak & Amorose, 2005; Mageau & Vallerand, 2003). In contrast, coaches' controlling behaviors have been shown to predict athlete need thwarting (Bartholomew, Ntoumanis, Ryan, Bosch, et al., 2011; Blanchard et al., 2009).

Moreover, coaches influence athlete motivation by creating a psychological environment (i.e., coach-created motivational climate) based upon their coach-athlete interactions, type of feedback provided, training structure, and responses to performances (Duda et al., 2018; Duda, 2001; Roberts, 2012). Coach-created motivational climates are described as either mastery or performance climates. In a mastery climate, coaches emphasize behaviors that allow athletes to judge their competence and success based upon self-improvement, doing their best, and mastering a task (Roberts, 2012). Further, in a performance climate, coaches emphasize behaviors that permit athletes to judge their competence and success based upon being the best compared to others. Coach-created motivational climates influence athlete BPN satisfaction and frustration. More specifically, mastery climates have been shown to be positively associated with BPN satisfaction and are ultimately considered "empowering" while performance climates are positively associated with BPN frustration and are considered "disempowering" (Duda et al., 2018; Elsborg et al., 2022; García-González et al., 2019; Harwood et al., 2015; Monteiro et al, 2018; Weeldenburg et al., 2020).

Sport Persistence and Dropout

BPNT (Deci & Ryan, 2000) is a central theory to understanding youth athletes' sport outcomes. While several factors such as BPN satisfaction, self-determined motivation, and coach-created mastery climates have been shown to contribute to positive psychological experiences in sport, dropout is common. Calvo et al. (2010) provided support for the utility of

BPNT as a framework to examine motivational outcomes such as persistence and dropout in youth sport. Similarly, in a review examining correlates of attrition in youth sport, Balish et al. (2014) stated that BPNT was found to be the most supported theory of youth sport attrition and noted that intrinsic motivation, perceived competence, autonomy, and relatedness were all negatively associated with youth sport attrition. In addition, research has shown that quality coach-athlete relationships are positively related to sustained sport participation (Rottensteiner et al., 2015) and negatively related to attrition (Balish et al., 2014), providing supporting evidence for the impact of social-contextual factors on athlete motivational outcomes in sport (Ryan & Deci, 2000a).

There are few studies examining youth sport dropout rates, due to methodological difficulties studying youth athletes longitudinally (Gardner et al., 2017). However, an alternative approach to studying dropout is examining athletes' behavioral intentions, as behavioral intentions have been shown to be an indicator of dropout behavior (Gardner et al., 2017). Several studies have examined motivational variables and their influence on intentions to continue sport participation. For example, Castillo-Jiménez et al. (2022) found that BPN satisfaction is positively related to intentions to continue sport participation while BPN thwarting is positively related to intention to drop out of sport. Also, Alvarez et al. (2012) found that intrinsic motivation was positively related to intentions to continue sport participation, and mastery climates predicted intentions to participate via need satisfaction and intrinsic motivation. Overall, basic need satisfaction, self-determined motivation, and coach-created mastery climates are all important for continued sport participation, and the coach has been shown to influence each of these areas.

Measurement of Basic Need Satisfaction and Thwarting

Considering both the well-established and growing interest in studying motivation in youth sport settings (e.g., Weiss, 2019), appropriate measurement tools are necessary to advance understanding. While BPNT has been applied extensively in the examination of youth sport (Balish et al., 2014), many different instruments have been used to measure the constructs of basic need satisfaction and frustration in sport. And, ultimately, there have been inconsistencies in the ways BPN satisfaction and frustration have been measured in the literature. For example, Bartholomew, Ntoumanis, Ryan, and Thøgersen-Ntoumani (2011) assert that most attention has focused on BPN satisfaction while BPN frustration has been understudied, especially in relation to negative and maladaptive outcomes. Indeed, they found that BPN frustration predicted a larger amount of variance in maladaptive outcomes and ill-being comparatively to BPN satisfaction measures. Further, they posit that using BPN satisfaction to measure BPN frustration is thus problematic because the absence of BPN satisfaction does not necessarily indicate need frustration is occurring, but rather indicates need dissatisfaction (Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011). The study and measurement of coach behaviors that frustrate athletes' BPN has received increased attention in recent years (e.g., Bartholomew et al., 2009, Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011; Bhavsar et al., 2019; Rocchi, Pelletier, & Desmarais, 2017) but remains understudied.

Some instruments have assessed athletes' BPN satisfaction or frustration generally without direct link to the coach's influence (e.g., Bartholomew, Ntoumanis, Ryan, Bosch, et al., 2011; Ng et al., 2011). Although this approach may be useful in some circumstances, it can be problematic when examining the coach's role in BPN satisfaction and frustration. When measuring BPN satisfaction and frustration without direct link to the coach's influence, it cannot

be determined whether athletes' BPN are satisfied or frustrated specifically due to the coach's influence or if there may be other unspecified social-environmental factors influencing need satisfaction or frustration such as parents, teammates, or the broader sport environment. While some measures such as the Controlling Coach Behaviors Scale (Bartholomew et al., 2010) and Health Care Climate Questionnaire (Williams et al., 1996) have attributed autonomy satisfaction or frustration directly to the coach's influence, these questionnaires neglect to measure competence and relatedness.

This directly ties to an additional measurement inconsistency involving the inclusion and exclusion of relevant constructs. Much of the literature has focused on autonomy-supportive or controlling (i.e., thwarting) coach behaviors with limited examination of competence and relatedness behaviors (Rocchi et al., 2013; Sparks et al., 2017). Thus, the full range of BPN are not being thoroughly explored. While scholars have indicated that the three BPN in SDT have been shown to be interconnected (Ntoumanis, 2012; Ryan & Deci, 2017), Sheldon and Filak (2008) provided experimental evidence that all three basic needs are uniquely important, and thus should be examined. Even when all three basic needs have been considered, the instruments utilized to measure the coach's influence on basic need satisfaction and frustration have varied in their dimensionality. Unidimensional measurement instruments such as the Tripartite Measure of Interpersonal Behaviors-Coach (TMIB-C; Bhavsar et al., 2019) examine coach need supportive behaviors more broadly but do not distinguish between specific behaviors that support autonomy, competence, or relatedness. Multidimensional measures such as the Interpersonal Behaviors Questionnaire (IBQ; Rocchi, Pelletier, Cheung, et al., 2017) may be more effective at assessing how significant others (e.g., coaches) influence all three basic psychological needs.

Interpersonal Behaviors Questionnaire in Sport (IBQ)

The IBQ (Rocchi, Pelletier, Cheung, et al., 2017) was developed within the context of BPNT and SDT. The IBQ is a comprehensive measure that has been used to assess perceptions of significant others' behaviors that support or thwart autonomy, competence, and relatedness. The following behavioral dimensions were assessed including autonomy-supportive, competence-supportive, relatedness-supportive, autonomy-thwarting, competence-thwarting, and relatedness-thwarting. Considering the important role of others in the social environment in affecting basic need satisfaction and frustration, the IBQ was extended to the sport context. Thus, the IBQ in Sport (Rocchi, Pelletier, & Desmarais, 2017) was created to examine athletes' perceptions of coach interpersonal behaviors that support or thwart athlete basic psychological needs. The IBQ in Sport (which will here forth be referred to as the IBQ) addresses the previously identified measurement inconsistencies by concurrently examining both need satisfaction and frustration together, examining all three BPN concurrently, and attributing BPN satisfaction or frustration to specific coach interpersonal behaviors. Thus, the IBQ is a comprehensive instrument that can be utilized to measure and provide a more holistic understanding of the extent to which athletes perceive coach behaviors to influence their BPN satisfaction and frustration. In the original validation study, internal consistency and validity evidence were established in an adult, college-athlete population (Rocchi, Pelletier, & Desmarais, 2017). Thus, the IBQ in Sport seems to be an appropriate instrument to examine college-aged athletes' perceptions of coach interpersonal behaviors that influence basic need satisfaction and frustration in sport.

Evidence for Use of the IBQ with Youth Athletes

Standards for Educational and Psychological Testing (American Educational Research

Association [AERA] et al., 2014), provides criteria for the development and evaluation of tests as well as guidelines for assessing validity. The work presented in the current project is guided by these standards. For example, claims about validity should be specific to both the context and population in which the instrument will be applied (AERA et al., 2014). Thus, to study the extent that coaches influence basic need satisfaction and frustration in youths, it is important to utilize an instrument that demonstrates reliability and validity evidence specifically in a youth athlete population. Additionally, validity should be considered as a unitary concept, where various sources of validity evidence can be accumulated to support the use of an instrument for its intended purpose (AERA et al., 2014). The sources of validity evidence that will be discussed in this project include relations to other conceptually related variables and internal structure.

To establish evidence of relationships to other conceptually related variables, the variables or constructs measured by the instrument should be related to other theoretically relevant constructs the instrument would be expected to predict or be related to (AERA et al., 2014). For example, it would be expected that the IBQ subscale of autonomy-support should be related to intrinsic motivation as this relationship has been well-supported in the literature (e.g., Adie et al., 2008; Hollembeak & Amorose, 2005; Mageau & Vallerand, 2003). AERA et al. (2014) also states that both convergent and divergent evidence should be provided. Convergent evidence is established when the items intended to measure the same dimension are related to one another. For example, it would be expected that all items intended to measure autonomy-supportive coach behaviors would be correlated to one another. Divergent evidence is established when a scale dimension (i.e., subscale) of the instrument is unrelated or weakly related to other supposedly different scale dimensions within the same instrument. For example, it would be expected that the autonomy-supportive coach behaviors subscale would be weakly

related to other subscales such as competence-supportive coach behaviors.

Analyses of the internal structure, or what may be more commonly known as factor structure, indicates the degree to which a set of similar survey items are presumably representative of the construct they intend to measure (AERA et al., 2014). For example, assessing athletes' perceptions of coach autonomy-supportive behaviors may be difficult to quantify as psychological constructs cannot always be readily observed. So, a set of self-report items conceptually believed to be indicative of the constructive is used to represent the latent factor of athlete perceptions of coach-autonomy-supportive behaviors, and thus in a measurement context represents the factor structure.

While validity evidence for the IBQ in Sport has been established with an adult athlete population (Rocchi, Pelletier, & Desmarais, 2017), there is minimal validity evidence for use of the instrument in a youth athlete population (e.g., Wekesser et al., 2021). Wekesser et al. (2021) provided evidence for relations to other variables by reporting significant relationships among IBQ subscales (e.g., autonomy-support, competence-support), coach-athlete relationship quality, and intentions to continue sport participation with youth aged 11 to 16. While evidence of relations to other related variables was found, Wekesser et al. (2021) also reported low internal consistency for some of the IBQ composite scores and recommended further testing of the psychometric properties of the IBQ in youth populations, specifically athletes aged 14 and younger. This recommendation was based on Rocchi and Pelletier's (2018) administration of the IBQ with athletes ages 14 and older which did not report any psychometric problems. Considering the suggestion for continued psychometric testing of the IBQ in youth populations (Wekesser et al., 2021) and the standard to accumulate multiple sources of validity evidence for the specific population in which the instrument will be used (AERA et al., 2014), further

investigation of youths' responses to the IBQ is recommended.

Developmental Considerations in Measurement and Instrument Development

Survey research has been used to measure individuals' attitudes and perceptions. When respondents are presented with survey items, they must undergo a series of tasks to adequately form responses to the survey items. These tasks, or cognitive steps are outlined by Tourangeau (1984) and make up the question answering process. The four cognitive steps involved in the question answering process include the following: comprehension of the question, retrieval from memory, judgment process, and response process. Comprehension is the first step of this process and involves the respondent reading the survey item, interpreting its meaning, and understanding what is being asked. It is important to note that respondents' prior knowledge (or lack of knowledge) can influence how they interpret the text, and thus must be considered in the development of survey items. The second step in the question answering process is retrieval. Retrieval is the process where the respondent must recall memories, experiences, or information that is relevant to the question. The third step in the question answering process is the judgment process. This step involves accessing the information gathered during retrieval, connecting and making inferences based upon that information, and ultimately forming a decision regarding how to answer the survey question. The fourth and final step of the question answering process is the response process. The response process occurs when a person takes the judgments drawn from the previous step and formulates an appropriate response based upon the response format requested (Tourangeau, 1984). In the case of responding to Likert scale items, a respondent would need to consider their judgment about the question and select the most appropriate response from a set of pre-determined response categories.

Recognizing and planning instrument design around the cognitive steps involved in the

question answering process is important because errors can occur at any given step of the process, which could ultimately influence how respondents answer the survey items. For example, measurement error can occur during the comprehension stage if respondents are unfamiliar with item wording or do not fully understand what they are being asked (Arthur et al., 2017). During the retrieval stage, measurement error can occur if participants cannot remember details correctly, retrieve the wrong information, or do not have relevant experiences to draw from. In the judgment process, measurement error can occur if respondents guess, estimate, or form a decision based upon schema or stereotypes. Finally, measurement error can occur in the response process when respondents select the unintended answer, do not provide an appropriate response, or attempt to provide socially desirable responses instead of their "true" response (Arthur et al., 2017).

When designing questionnaires, researchers should consider the four steps of the question answering process and attempt to minimize measurement error that may occur at each of these steps. While problems with survey items can occur in adult populations, children may be especially vulnerable to committing these types of measurement error, as even slight problems may produce larger impacts than adults (Borgers et al., 2000). Thus, when children act as respondents in survey research, questionnaire design should be sensitive to children's developmental stages and associated cognitive capacities, as cognitive development affects the quality of survey responses. Additionally, research has shown that from eight years on, children can be surveyed, if questionnaires are intentionally developed and specifically designed for this age group (Borgers et al., 2000).

Questionnaire Design Recommendations for Children

Several researchers have provided recommendations for designing questionnaires

appropriate for children (e.g., Arthur et al., 2017; Bell, 2007; Borgers et al., 2000; de Leeuw, 2011; de Leeuw et al., 2004; Krosnick & Presser, 2010). First, survey items should contain simple, straightforward, and familiar vocabulary while avoiding complex wording (Arthur et al., 2017; Bell, 2007; de Leeuw, 2011; Krosnick & Presser, 2010). Moreover, questions should be short and concise (Bell, 2007). Both recommendations are important for item comprehension. Additionally, these strategies can increase readability. Readability is concerned with how successful people are at comprehending a selected text (Lorge, 1944). Commonly used variables to estimate readability may include the number of words, number of syllables, and/or average sentence length. One of the most widely adopted methods of assessing the readability of texts is through the Flesch-Kincaid readability tests (Kincaid et al., 1975). The two tests include the Flesch Reading Ease test and the Flesch-Kincaid grade level test. The Flesch Reading Ease test uses the following formula:

$$206.835 - 1.015 \left(\frac{Total\ number\ of\ words}{Total\ number\ of\ sentences}\right) - 84.6 \left(\frac{Total\ number\ of\ syllables}{Total\ number\ of\ words}\right)$$

This formula provides a set of scores ranging from zero "Extremely difficult to read," to 100 "Very easy to read." The Flesh-Kincaid grade level test uses the following formula:

$$0.39 \left(\frac{Total\ number\ of\ words}{Total\ number\ of\ sentences}\right) + 11.8 \left(\frac{Total\ number\ of\ syllables}{Total\ number\ of\ words}\right) - 15.59$$

To determine the appropriateness of the selected text, this formula calculates a number that corresponds to a given grade level in which readers would be able to comprehend the text (Kincaid et al., 1975). Considering both formulas are derived based on the average sentence length (i.e., total number of words divided by total number of sentences) and average syllables per word (i.e., total number of syllables divided by total number of words), it would make sense that shorter vocabulary words and concise survey items would improve readability scores. Other recommendations for questionnaire design aimed to improve comprehension include using

unambiguous language as well as avoiding double negation and double-barreled questions, and these have been shown to be problematic for children (Arthur et al., 2017; Bell, 2007; Borgers & Hox, 2000; de Leeuw, 2011; Krosnick & Presser, 2010).

Some scholars have also provided recommendations regarding the number of response options offered for Likert scales. Krosnick and Presser (2010) state there is not a widely adopted standard regarding the best number of response options when surveying the general population, and in practice, the number of response options offered varies greatly across survey instruments. However, some scholars have recommended utilizing a five-point scale when surveying youth, as youth may not be able to make fine-grained distinctions (e.g., slightly agree, mostly agree, completely agree) and adequately differentiate between small deviations in the wording of scale anchors (Bell, 2007; Krosnick & Presser, 2010). Additionally, fewer response options reduce the cognitive demands necessary to make an appropriate response selection during the response process (Bell et al., 2007; Borgers et al., 2004). When providing response options, most surveys will minimally provide scale anchors for the most extreme options. With youth, providing completely labeled scale anchors is recommended as this avoids respondents from inferring the meaning of unlabeled scale anchors and can reduce the burden on participants during the question-answering process (de Leeuw, 2011; Krosnick & Presser, 2010).

Current Project

The current project has three major aims which will be investigated across three studies. The purpose of Study 1 is to empirically examine the internal structure for youth athletes' responses to the IBQ. The purpose of Study 2 is to identify and then modify problematic IBQ items to create the Youth Interpersonal Behaviors Questionnaire in Sport (Y-IBQ). The purpose of Study 3 is to examine the psychometric properties of the newly revised Y-IBQ. Accomplishing

the aims outlined in the current project will contribute toward three major outcomes. Purpose 1 will address the recommendation by Wekesser et al. (2021) to conduct further psychometric testing of the IBQ with youth populations. Achieving Purpose 2 will address possible reasons for psychometric issues while providing a modified version of the IBQ (i.e., the Y-IBQ) that will undergo pilot testing with youth. Finally, accomplishing Purpose 3 will provide reliability and validity evidence (as recommended by AERA et al., 2014) for the newly revised Y-IBQ to assess youth athletes' perceptions of coach behaviors that influence basic need satisfaction and thwarting.

CHAPTER III: MATERIALS AND METHODS

This project employed a sequential mixed-methods design. This approach included three separate studies beginning with a quantitative phase, followed by a qualitative phase to explain the quantitative results, and ended with a quantitative phase to test the qualitative results (Creswell, 2015). Each phase of data analysis determined what needed to be further explored in the subsequent phase. In this project, Study 1 consisted of a quantitative, secondary data analysis to investigate psychometric issues reported when using the IBQ with youth (e.g., Wekesser et al., 2021) by examining the internal structure of youth athletes' responses to the IBQ. In Study 2, qualitative, cognitive think-aloud interviews were conducted to (a) examine specific items contributing to the psychometric issues and (b) pretest developmentally driven modifications to the IBQ. Study 3 provided initial validity evidence for the newly developed Youth Interpersonal Behaviors Questionnaire (Y-IBQ) by quantitatively examining the internal structure using an exploratory structural equation modeling (ESEM) approach. The following section contains the materials and methods information for each of the three studies.

Study 1: Quantitative Secondary Data Analysis

Participants and Procedure

This secondary analysis used item-level data from a previous study examining how coaching behaviors and coach-athlete relationship quality influenced youth athletes' intentions to continue sport participation (Wekesser et al., 2021). Wekesser et al. (2021) focused on six observed composite scores (i.e., not item-level data) derived from responses to the IBQ (e.g., autonomy-supportive, autonomy-thwarting, etc.) and assumed that the internal structure reported in Rocchi, Pelletier, and Desmarais (2017) held for youth athletes. The current study focused on responses to individual IBQ items with a latent variable approach and tested the assumption that

the internal structure found in Rocchi, Pelletier, and Desmarais (2017) held for youth athletes. Cross-sectional data were collected in the United States between the Fall of 2018 and the Spring of 2019 from 148 athletes aged 11 to 16 (M = 13.83 ± 1.58). A slight majority of participants identified as female (54.7%), and participants came from 13 different individual or team sports.

Measures

Participants completed demographic questions and three survey measures. The current study will examine demographic and coaching behaviors data only.

Demographic Questionnaire

Information was collected regarding participants' age, gender identity, sport type, ethnicity, race, and months spent playing sport with their coach.

Coach Interpersonal Behaviors

The IBQ (Rocchi, Pelletier, & Desmarais, 2017) was used to assess athletes' perceptions of coach behaviors that satisfy or thwart athlete basic psychological needs. The IBQ consists of 24 items spanning six subscales with four items in each subscale. Items are rated on a seven-point Likert scale with 1 indicating "Do not agree" and 7 indicating "Completely agree". Average scores were calculated for each subscale. An example item from the autonomy-support subscale is, "My coach supports my decisions." Internal consistency for composite scores measured via McDonald's (1970) omega coefficient (ω) was: .82 for autonomy-supportive, .72 for autonomy-thwarting, .79 for competence-supportive, .67 for competence-thwarting, .81 for relatedness-supportive, and .70 for relatedness-thwarting. A copy of the IBQ instrument is included in Appendix A.

Data Analysis

The percentage of missing data was less than one percent (i.e., ~0.2%). The model was

estimated using full information maximum likelihood that handled missing data under the missing at random assumption consistent with suggestions from Patel et al. (2021). Item-level descriptive statistics are presented in Table 1. Table 2 shows item-level Pearson correlations. Latent construct reliability was measured with coefficient *H* (Hancock & Mueller, 2001) using structure coefficients (Graham et al., 2003). Next, a confirmatory factor analysis (CFA) was conducted using the structural equation modeling software in M*plus* 7.4 (Muthén & Muthén, 1998-2017). Figure 1 shows the a priori measurement theory (i.e., internal structure) for youth athletes' responses to the IBQ. This six-factor model was originally proposed by Rocchi, Pelletier, and Desmarais (2017) when examining adults' responses to the IBQ and is theoretically grounded in BPNT (Ryan & Deci, 2000a). The model was estimated using a maximum likelihood robust (MLR) estimator consistent with Rocchi, Pelletier, and Desmarais (2017). Data were treated as continuous, and the Satorra-Bentler scaling method was employed to provide standard errors and a mean-adjusted chi-square test statistic robust to nonnormality (MLR; Yuan & Bentler, 2000). Model data fit was assessed using Hu and Bentler's (1999) recommended heuristics for χ^2, RMSEA, CFI, TLI, and SRMR.

Power Estimation

A post-hoc power analysis for model-data fit (e.g., Hancock & French 2013; MacCallum et al., 1996) was conducted as advocated in exercise science (e.g., Myers et al., 2016; Myers et al., 2018). For the power analysis, alpha was set to .05. Degrees of freedom (*df*) were set to 237 consistent with Rocchi, Pelletier, and Desmarais (2017). Sample size was set to 148 consistent with Wekesser et al. (2021). Population model data fit (ε) was set to .05 in the null condition (ε_0) to represent close fit consistent with general methodological recommendations (McCallum et al., 1996; Steiger & Lind, 1980) and the observed RMSEA value of .05 reported in Rocchi, Pelletier,

and Desmarais (2017) with adults. Population model data fit was set to .08 in the alternative condition (ε_1) to represent unclose (i.e., poor) fit consistent with general methodological recommendations (McCallum et al., 1996; Steiger & Lind, 1980) and psychometric concerns expressed in Wekesser et al. (2021) with youths. Power was calculated using an online utility (Preacher & Coffman, 2006), and power estimation equaled .99.

Study 2: Qualitative Cognitive Interviews

Cognitive Interviewing Method

Cognitive interviewing is a common method that has been used to identify and correct problems with survey items (Beatty & Willis, 2007). This method taps into the unobservable thought processes used when answering survey questions by evaluating response quality and determining if the question is generating the intended response. The cognitive interviewing process involves distributing survey questions to a participant while simultaneously collecting verbal information about their responses and process of selecting a response. This can be achieved by asking participants to think out loud as they read and respond to items, report how they arrived at the answer, and voice any difficulties they had while answering (Woolley et al., 2004). The two major approaches to cognitive interviewing include think-aloud interviewing and verbal probing techniques (Willis, 2012). Many researchers use a combination of the techniques to help identify problems (i.e., errors) and diagnose the root of them (Beatty & Willis, 2007). Further, it is recommended that interviews are conducted in iterative rounds with questionnaire revisions made between rounds until few new insights are found. Cognitive interviewing techniques are common for testing survey items with youth populations due to children's varying stages of cognitive development (LaPietra et al., 2020; Silva et al., 2019). Considering psychometric concerns found when using the IBQ measure in youth populations (Wekesser et

al., 2021), cognitive interviewing can be an appropriate method to assist in detecting and modifying problematic items, so they are developmentally appropriate for youth and adequately measure youths' perceptions.

Participants

Participants were eligible for the study if they were between nine and 14 years old and participating in a sport that involved working with a coach. Participants from any competitive level were allowed to participate. The sample consisted of 14 athletes (50% female) ranging from nine to 14 years old (M_{age} = 11.57 ± 1.65). Participants came from a variety of sports including soccer (n = 8), dance (n = 2), basketball (n = 1), swimming (n = 1), tennis (n = 1), and hockey (n = 1). Each round of interviews varied in the number of participants which are listed as follows: Round 1 (n = 4), Round 2 (n = 8), and Round 3 (n = 2).

Procedure

After receiving institutional review board approval from Michigan State University (approval #: 00005616), coaches and/or parents of participants were contacted via personal contacts and snowball sampling. Interested guardians and children were provided with informed consent documents and were given the opportunity to ask questions about the study. Guardians signed informed consent documents, while the youth participants signed the child assent forms. Then, interviews were scheduled and initiated via Zoom. Before the interview formally began, the assent form was reviewed with participants, and child assent was confirmed verbally. Guardians were given the option to be present during the interview but were asked not to participate unless they had a question or requested to end the interview.

The interviewer shared a computer screen with two practice questions to familiarize participants with the cognitive think-aloud interviewing technique and the types of responses

they would need to provide. Participants were instructed to read each question aloud, explain what they were thinking while formulating a response, and describe how/why they arrived at that response. After completing the practice questions, the interviewer continued this protocol with each IBQ survey item. During the interviews, direct probing about the interpretation of questions and responses was used to identify the source of response error. An example of a direct probe was, “I noticed that you hesitated. Could you tell me what you were thinking?” Participants were encouraged to ask questions often and report any difficulties experienced when answering the questions. Each interview was recorded, and interviews lasted approximately 30 minutes. The cognitive think-aloud interview protocol applied in the current study and a list of probes are presented in Appendix B.

Measure

In Round 1, participants responded to the 24 survey items from the IBQ described in Study 1. In subsequent rounds, participants responded to the IBQ items, however, the language of some items was modified between rounds based upon the problems encountered by participants during the previous round of interviews. Participants also answered questions about the difficulty of survey items and were asked to provide general advice for improving the questionnaire.

Data Analysis

Cognitive interviews were analyzed using a combined approach of detailed note-taking with the coding of errors during the interview as well as systematic review and coding of errors from verbatim interview transcripts (Blair & Brick, 2010). While Willis (2005) purports data analysis can be completed solely through notetaking, a combined approach was utilized to permit the interviewer to recognize and categorize problematic items immediately while also allowing

for thorough analysis afterward to identify any omitted problems. Participant errors were identified and coded using the four-step response model (Tourangeau, 1984) as a coding framework (i.e., comprehension, retrieval, judgment, response). In some cases, errors received more than one code. Additionally, "struggles" were coded when a participant had clear difficulty answering the question but eventually generated an appropriate response (Al-Janabi et al., 2013). Once minimal new errors were detected, the interview round was complete.

Modifications were made with the intent to revise items that could be problematic for a typical child taking the survey. With this in mind, the goal was to keep items as clear and concise as possible, as this is recommended to improve reliability in children's responses to survey items (Borgers & Hox, 2000). Identifying noticeable patterns where participants had issues indicated item modification was necessary (e.g., multiple children had problems with the same item). After the first round of interviews, the interviewer (MW) consulted with a team of experienced youth sport researchers to discuss problematic survey items and potential revisions to address the problems experienced by participants. The coding framework guided the types of modifications needed to address problematic items. Revised survey items were included in the next round of interviews with a goal for the rate of problem identification to decline across revision rounds. To assess readability of the modified survey directions and items, readability scores were calculated for the Flesh-Kincaid grade level test and Flesch Reading Ease test (Kincaid et al., 1975) using an online text readability calculator (Text Readability Consensus Calculator, n.d.).

Study 3: Exploratory Structural Equation Modeling

Sample Size Determination

An a priori power analysis was conducted for the ESEM as advocated in exercise science (Myers et al., 2016; Myers et al., 2018). For the power analysis, alpha was set to .05 with a

desired power quotient of .80. Degrees of freedom (*df*) were set to 147. Population model data fit (e) was set to .05 in the null condition (e_0) to represent an upper boundary of close fit consistent with general methodological recommendations (McCallum et al., 1996; Steiger & Lind, 1980). Population model data fit was set to .025 in the alternative condition (e_1) to represent close (i.e., but imperfect) fit consistent with general methodological recommendations (McCallum et al., 1996; Steiger & Lind, 1980). Power was calculated using an online utility (Preacher & Coffman, 2006), and a minimum sample of 200 athletes was needed.

Participants

Participants were recruited from sports teams and competitions of varying competitive levels throughout the midwestern region of the United States. The sample included 330 youth athletes between the ages of nine to 14 years (M = 11.95 ± 1.56). A slight majority identified as male (n = 190), while others identified as female (n = 137), non-binary (n = 2), or preferred not to answer (n = 1). A total of 13 sports were represented including baseball, basketball, cross country, dance, football, gymnastics, hockey, lacrosse, soccer, softball, swimming, volleyball, and wrestling. The highest participation came from basketball (n = 116) and swimming (n = 45).

Procedure

After institutional review board approval from Michigan State University (approval #: 00008493), sport administrators, coaches, and/or parents were contacted for recruitment. After providing consent, parents completed a demographic questionnaire based on their child's primary sport. Then, athletes provided assent and were prompted to answer survey questions about the coach in their primary sport. The survey packet consisted of four measures including the Youth-Interpersonal Behaviors Questionnaire developed in Study 2, the Sport Motivation Scale-Youth (Harris & Watson, 2011), the Motivational Climate Scale for Youth Sports

(MCSYS; Smith et al., 2008), and three items assessing athletes' intentions to continue sport participation in the next year (e.g., Chatzisarantis & Hagger, 2009; Wekesser et al., 2021). The surveys took approximately 10 to 15 minutes to complete. Study 3 examines the Y-IBQ survey data only.

Measures

Demographic Information

Demographic information was collected for athletes' age, gender identity, ethnicity, race, primary sport, competition level, team name, initials of their primary coach, and amount of time spent working with their primary coach. A list of the demographic questions for Study 3 is provided in Appendix C.

Coach Interpersonal Behaviors

The Youth Interpersonal Behaviors Questionnaire developed in Study 2 was utilized to examine athletes' perceptions of coach interpersonal behaviors that support or thwart athletes' basic needs. The Y-IBQ consists of six subscales with four items each. Items are rated on a five-point Likert scale with 1 = "Completely disagree", 2 = "Somewhat disagree", 3 = "Neutral", 4 = "Somewhat agree", 5 = "Completely agree". Average scores are calculated for each subscale. The Y-IBQ measure is provided in Appendix D.

Data Analysis

To account for the high correlations observed among latent factors in Study 1, an ESEM approach (Asparouhov & Muthén, 2009) was used to allow for free estimation of cross-loadings among items and factors. The model was fitted in M*plus* 7.4 (Muthén & Muthén, 1998-2017) and used an oblique target rotation (Browne, 1972, 2001) consistent with recent methodological research on target rotation in ESEM (Myers et al., 2013; Myers et al., 2015). Figure 2 shows the

a priori measurement theory for youths' responses to the Y-IBQ using an ESEM approach. Since data were hierarchical due to the nesting of athletes within coaches, the ESEM model specified coach as a cluster variable and modeled a pooled within-cluster covariance matrix to account for dependency due to coach (e.g., Muthén, 1989). Weighted least squares mean- and variance-adjusted (WLSMV) estimation was applied to account for the categorical nature of data (Finney & DiStefano, 2013; Muthén, 1984) consistent with recent recommendations in physical education and exercise science (Myers et al., 2023). The percentage of missing data was less than one percent (i.e., ~0.9%). Missing data were handled using pairwise present under the missing at random assumption outlined in Patel et al. (2021). Model data fit was assessed using Hu and Bentler's (1999) recommended heuristics for χ^2, RMSEA, CFI, and TLI. Latent construct reliability was measured with coefficient *H* (Hancock & Mueller, 2001) using structure coefficients (Graham et al., 2003). The M*plus* ESEM input file, which details the target rotation matrix, is available in Appendix E.

FIGURES

Figure 1

A Priori Measurement Theory for Responses to the Interpersonal Behaviors Questionnaire (IBQ) from a Confirmatory Factor Analysis Perspective

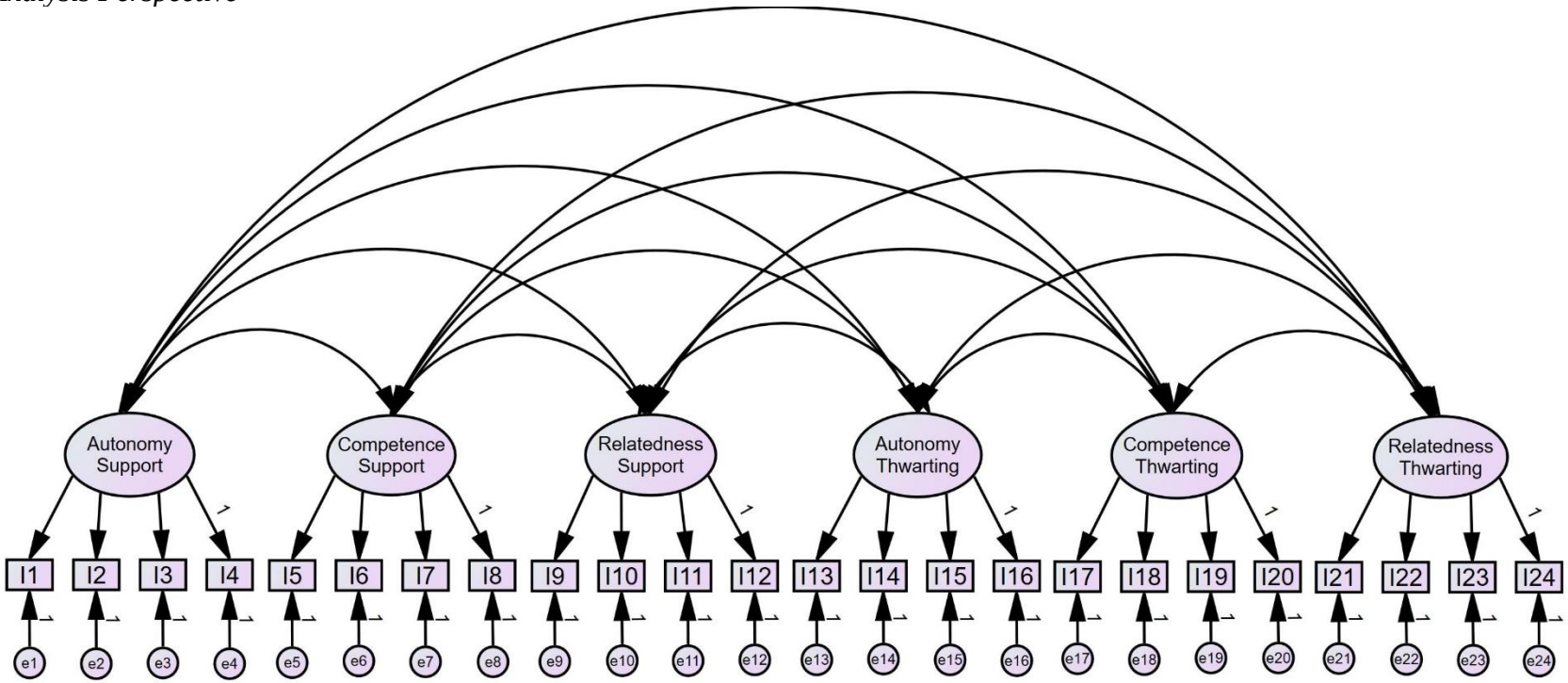
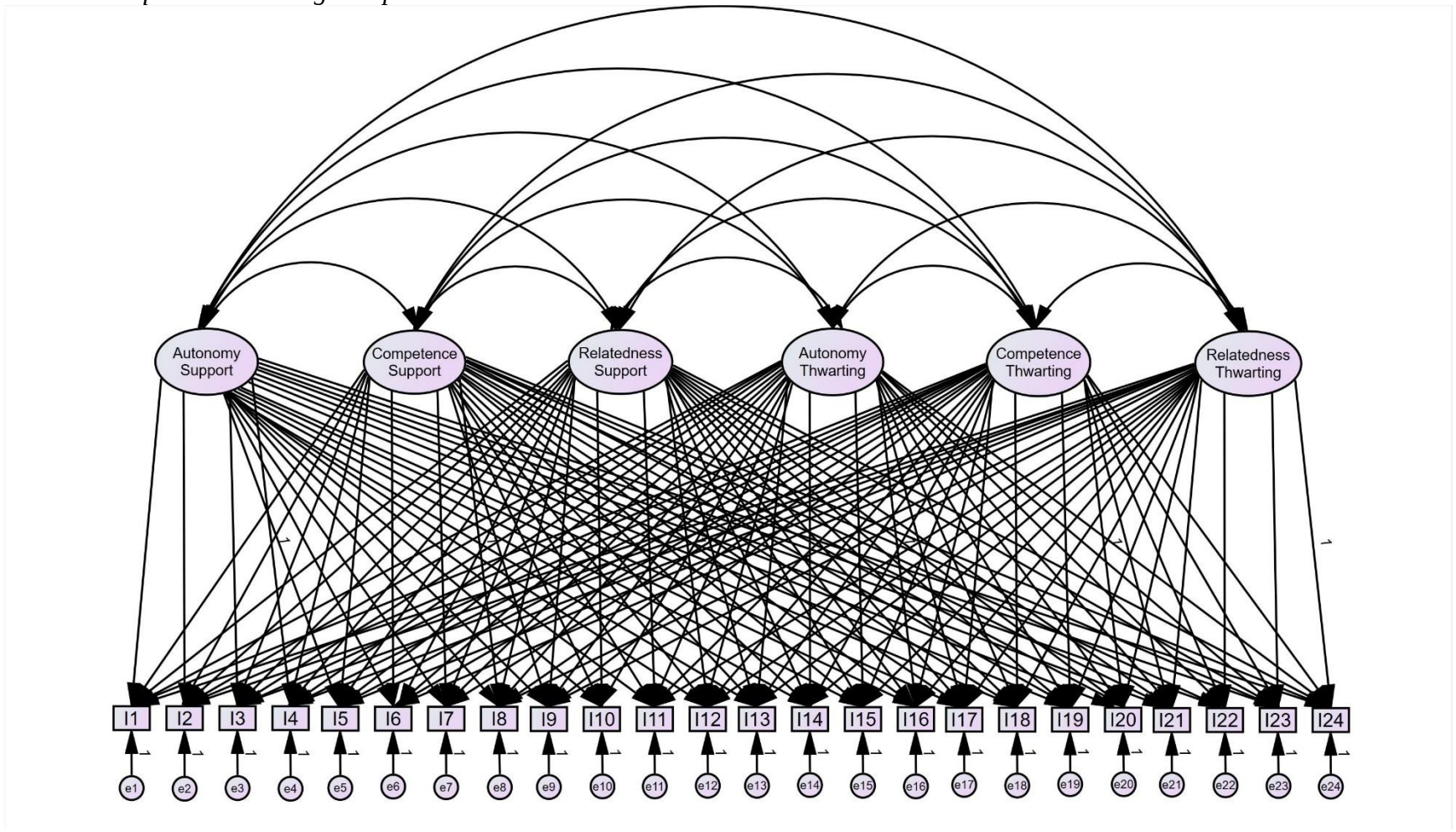


Figure 2

A Priori Measurement Theory for Responses to the Youth Interpersonal Behaviors Questionnaire (Y-IBQ) from an Exploratory Structural Equation Modeling Perspective



CHAPTER IV: RESULTS

The following section contains the results for each phase of the sequential mixed-methods design. Item-level descriptive statistics and CFA results are presented in Study 1. In Study 2, qualitative results are provided for each round of cognitive think-aloud interviews. Study 3 includes the ESEM results and latent construct reliability for the newly developed Y-IBQ instrument.

Study 1: Quantitative Secondary Data Analysis

Descriptive Statistics

Table 1 shows the item-level descriptive statistics (i.e., means, standard deviations, ranges) for the IBQ. Participants reported high mean scores on the autonomy-, competence-, and relatedness support items with means for each item larger than five. This indicates athletes generally felt their coach exhibited behaviors that supported their basic psychological needs. Participants reported low mean scores on the competence- and relatedness-thwarting items, with means for each item smaller than three. This indicates that athletes generally felt their coaches did not engage in behaviors that thwarted competence and relatedness. However, on the autonomy-thwarting items, participants scored in the mid-range with means spanning from 2.61 to 4.71 on the various items. This indicates that athletes perceived both autonomy-supportive and autonomy-controlling behaviors from their coaches.

Table 2 provides item-level Pearson correlations for responses to the IBQ scale items. Generally, inter-item reliability was lower amongst the thwarting items compared to the supportive items. Convergent correlations refer to item-level correlations within a scale dimension (e.g., correlation among all autonomy-support items). Divergent correlations refer to item-level correlations outside a scale dimension but of the same valence (e.g., correlation

among all competence- and relatedness-support items). For each dimension, the average item-level convergent correlation was greater than the average item-level divergent correlation: .53 versus .45 for autonomy-support, .48 versus .39 for competence-support, .50 versus .44 for relatedness-support, .39 versus .26 for autonomy-thwarting, .33 versus .28 for competence-thwarting, and .37 versus .30 for relatedness-thwarting. The difference between the average convergent and divergent correlation within each dimension was modest (i.e., ranged from .05 for competence-thwarting to .13 for relatedness-support), suggesting little differentiation between sets of items by dimension. Further, the average convergent correlation within each dimension ranged from only small-moderate (i.e., .33 for autonomy-thwarting) to moderate (i.e., .53 for autonomy-support) in size, suggesting modest common variance among items within dimensions. These patterns of item-level correlations collectively provided modest descriptive evidence for the a priori measurement theory for youth athletes' responses to the IBQ measure.

Confirmatory Factor Analysis and Latent Construct Reliability

The model was empirically identified, and model estimation terminated normally. There was, however, a warning that the latent variable matrix was non-positive definite and that this may have been due to linear dependency among more than two latent variables. The observation of a non-positive definite latent variable matrix is not surprising given the large model, small sample size, and highly correlated latent variables (e.g., MacCallum et al., 2009). The following results should be interpreted with modest caution, however, because there is simulation evidence that suggests the results are likely trustworthy (MacCallum et al., 2009).

Model-data fit statistics indicated that the null hypothesis for exact fit was rejected $\chi^2(237) = 412.56$, $p < .001$, and that overall model-data fit was poor (RMSEA [$CI_{90\%}$] = .071 [.059, .082], CFI = .842, TLI = .816, SRMR = .075). Table 3 provides standardized pattern

coefficients (i.e., factor loadings), standard errors, and latent construct reliability coefficient *H* values for responses to the IBQ. The standardized factor loadings for each item were larger than .41. When informally comparing the standardized factor loadings to those in the original validation study (Rocchi, Pelletier, & Desmarais, 2017), the loadings in the current study were lower for most items, and generally, the differences were larger on the thwarting items compared to the supportive items. Latent construct reliability was good and ranged from $H = .85$ for competence-thwarting to $H = .92$ for both autonomy- and relatedness-support. Correlations between latent variables ranged from -.23 to .94 (see Table 4). Very high correlations were observed between autonomy- and relatedness-supportive ($r = .94$) and competence- and relatedness-thwarting ($r = .88$) which indicated some redundancy (and likely the source of the non-positive definite latent variable matrix). In sum, while latent reliability was good, poor model-data fit and high factor correlations indicated problems with the internal structure (i.e., validity) for youth (i.e., consistently measuring an ill-defined construct). Thus, further investigation using qualitative interviews is warranted to explain the quantitative results.

Study 2: Qualitative Cognitive Interviews

Qualitative Results

A general overview is outlined before presenting results specific to each interview round. Additionally, an overview of revisions made to the scale after each interview round can be found in Table 5. The final revised Y-IBQ is provided in Appendix D.

Overview

Across three interview rounds, 19 out of 24 items were shown to have at least one participant experience a problem or struggle when answering. Four participants completed Round 1 totaling 28 combined problems and struggles with an average of seven per person. Ten

items were shown to have at least one participant experience a problem, and one item was coded as a struggle. Most participants in this round encountered problems with the same five items (i.e., items 13, 15, 18, 21, 23), indicating revisions were necessary. Additionally, three of those items (i.e., 13, 18, 23) displayed the lowest factor loadings in Study 1. Eight participants completed Round 2 (M_{issues} = 4.13) where 11 items were shown to have at least one participant experience a problem, and five items were coded as struggles. While there were more items with problems and struggles compared to round 1, the average number per person was lower. Two participants completed Round 3 (M_{issues} = 3.00) where three items had problems, and three items had struggles. A detailed analysis of the errors that occurred within each interview is provided in Appendix F. Overall, the average number of problems and struggles decreased across each interview round and the corresponding iteration of the survey.

Round 1

Of the 28 problems and struggles identified, 23 involved item comprehension. One factor influencing comprehension was the complexity of item wording. For example, all participants had difficulty comprehending the words, "incompetent" and "imposes". This was apparent when participants acknowledged they did not know what the word meant or asked for a definition. One participant asked, "Could you give me the definition of incompetent? I think I know what it is but I'm not totally sure." Another issue leading to comprehension problems was item ambiguity. For example, the item "My coach is distant when we spend time together" was problematic for three of the four participants. Specifically, the word "distant" was ambiguous and confusing as participants considered physical distance rather than emotional distance. One participant stated, "I kind of know what it means, but I kind of don't at the same time. Distant…does that mean far away or not really paying attention?" Another ambiguous item deemed problematic by

participants read, “My coach pressures me to adopt certain behaviors.” This item was misunderstood and confusing for participants because “pressures” was not viewed in a thwarting way, and the word “adopt” was ambiguous by carrying multiple meanings. Other problems stemmed from negatively phrased questions which influenced the response process. Participants struggled with questions such as, “My coach does not comfort me when I am feeling low.” When asked to rate their opinions from 1 “Do not agree” to 7 “Completely agree”, participants had difficulty processing the negatively phrased question stem in addition to the negative response anchor (i.e., double negative), which led to unintended responses (e.g., a participant says coach does not comfort them when they do). Some participants would ask for clarification to ensure their intended response. One participant clarified, “The lower [the number] is, does it mean not comfort me?” The modifications made after Round 1 focused on comprehension, the first step in the item response process. To address these problems, complex item wording was modified to plain language (e.g., replacing a word with a synonym) or item wording was adjusted.

Round 2

Thirty-three problems or struggles were detected across eight participants, yet one participant accounted for 11 of the 33. Item comprehension problems and struggles occurred less frequently (i.e., eight identified) indicating improvement based upon the modifications. However, problems/struggles were apparent in the retrieval and response processes with 10 and 13 respectively noted. A retrieval issue was noted at least once on five items. Four of those assessed relatedness- support or thwarting, indicating potential difficulty in gauging this dimension of SDT. The item, “My coach honestly enjoys spending time with me” was challenging to answer because a few athletes felt they had not spent enough time with their coach to answer appropriately. One participant explained, “I haven’t really spent any one-on-one [time]

like out of practice."

Item 23 (i.e., "My coach is uninterested when we spend time together") was especially problematic with five of the eight participants having problems or struggles due to comprehension, retrieval, or the response process. Some participants did not understand the meaning of "uninterested" or read it as "interested", which fundamentally changed the question meaning and intended response. In addition, retrieval was difficult where one athlete described:

> We don't really spend that much time together cause she's usually off doing coaching things and stuff. But when we are, she um, she'll listen to you. I don't know if she's interested in what you're talking about, but she won't be like this is boring bye.

Finally, participants had errors during the response process by selecting a response opposite of what they intended. One participant explained, "…the fact that there are double negatives really can confuse people." While item 23 was especially problematic, there were other items that caused problems during the response process which stemmed from the double negative in the question stem and response. To address issues in this interview round, the questionnaire directions were modified to provide participants with a more thorough explanation of how to respond to survey items. The modified directions encouraged participants to consider how much they agree or do not agree with the statements, explained scale anchors, reminded participants they can choose any number on the scale, and prompted participants to say "My coach…" before each statement. Additionally, one item (i.e., "My coach does not pay attention to me") was added to the interviews for comparison with item 23 to see if participants responded better to the adjusted item wording.

Round 3

Three problems and three struggles were encountered by one participant, while the other

had none. Of the issues encountered, three were coded as comprehension. One participant stumbled on the word "encourages" for two separate items, however, this was the first time a participant had difficulty with that word across the three interview rounds. The other comprehension issue had also been noted in Round 2 where "uninterested" was read as "interested" which led to an error in interpreting the question. Two items involved retrieval issues where the participant did not feel they had relevant experiences in sport to adequately respond. When responding to the item, "My coach does not comfort me when I am feeling sad", the participant said, "I never really get sad at soccer, so it doesn't really work." The last problem involved the response process where the participant gave an unintended answer due to difficulty processing the double negatives. Although the participant had a problem processing the double negative on the item, this only occurred one time, so it appears that modifying the directions was beneficial to increase understanding of how to respond to items with negative question stems.

Final survey modifications included minor wording changes to make directions/items clearer and more succinct, adding the "My coach…" question stem before each question as a cue to focus on the coach's influence, and adjusting the seven-point scale to a five-point scale to attend to scale effects for children. Additionally, item 23 was removed and replaced with the comparison item included in the previous round of revisions. After final revisions were made, face validity was established by asking two experienced youth sport researchers to indicate whether the items were representative of the corresponding scales and indicate the suitability of the items for youth based on comprehension and clarity. Readability tests showed that the Flesch Reading Ease score was 90.60, indicating that the Y-IBQ is "very easy to read." Further, the Y-IBQ demonstrated a Flesch-Kincaid grade level score of 2.5, which corresponds to a third-grade level of reading. Study 2 identified problems with the IBQ instrument for youth, leading to a

modified instrument, the Y-IBQ. Further quantitative analyses are necessary to test the psychometric properties of the Y-IBQ with youth athletes.

Study 3: Exploratory Structural Equation Modeling

Quantitative ESEM Results

The percentage of observed responses for each Y-IBQ scale item is presented in Table 6. For the autonomy-, competence-, and relatedness-supportive coach behavior items, a general pattern of responses was exhibited with a higher frequency of responses in the categories "Somewhat Agree" and "Completely Agree" compared to the other response categories. For the autonomy-, competence-, and relatedness-thwarting coach behavior items, a higher frequency of responses were observed in the "Completely Disagree" and "Somewhat Disagree" categories.

The model was empirically identified, and model estimation terminated normally with no error messages. Model-data fit statistics indicated that the null hypothesis for exact fit was rejected $\chi^2(147) = 194.48$, $p = .005$, but there was evidence for good model-data fit overall (RMSEA [$CI_{90\%}$] = .031 [.018, .043], CFI = .991, TLI = .983). Table 7 provides target-rotated standardized pattern coefficients, standard errors, item-level variance accounted for (R^2), and latent construct reliability coefficient *H* values for responses to the Y-IBQ. The target-rotated pattern coefficient matrix was mostly consistent with the a priori measurement theory, where items had meaningful standardized pattern coefficients on the intended coach behavior factor and non-meaningful standardized pattern coefficients on the remaining coach behavior factors. However, there were some exceptions where a significant pattern coefficient loaded onto a factor with the same basic need but opposite valence (e.g., items intended to load onto the competence-support factor had significant, negative factor loadings on the competence-thwarting factor). This occurred for at least one pattern coefficient on each of the competence-support, relatedness-

support, competence-thwarting, and relatedness-thwarting factors. While item 5 was intended to measure competence support, its standardized primary coefficient was negligible (i.e., $\lambda = .12$), and loaded better onto the competence-thwarting and relatedness-support factors ($\lambda = -.37$ and $\lambda = .30$ respectively). Finally, while item 20 was intended to measure competence thwarting, its standardized primary coefficient also had significant lambdas on the competence-support ($\lambda = -.40$), relatedness-support ($\lambda = .41$), and relatedness-thwarting factors ($\lambda = .43$). Although some of the items performed unexpectedly, they were retained in their respective dimensions to maintain consistency with the original IBQ instrument (i.e., Rocchi, Pelletier, & Desmarais, 2017). Item-level variance accounted for ranged from $R^2 = 38\%$ (item 17) to 86% (item 20) with an average of $R^2 = 63\%$. Latent construct reliability was good across all factors and ranged from .87 to .92. Correlations between latent variables ranged from -.53 to .50 (See Table 8). The range of correlations observed in Study 3 exhibits less redundancy compared to the values observed in Study 1 (i.e., -.23 to .94).

TABLES

Table 1

Descriptive Statistics for Each Interpersonal Behaviors Questionnaire (IBQ) Scale Item

IBQ Scale Dimension	Item number and content	*M* ± *SD*	Min	Max
Autonomy-Support	1. My coach gives me the freedom to make my own choices	5.25 ± 1.49	1.00	7.00
	2. My coach encourages me to make my own decisions	5.65 ± 1.39	1.00	7.00
	3. My coach supports the choices I make for myself	5.66 ± 1.43	1.00	7.00
	4. My coach supports my decisions	5.92 ± 1.26	1.00	7.00
Competence-Support	5. My coach tells me that I can accomplish things	6.30 ± 1.11	2.00	7.00
	6. My coach encourages me to improve my skills	6.61 ± 0.82	1.00	7.00
	7. My coach provides valuable feedback	6.16 ± 1.19	1.00	7.00
	8. My coach acknowledges my ability to achieve my goals	6.31 ± 0.99	1.00	7.00
Relatedness-Support	9. My coach relates to me	5.09 ± 1.55	1.00	7.00
	10. My coach is interested in what I do	5.98 ± 1.23	1.00	7.00
	11. My coach honestly enjoys spending time with me	5.31 ± 1.50	1.00	7.00
	12. My coach takes the time to get to know me	5.53 ± 1.68	1.00	7.00
Autonomy-Thwarting	13. My coach pressures me to adopt certain behaviors	4.71 ± 1.94	1.00	7.00
	14. My coach pressures me to do things their way	3.27 ± 1.91	1.00	7.00
	15. My coach imposes their opinions on me	3.48 ± 1.94	1.00	7.00
	16. My coach limits my choices	2.61 ± 1.69	1.00	7.00
Competence-Thwarting	17. My coach points out that I will likely fail	1.55 ± 1.32	1.00	7.00
	18. My coach sends me the message that I am incompetent	1.77 ± 1.30	1.00	7.00
	19. My coach doubts my capacity to improve	1.55 ± 1.29	1.00	7.00
	20. My coach questions my ability to overcome challenges	2.16 ± 1.81	1.00	7.00
Relatedness-Thwarting	21. My coach does not comfort me when I am feeling low	2.31 ± 1.77	1.00	7.00
	22. My coach does not connect with me	2.14 ± 1.63	1.00	7.00
	23. My coach is distant when we spent time together	2.74 ± 1.77	1.00	7.00
	24. My coach does not care about me	1.28 ± 0.85	1.00	6.00

Note. N = 148. Possible scores range from 1 to 7. M = Mean, SD = Standard Deviation, Min = Minimum, Max = Maximum

Table 2

Item-Level Pearson Correlations for Responses to the Interpersonal Behaviors Questionnaire (IBQ)

IBQ Subscale	Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	1	---																							
Autono. Support	2	**.70**	---																						
	3	**.35**	**.51**	---																					
	4	**.48**	**.60**	**.52**	---																				
	5	.36	.60	.46	.52	---																			
Compet. Support	6	.30	.34	.29	.50	**.42**	---																		
	7	.34	.37	.31	.49	**.39**	**.44**	---																	
	8	.35	.47	.33	.45	**.57**	**.50**	**.56**	---																
	9	.57	.63	.44	.58	.54	.41	.40	.45	---															
Related. Support	10	.43	.59	.47	.43	.63	.25	.32	.51	**.47**	---														
	11	.47	.57	.41	.58	.45	.18	.29	.31	**.61**	**.45**	---													
	12	.48	.53	.33	.46	.40	.18	.34	.33	**.50**	**.35**	**.60**	---												
	13	-.08	-.02	-.03	-.03	-.03	.08	-.04	.00	-.10	.00	-.12	-.09	---											
Autono. Thwart	14	-.22	-.28	-.06	-.17	-.13	-.20	-.24	-.24	-.25	-.10	-.15	-.24	**.38**	---										
	15	-.29	-.18	-.16	-.11	-.03	.02	-.15	-.14	-.07	-.18	-.09	-.05	**.36**	**.30**	---									
	16	-.34	-.29	-.07	-.22	-.10	-.02	-.13	-.21	-.17	-.19	-.10	-.15	**.30**	**.45**	**.54**	---								
	17	-.34	-.18	-.01	-.16	-.11	-.05	-.15	-.11	-.19	-.04	-.19	-.21	.15	.23	.16	.36	---							
Compet. Thwart	18	-.14	-.14	-.19	-.24	-.13	-.08	-.17	-.20	-.19	-.11	-.11	-.07	.22	.08	.25	.35	**.25**	---						
	19	-.20	-.04	.00	-.09	-.10	-.18	-.26	-.21	-.07	-.05	.02	-.05	.21	.13	.25	.34	**.42**	**.42**	---					
	20	-.36	-.29	-.06	-.24	-.15	-.05	-.22	-.18	-.20	-.28	-.23	-.29	.19	.28	.26	.42	**.26**	**.20**	**.43**	---				
	21	-.28	-.30	-.24	-.36	-.35	-.30	-.36	-.35	-.33	-.29	-.29	-.25	.24	.41	.24	.41	.26	.39	.30	.34	---			
Related. Thwart	22	-.23	-.26	-.18	-.32	-.28	-.36	-.33	-.34	-.42	-.21	-.33	-.35	.16	.41	.08	.30	.38	.14	.16	.25	**.52**	---		
	23	-.22	-.08	-.05	-.16	-.14	-.10	-.22	-.30	-.22	-.16	-.14	-.13	.15	.35	.44	.41	.25	.41	.32	.34	**.35**	**.24**	---	
	24	-.31	-.27	-.12	-.31	-.21	-.18	-.33	-.26	-.23	-.18	-.31	-.37	.08	.24	.12	.33	.57	.22	.33	.46	**.38**	**.48**	**.25**	---

Note. $N = 148$. Correlation was significant at the $p < .05$ level if $r > |.16|$ and at the $p < .01$ level if $r > |.21|$. Bolded values show convergent relationships proposed in the a priori measurement theory for responses to the IBQ. Non-bolded values show divergent relationships proposed in the a priori measurement theory for responses to the IBQ.

Table 3

Standardized Factor Loadings, Standard Errors, and Coefficient H for the Interpersonal Behaviors Questionnaire (IBQ) Scale Items

IBQ Scale Dimension	Item number and content	FL	SE
Autonomy-Support *H* = .92	1. My coach gives me the freedom to make my own choices	.735	.062
	2. My coach encourages me to make my own decisions	.866	.034
	3. My coach supports the choices I make for myself	.593	.104
	4. My coach supports my decisions	.735	.047
Competence-Support *H* = .90	5. My coach tells me that I can accomplish things	.737	.070
	6. My coach encourages me to improve my skills	.619	.071
	7. My coach provides valuable feedback	.655	.122
	8. My coach acknowledges my ability to achieve my goals	.758	.067
Relatedness-Support *H* = .92	9. My coach relates to me	.788	.047
	10. My coach is interested in what I do	.636	.076
	11. My coach honestly enjoys spending time with me	.748	.059
	12. My coach takes the time to get to know me	.666	.073
Autonomy-Thwarting *H* = .86	13. My coach pressures me to adopt certain behaviors	.415	.082
	14. My coach pressures me to do things their way	.555	.082
	15. My coach imposes their opinions on me	.612	.068
	16. My coach limits my choices	.845	.052
Competence-Thwarting *H* = .85	17. My coach points out that I will likely fail	.582	.118
	18. My coach sends me the message that I am incompetent	.515	.121
	19. My coach doubts my capacity to improve	.615	.115
	20. My coach questions my ability to overcome challenges	.591	.091
Relatedness-Thwarting *H* = .88	21. My coach does not comfort me when I am feeling low	.681	.066
	22. My coach does not connect with me	.621	.107
	23. My coach is distant when we spent time together	.553	.098
	24. My coach does not care about me	.610	.106

Note. *N* = 148. FL = Factor Loading, SE = Standard Error, *H* = Coefficient H

Table 4

Latent Variable Correlations for the Interpersonal Behaviors Questionnaire (IBQ)

	AS	CS	RS	AT	CT	RT
AS	---					
CS	.78	---				
RS	.94	.77	---			
AT	-.39	-.23	-.27	---		
CT	-.38	-.37	-.34	.71	---	
RT	-.51	-.65	-.61	.70	.88	---

Note. AS = Autonomy-Support, CS = Competence-Support, RS = Relatedness-Support, AT = Autonomy-Thwarting, CT = Competence-Thwarting, RT = Relatedness-Thwarting

Table 5

List of Revisions Applied to IBQ Scale Items After Each Interview Round

Round 1		Round 2		Round 3	
Item	Revision	Item	Revision	Item	Revision
7	Replaced "valuable" with "helpful"	Scale Directions	Detail added regarding how to respond to items. Scale anchors fully explained. Text was changed from: "Using the scale below, please indicate the extent to which you agree with the following statements about how your coach generally behaves with you." to: "Using the scale below, please circle the answer that shows how much you agree or do not agree with the statements about how your **coach** generally behaves with you. 1 = Do not agree. 7 = Completely agree. 4 = Somewhat agree. The other numbers are in-between. You can choose any of the numbers from 1 to 7."	Response Scale Options	Response options cut from 7 to 5 Response options were completely labeled
8	Phrasing changed from "acknowledges my ability to achieve" to "says I can reach"			Response Scale Phrasing	Responses changed to *completely disagree, somewhat disagree, neutral, somewhat agree, completely agree*
13	Phrasing changed from "pressures me to adopt certain behaviors" to "pressures me to act in a way I don't want to"			Scale Directions	Replaced "generally" with "usually" Updated response option and labels to reflect associated adjustments.
15	Replaced "impose" with "forces"			Item Stem	"My coach" added before each item
18	Phrasing changed from "sends me the message that I am incompetent" to "makes me think I am bad at my sport"			3	Removed "for myself" to simplify item phrasing
19	Phrasing changed from "doubts my capacity to improve" to "doubts if I can improve"			5	Removed "that" to simplify item phrasing
20	Phrasing changed from "questions my ability to overcome challenges" to "does not think I can overcome challenges"	15	Replaced "opinions" with "views"	11	Removed "honestly" to simplify item phrasing

Table 5 (cont'd)

21	Replaced "low" with "sad"	23	Added item, "My coach does not pay attention to me" for comparison to see if participants respond easier	15	Replaced "views" with "ideas"
22	Phrasing changed from "does not connect with me" to "does not try to get to know me"			23	Replaced item 23 with simpler item added in the previous round
23	Replaced "distant" with "uninterested"				

Table 6

Percentage of Observed Responses to Each Youth Interpersonal Behaviors Questionnaire (Y-IBQ) Scale Item by Response Category

Y-IBQ Scale Dimension	Item number and content	Level of Agreement				
		Completely Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Completely Agree
Autonomy-Support	1. My coach gives me the freedom to make my own choices	2.4%	7.3%	21.0%	36.8%	32.5%
	2. My coach encourages me to make my own decisions	1.5%	7.0%	14.8%	36.1%	40.6%
	3. My coach supports the choices I make	0.6%	2.7%	13.7%	38.6%	44.4%
	4. My coach supports my decisions	0%	0.9%	15.3%	36.8%	47.0%
Competence-Support	5. My coach tells me I can accomplish things	0%	0.3%	3.0%	22.5%	74.2%
	6. My coach encourages me to improve my skills	0.6%	0.3%	2.1%	10.4%	86.5%
	7. My coach provides helpful feedback	0.6%	1.5%	5.8%	16.5%	75.5%
	8. My coach says I can reach my goals	0.3%	0.9%	6.2%	15.1%	77.5%
Relatedness-Support	9. My coach relates to me	3.0%	5.2%	22.2%	37.1%	32.5%
	10. My coach is interested in what I do	0.6%	4.2%	12.7%	27.9%	54.5%
	11. My coach enjoys spending time with me	1.5%	3.4%	22.3%	29.7%	43.1%
	12. My coach takes the time to get to know me	2.5%	3.1%	14.8%	32.6%	47.1%
Autonomy-Thwarting	13. My coach pressures me to act in a way I don't want to	66.9%	19.8%	7.3%	4.0%	2.1%
	14. My coach pressures me to do things their way	29.1%	26.7%	27.9%	10.6%	5.8%
	15. My coach forces their ideas on me	49.1%	29.3%	15.7%	4.6%	1.2%
	16. My coach limits my choices	51.8%	25.5%	13.2%	8.0%	1.5%
Competence-Thwarting	17. My coach points out that I will likely fail	84.1%	8.8%	4.0%	2.4%	0.6%
	18. My coach makes me think I am bad at my sport	89.9%	6.4%	2.1%	0.6%	0.9%
	19. My coach doubts if I can improve	92.7%	4.0%	1.2%	0.9%	1.2%
	20. My coach does not think I can overcome challenges	87.2%	7.3%	2.4%	1.8%	1.2%
Relatedness-Thwarting	21. My coach does not comfort me when I am feeling sad	58.7%	15.3%	15.9%	6.1%	4.0%
	22. My coach does not try to get to know me	73.1%	14.7%	6.7%	3.4%	2.1%
	23. My coach does not pay attention to me	73.2%	19.4%	4.0%	2.8%	0.6%
	24. My coach does not care about me	92.4%	4.9%	2.8%	0%	0%

Note. $N = 330$.

Table 7

Target-Rotated Standardized Pattern Coefficients (λ), Item-Level Variance Accounted for (R^2) and Latent Construct Reliability (H) for Responses to the Youth Interpersonal Behaviors Questionnaire (Y-IBQ) Scale

Y-IBQ Scale Dimension	Item	Factor 1		Factor 2		Factor 3		Factor 4		Factor 5		Factor 6		
		λ	*SE*	Λ	*SE*	λ	*SE*	λ	*SE*	λ	*SE*	λ	*SE*	R^2
Autonomy Support (*H* = .92)	1	.73	.06											60%
	2	.79	.06									.36	.06	73%
	3	.73	.07											67%
	4	.66	.05											74%
Competence Support (*H* = .89)	5			.12†	.11	.30	.07			-.37	.08			54%
	6			.43	.11					-.32	.09			53%
	7			.50	.11									56%
	8			.60	.09									68%
Relatedness Support (*H* = .87)	9					.44	.08							51%
	10	.32	.07			.38	.09							57%
	11			.44	.08	.33	.10							62%
	12					.66	.09					-.34	.07	72%
Autonomy Thwarting (*H* = .91)	13							.61	.06					54%
	14							.80	.06					67%
	15							.77	.07					70%
	16							.46	.06					43%
Competence Thwarting (*H* = .90)	17									.42	.10			38%
	18									.41	.10			67%
	19									.79	.12			79%
	20			-.40	.09	.41	.09			.40	.08	.43	.08	86%
Relatedness Thwarting (*H* = .89)	21											.33	.10	41%
	22					-.35	.07					.56	.13	66%
	23											.50	.09	63%
	24							.37	.10			.39	.11	81%

Note. *N* = 330. To reduce clutter an estimated secondary λ was omitted from the table if the absolute value was < .30. Each λ provided in this table was statistically significant at $p \leq .001$ unless denoted by †

Table 8

Latent Variable Correlations for the Youth Interpersonal Behaviors Questionnaire (Y-IBQ)

	AS	CS	RS	AT	CT	RT
AS	---					
CS	.50	---				
RS	.43	.27	---			
AT	-.39	-.28	-.26	---		
CT	-.36	-.24	-.35	.46	---	
RT	-.40	-.53	-.29	.33	.29	---

Note. AS = Autonomy-Support, CS = Competence-Support, RS = Relatedness-Support, AT = Autonomy-Thwarting, CT = Competence-Thwarting, RT = Relatedness-Thwarting

CHAPTER V: DISCUSSION

This section contains an integrated discussion of the results for Studies 1, 2, and 3. Then, practical implications and future research directions are provided. The first aim of this project was to examine the internal structure of youth athletes' responses to the IBQ. Results from the confirmatory factor analysis showed that model-data fit was poor, signifying a lack of validity evidence for the internal structure in a youth athlete sample. Latent reliability was good across all factors, suggesting stability for each of the latent constructs. However, it appears that the indicators may be consistently measuring conceptually imprecise, and in some cases empirically redundant, constructs. For example, some correlations among latent variables were very high, especially among autonomy- and relatedness-supportive behaviors. It is not surprising that autonomy- and relatedness-supportive behaviors were strongly correlated, as autonomy and relatedness satisfaction have been considered to be intertwined (Ryan & Deci, 2017). Additionally, previous research has shown strong associations among coach autonomy supportive behaviors and athletes' basic need satisfaction of autonomy, competence, and relatedness (Mossman et al., 2022). While the stronger correlation among autonomy- and relatedness-supportive coach behaviors is theoretically reasonable, the extremely high correlation (r = .94) was unexpected. This redundancy could indicate the factors are not distinct, making the measurement model ill-defined in its current state. Similarly, item-level correlations showed small differences between the average convergent and divergent correlations within each dimension suggesting little empirical distinction (by participants) between subsets of items intended (by scale developers) to measure a particular construct and other subsets of items intended to measure a different construct. Ntoumanis (2012) suggested that the three basic psychological needs outlined in SDT have been shown to be moderately to highly correlated in

survey research. This pattern of relationships among basic psychological needs was observed at a very high level in the current study with youths and at a more moderate level in the original validation studies with adults (e.g., Rocchi, Pelletier, Cheung, et al., 2017; Rocchi, Pelletier, & Desmarais, 2017). Overall, Study 1 showed problems with the internal structure for youths' responses to the IBQ, signaling a need to investigate potential sources of measurement error and revise the measure for youths.

The second project aim was to identify problematic IBQ items via cognitive think-aloud interviews and modify those items to create the Youth Interpersonal Behaviors Questionnaire in Sport (Y-IBQ). The following discussion helps explain the quantitative results (i.e., possible reasons why the internal structure did not hold for youth in Study 1). Overall, across the three interview and revision rounds, the average number of issues encountered by participants decreased. Additionally, the classification of issues shifted from the comprehension stage of the question-answering process (Tourangeau, 1984) to the latter stages in the process such as retrieval and response. This shift was sensible considering comprehension is the first cognitive step necessary for responding to survey items, and if respondents cannot comprehend the item, it would be a barrier to formulating an appropriate response. These shifts indicated better understanding of survey items following the modifications.

In Round 1, most of the issues involved comprehension. Participants experienced more problems with the language and vocabulary used on the thwarting behavior items (e.g., incompetent, imposes, doubts my capacity) compared to the supportive behavior items. In addition, some of the thwarting behavior items were difficult to answer due to their ambiguous nature (e.g., "My coach is distant when we spend time together"). Recommendations for constructing questionnaires for youth state that items should be clear, concise, and unambiguous

(Arthur et al., 2017; Bell, 2007; Borgers et al., 2000; de Leeuw, 2011). Also, research has shown that children with higher recognition vocabulary demonstrate less survey response error (Fuchs, 2009). These are important considerations when constructing questionnaire items because incorporating clear, developmentally appropriate language and vocabulary is a key factor to increase comprehension and reduce response error. Thus, we replaced words that participants deemed confusing or ambiguous with simpler synonyms. While some response errors occurred in Round 1, the measure was not modified to specifically address those response errors until Round 2, with hopes to reduce most of the comprehension problems first.

In Round 2, fewer comprehension issues were seen, showing improvements from the initial round of modifications. However, issues with the retrieval and response processes were more common in this round which was likely due to participants being able to move past the comprehension stage into the next phases of the question-answering process (Tourangeau, 1984). Interestingly, participants had the most difficulty with the retrieval step when answering the relatedness-supportive and relatedness-thwarting items. One reason why participants may not have been able to access relevant memories and experiences to formulate responses could be due to vague and ambiguous item wording. de Leeuw (2011) asserts that children have low tolerance for ambiguity and vague survey items, which may have contributed to retrieval difficulty. Question vagueness and ambiguity can make it difficult to know what memories or experiences to draw from when attempting to formulate a response. For example, some participants had difficulty responding to the item, “My coach is interested in what I do.”

Some participants were uncertain if they should respond with regard to in-sport or out-of-sport coach-athlete interactions. In some cases, youth athletes may only have sport-specific interactions with their coaches, and if they perceived the question as asking about out-of-sport

interactions, this could affect the response. In addition, it is possible some children may not have developed a strong enough relationship with their coach to respond appropriately. Factors such as an athlete's age and competitive level could influence the amount of time they spend with their coach, making it more difficult to access relevant experiences to respond to the relatedness questions. Last, we anticipated and detected response errors which were due to participants struggling to respond to negatively formed questions. de Leeuw (2011) indicated that negatively formed questions can be problematic for children in the seven- to 12-year-old age group. This is because higher cognitive abilities are necessary to understand negation, and especially before age 12, children have not fully developed those capabilities (Borgers et al., 2000; de Leeuw, 2011). Indeed, several items had a negative stem and response anchor which led some participants to select the opposite answer than intended. However, the evidence on children understanding and responding accurately to negatively formed questions is mixed. Borgers et al. (2004) found that negatively formed questions did not influence children's reliability of responses to a survey. While some scholars have recommended avoiding use of negatively formed questions, if possible (Arthur et al., 2017; de Leeuw, 2011), there can be advantages to retaining negatively formed questions. With a questionnaire that specifically measures athletes' perceptions of thwarting coach behaviors, retaining negatively formed items provides language that better addresses the negative constructs being measured. This can also reduce acquiescent bias (i.e., general agreement toward all statements regardless of content) which has been shown to be a problem for young children (Soto et al., 2008). Consequently, the questionnaire directions were modified to provide more information and clarity regarding how to respond to questions as well as meanings of scale anchors with hopes to address response errors stemming from negatively formed questions. This modification was based on Borgers and Hox's (2000) suggestion to use a

clear and extensive introductory text to improve the reliability of survey responses.

By Round 3, most of the problems seemed to have been addressed by the modifications following Rounds 1 and 2. Across the two participants, only one response error was seen, showing promising effects of modifying the survey directions to increase understanding of how to respond to negatively formulated questions. The survey directions were modified once more to adjust the number of scale options and response anchors. A five-point scale was adopted based on participants' recommendations and a growing body of literature recommending fewer response options for children to reduce the cognitive demands necessary to differentiate between options and form adequate responses (Bell et al., 2007; Borgers et al., 2004). In addition, the response scale was completely labeled to ease interpretation and clarify scale points (Bell, 2007; Krosnick & Presser, 2010). Like previous rounds, wording changes were employed to maintain clear, concise, and unambiguous wording (Bell, 2007). Considering younger children have not fully developed their working memory capacity, Arthur et al. (2017) recommended incorporating contextual information into questions to promote deeper processing for youth. Therefore, the "my coach" stem was added to each item to prompt participants to respond to the items while considering their coach's behavior.

Overall, the number of items with problems and the number of issues identified decreased across rounds demonstrating that the modifications were valuable and improved youths' ability to appropriately respond to the survey items. The revised Y-IBQ measure developed in Study 2 shows promise as a developmentally appropriate measure for youth. When surveying young children, Bell (2007) recommends a combination of pretesting the measure via interviews and expert examination to provide a more robust survey. Study 2 achieved both of those criteria and demonstrates preliminary evidence for the revised Y-IBQ. The lack of model-data fit in Study 1

and modifications applied to the survey in Study 2 encourage further testing of the measurement model to establish separation of SDT constructs or indicate the need to combine redundant factors into a composite (e.g., need supportive behaviors).

The third project aim (i.e., Study 3) assessed the psychometric properties of the Y-IBQ in a large sample of youth athletes. Considering the high factor correlations observed in Study 1 and revision to the IBQ to form the Y-IBQ in Study 2, an exploratory structural equation modeling approach was taken to allow items to cross-load on more than one factor to represent some uncertainty (e.g., possible cross-loadings on unintended factors) in the a priori model in Study 3. ESEM results showed good model-data fit, providing validity evidence for the Y-IBQ internal structure in a youth athlete sample. While most factor loadings fit a priori theoretical expectations and were substantial, there were some exceptions. For example, item 5 had a negligible loading on the intended competence-support factor and a larger cross-loading on the unintended competence-thwarting factor. Accordingly, future studies using the Y-IBQ should consider revising this item to be more strongly associated with the intended factor (i.e., competence support). In most cases when an item exhibited a cross-loading on an unintended factor, the unintended factor represented the same basic need but of a different valence (e.g., competence-support vs. -thwarting) or generally represented coach behaviors of the same valence (i.e., need supportive vs. need thwarting behaviors). Theoretically, this pattern of cross-loadings is sensible and consistent with the observation of moderate to high correlations among the basic psychological needs in survey research (Ntoumanis, 2012) and may explain the high latent factor correlations observed in Study 1, as some of the factors could be defined by shared indicators. Item 20 (i.e., “My coach does not think I can overcome challenges”) performed poorly, as it exhibited moderate cross-loadings with several factors. It is possible this item may

have performed poorly since it was the only item within the competence-thwarting dimension containing a double negative which could lead to the item unintentionally measuring low levels of need support as opposed to need-thwarting behaviors. Consequently, future studies using the Y-IBQ, should potentially consider adjusting item wording (e.g., "My coach doubts I can overcome challenges") and respectively examine the performance of this item. All factors demonstrated acceptable latent reliability, suggesting stability for each of the latent constructs.

This project fulfilled Wekesser et al.'s (2021) suggestion to conduct further psychometric testing of the IBQ instrument in youths. Study 1 provided empirical evidence for poor model-data fit and a lack of validity evidence for the IBQ internal structure in a youth athlete sample. This led to Study 2, which identified problematic IBQ items (using a qualitative approach) and modified them to create the Youth Interpersonal Behaviors Questionnaire in Sport. Study 3 provided empirical evidence for good model-data fit and established initial reliability and validity evidence for the Y-IBQ in a youth athlete sample. Overall, this study used a mixed-methods approach to provide qualitative and quantitative evidence for improvement in the measurement of youth athletes' perceptions of interpersonal coaching behaviors.

While the IBQ had been used in survey research with athletes ages 14 and older (i.e., Rocchi & Pelletier, 2018), the IBQ had not been used with youths younger than 14 until Wekesser et al. (2021). However, Wekesser et al. (2021) identified potential psychometric issues for athletes' responses to the IBQ in their sample (i.e., athletes aged 11-16) and recommended further psychometric testing should be conducted with increased attention given to athletes 14 and younger. In Study 1, the ages of athletes surveyed did not match Wekesser et al.'s (2021) specific age recommendation due to the use of previously collected data and a modest CFA sample size. However, this recommendation was followed in Studies 2 and 3 where the use of

the IBQ was examined with athletes ages nine to 14 years old. For researchers surveying youths, especially between the ages of nine to 14 years, we recommend utilizing the Y-IBQ, as this study provides reliability and validity evidence in a youth sample, and the instrument was created based upon developmentally informed modifications to the original IBQ measure. For researchers surveying adults, we recommend utilizing the IBQ or the IBQ-Self (i.e., Rocchi, Pelletier, & Desmarais, 2017), as instrument reliability and validity evidence have been provided in adult samples.

This study has at least two primary limitations. First, to informally compare our Study 1 CFA results to those in the original validation study (i.e., Rocchi, Pelletier, and Desmarais, 2017), we treated the data as conditionally multivariate normal and used maximum likelihood estimation with rescaled (based on multivariate kurtosis in the observed variables) standard errors and a test statistic to parallel Rocchi, Pelletier, and Desmarais (2017). However, we consider the responses to the IBQ items to be ordinal (and therefore neither conditionally multivariate normal nor on a continuous metric) and recommend applying a weighted least squares mean- and variance-adjusted (WLSMV) estimator to account for the ordinal nature of the data (Finney & DiStefano, 2013) in the future – which we did in Study 3. Second, a potential limitation in Study 2 was the decision to retain negatively phrased items even though they have been suggested to be problematic (de Leeuw, 2011). After careful consideration of how inclusion could impact responses, we maintained negatively phrased items while modifying the survey directions to guide participants how to select an appropriate response. It is important for thwarting items to target specific coach behaviors that actively undermine athletes' basic psychological needs. This is important because it has been suggested that low scores on need satisfaction do not necessarily indicate need frustration but may suggest need dissatisfaction

(Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumanis, 2011). Unfortunately, some of the Y-IBQ items may not actively assess need-thwarting behaviors (e.g., "My coach does not think I can overcome challenges") and may possibly assess low levels of need-supportive coach behaviors instead. As much as possible, we attempted to reduce the use of items containing double negatives, but in some cases, it was challenging to apply age-appropriate language while still intending to actively measure thwarting behaviors. Thus, some items containing double negatives were retained.

Overall, this project provides empirical evidence that supports the use of the Y-IBQ for measuring youth athlete perceptions of coach interpersonal behaviors in sport. Across the three studies in described in this project, empirical evidence is provided to demonstrate that the measurement of youth athletes' perceptions of coaching behaviors that influence basic need satisfaction and frustration has improved. Establishment of the Y-IBQ provides an age-appropriate instrument that will allow researchers to better study youth athletes' perceptions of coaching behaviors and how those may influence athlete outcomes. Future research should continue to examine the psychometric properties, specifically other sources of validity evidence, of our Youth Interpersonal Behaviors Questionnaire in Sport (Y-IBQ). For example, considering the well-established relationships among coaching behaviors, athlete motivation, and sport continuation (Gardner et al., 2016, 2017; Vallerand, 2007), it would be valuable to examine these relationships using the new Y-IBQ instrument to establish validity evidence for relations to other conceptually related variables. Additionally, future research should continue to test the psychometric properties of the Y-IBQ with a special focus on the functioning of negatively worded items, in a large, representative youth athlete sample.

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APPENDIX A: INTERPERSONAL BEHAVIORS QUESTIONNAIRE IN SPORT

Using the scale below, please indicate the extent to which you agree with the following statements about how your coach generally behaves with you.

1	2	3	4	5	6	7
Do not agree			**Somewhat agree**			**Completely agree**

My coach ….

	Do not agree			**Somewhat agree**			**Completely agree**
Tells me that I can accomplish things.	1	2	3	4	5	6	7
Relates to me.	1	2	3	4	5	6	7
Gives me the freedom to make my own choices.	1	2	3	4	5	6	7
Is interested in what I do.	1	2	3	4	5	6	7
Encourages me to make my own decisions.	1	2	3	4	5	6	7
Pressures me to adopt certain behaviors.	1	2	3	4	5	6	7
Does not comfort me when I am feeling low.	1	2	3	4	5	6	7
Does not connect with me.	1	2	3	4	5	6	7
Points out that I will likely fail.	1	2	3	4	5	6	7
Supports the choices I make for myself.	1	2	3	4	5	6	7
Pressures me to do things their way	1	2	3	4	5	6	7

1	2	3	4	5	6	7
Do not agree			**Somewhat agree**			**Completely agree**

My coach ….

	Do not agree			**Somewhat agree**			**Completely agree**
Sends me the message that I am incompetent.	1	2	3	4	5	6	7
Doubts my capacity to improve.	1	2	3	4	5	6	7
Honestly enjoys spending time with me.	1	2	3	4	5	6	7
Encourages me to improve my skills.	1	2	3	4	5	6	7
Supports my decisions.	1	2	3	4	5	6	7
Is distant when we spend time together.	1	2	3	4	5	6	7
Impose their opinions on me.	1	2	3	4	5	6	7
Limits my choices.	1	2	3	4	5	6	7
Takes the time to get to know me.	1	2	3	4	5	6	7
Provides valuable feedback.	1	2	3	4	5	6	7
Acknowledges my ability to achieve my goals.	1	2	3	4	5	6	7
Does not care about me.	1	2	3	4	5	6	7
Questions my ability to overcome challenges.	1	2	3	4	5	6	7

APPENDIX B: COGNITIVE THINK-ALOUD INTERVIEW PROTOCOL AND PROBES

- Welcome the participant and thank them for agreeing to participate in the interview. Explain who I am and why I am doing this project.

- Communicate that the parent can stay on the Zoom call if they would like but ask that they do not interrupt the interview unless they have a very important question or would like to end the interview immediately.

- Review the assent form & double check that the participant gives their assent. Say, "Today I am going to have you complete a survey that tells me more about your coach's behaviors. You are going to read the questions aloud and talk to me as you fill out the survey. I may ask you a few questions to help me understand your thought process. Is that okay? Is it okay if I begin the recording now?"

- Say, "During this interview, I want you to read the questions aloud and talk to me as you fill out the survey, telling me everything that you think about while reading and answering the question." Let's start out with an example.
    - Example 1: "How many windows and doors are in your kitchen where you live?"
    - Example 2: CART-Q directions and question: "I trust my coach."

- Say, "Are you ready to try the questions now?"

- Share interviewer's screen with the Interpersonal Behaviors Questionnaire items. Have the participants read the directions aloud. Go through each survey item at a comfortable pace until all questions have been answered.

- Thank the participant for their time and ask if they have any questions. Check to see if the participant's parent has any questions. End the Zoom call.

- List of Potential Probes:
    - What does the word, _____ mean to you?
    - How did you arrive at that answer?
    - Was that easy to answer, hard to answer, or somewhere in between?
    - I noticed that you hesitated. Could you tell me what you were thinking?

APPENDIX C: STUDY 2 DEMOGRAPHIC INFORMATION AND ERROR ANALYSIS

Table 9

Demographic Information and Error Analysis of Interview Responses to the Interpersonal Behaviors Questionnaire (IBQ)

Interview Round	Gender	Age	Sport	Number of Errors	Item Number with Error	Source of Error
Round 1 (n = 4)	Female	10	Dance	10	7, 8, 13, 15, 18, 19, 20, 21, 22, 23	Comprehension, Retrieval, Response
	Male	14	Soccer	8	7, 10, 13, 15, 18, 21, 22, 23	Comprehension, Response
	Female	13	Dance	3	13, 15, 18	Comprehension, Retrieval
	Female	10	Soccer	7	8, 13, 15, 18, 20, 21, 23	Comprehension, Judgment, Response
Round 2 (n = 8)	Male	14	Swimming	2	11, 13	Retrieval, Response
	Male	13	Basketball	2	3, 16	Response
	Female	11	Tennis	3	13, 23, 24	Comprehension, Response
	Female	12	Hockey	5	2, 11, 15, 19, 23	Comprehension, Retrieval, Judgment, Response
	Male	11	Soccer	5	9, 11, 18, 21, 23	Comprehension, Retrieval, Response
	Female	9	Soccer	2	10, 20	Retrieval
	Male	13	Soccer	11	9, 10, 13, 15, 16, 17, 19, 20, 21, 22, 23	Comprehension, Retrieval, Response
	Female	10	Soccer	3	3, 11, 23	Retrieval
Round 3 (n = 2)	Male	12	Soccer	0	---	---
	Male	10	Soccer	6	2, 6, 15, 21, 22, 23	Comprehension, Retrieval, Response

APPENDIX D: STUDY 3 DEMOGRAPHIC QUESTIONS

1. What is your child's current age? _____

2. Is your child of Hispanic, Latino, or Spanish origin? Yes No

3. What is your child's race? Select all that apply.
    a) American Indian or Alaska Native
    b) Asian
    c) Black or African American
    d) Native Hawaiian or Other Pacific Islander
    e) White or Caucasian
    f) Prefer not to answer

4. My child identifies as _____.
    a) Male
    b) Female
    c) Non-binary
    d) Prefer not to answer

5. What is your child's primary sport? _____
(If your child participates in more than one sport, indicate the sport in which they spend the most time participating each week.)

6. My child has been playing this sport for _____ years and _____ months.

7. List the first and last initials of your child's coach in their primary sport. _____
Example: AG *(If your child has more than one coach, indicate the coach in which they spend the most time with each week.)*

8. My child has been working with this coach for _____ years and _____ months.

9. What is the name of the team your child plays on? _____

_____

10. What competition level best describes your child's participation in their primary sport?
    a. Recreational
    b. Club/Travel
    c. School-based
    d. Other, please describe: _____

APPENDIX E: YOUTH INTERPERSONAL BEHAVIORS QUESTIONNAIRE IN SPORT

Using the scale below, please circle the answer that shows how much you agree or do not agree with the statements about how your **coach** usually behaves with you in sport. 1 = Completely disagree. 5 = Completely agree. 3 = Neutral. The other numbers are in-between. You can choose any of the numbers from 1 to 5.

	Completely disagree	**Somewhat disagree**	**Neutral**	**Somewhat agree**	**Completely agree**
My coach tells me I can accomplish things.	1	2	3	4	5
My coach relates to me.	1	2	3	4	5
My coach gives me the freedom to make my own choices.	1	2	3	4	5
My coach is interested in what I do.	1	2	3	4	5
My coach encourages me to make my own decisions.	1	2	3	4	5
My coach pressures me to act in a way I don't want to.	1	2	3	4	5
My coach does not comfort me when I am feeling sad.	1	2	3	4	5
My coach does not try to get to know me.	1	2	3	4	5
My coach points out that I will likely fail.	1	2	3	4	5
My coach supports the choices I make.	1	2	3	4	5
My coach pressures me to do things their way.	1	2	3	4	5

	Completely disagree	Somewhat disagree	Neutral	Somewhat agree	Completely agree
My coach makes me think I am bad at my sport.	1	2	3	4	5
My coach doubts if I can improve.	1	2	3	4	5
My coach enjoys spending time with me.	1	2	3	4	5
My coach encourages me to improve my skills.	1	2	3	4	5
My coach supports my decisions.	1	2	3	4	5
My coach does not pay attention to me.	1	2	3	4	5
My coach forces their ideas on me.	1	2	3	4	5
My coach limits my choices.	1	2	3	4	5
My coach takes the time to get to know me.	1	2	3	4	5
My coach provides helpful feedback.	1	2	3	4	5
My coach says I can reach my goals.	1	2	3	4	5
My coach does not care about me.	1	2	3	4	5
My coach does not think I can overcome challenges.	1	2	3	4	5

APPENDIX F: STUDY 3 MPLUS CODE EXPLORATORY STRUCTURAL EQUATION MODELING

```
TITLE: Y-IBQ PSYCHOMETRIC TESTING ESEM

DATA: FILE IS Y-IBQ.dat;

VARIABLE:
NAMES ARE clus ibq1 ibq2 ibq3 ibq4 ibq5 ibq6 ibq7 ibq8 ibq9 ibq10 ibq11 ibq12 ibq13
      ibq14 ibq15 ibq16 ibq17 ibq18 ibq19 ibq20 ibq21 ibq22 ibq23 ibq24;
CATEGORICAL ARE ibq1 ibq2 ibq3 ibq4 ibq5 ibq6 ibq7 ibq8 ibq9 ibq10 ibq11 ibq12 ibq13
      ibq14 ibq15 ibq16 ibq17 ibq18 ibq19 ibq20 ibq21 ibq22 ibq23 ibq24;
MISSING ARE ALL (-99);
CLUSTER = clus;

ANALYSIS:
TYPE = COMPLEX;
ESTIMATOR = WLSMV;
ROTATION = TARGET;

MODEL:
AS BY
IBQ1 IBQ2 IBQ3 IBQ4
IBQ5~0 IBQ6~0 IBQ7~0 IBQ8~0
IBQ9~0 IBQ10~0 IBQ11~0 IBQ12~0
IBQ13~0 IBQ14~0 IBQ15~0 IBQ16~0
IBQ17~0 IBQ18~0 IBQ19~0 IBQ20~0
IBQ21~0 IBQ22~0 IBQ23~0 IBQ24~0 (*1);

CS BY
IBQ5~0.3 IBQ6 IBQ7 IBQ8
IBQ1~0 IBQ2~0 IBQ3~0 IBQ4~0
IBQ9~0 IBQ10~0 IBQ11~0 IBQ12~0
IBQ13~0 IBQ14~0 IBQ15~0 IBQ16~0
IBQ17~0 IBQ18~0 IBQ19~0 IBQ20~0
IBQ21~0 IBQ22~0 IBQ23~0 IBQ24~0 (*1);

RS BY
IBQ9 IBQ10 IBQ11 IBQ12
IBQ1~0 IBQ2~0 IBQ3~0 IBQ4~0
IBQ5~0 IBQ6~0 IBQ7~0 IBQ8~0
IBQ13~0 IBQ14~0 IBQ15~0 IBQ16~0
IBQ17~0 IBQ18~0 IBQ19~0 IBQ20~0
IBQ21~0 IBQ22~0 IBQ23~0 IBQ24~0 (*1);

ATH BY
```

IBQ13 IBQ14 IBQ15 IBQ16
IBQ1~0 IBQ2~0 IBQ3~0 IBQ4~0
IBQ5~0 IBQ6~0 IBQ7~0 IBQ8~0
IBQ9~0 IBQ10~0 IBQ11~0 IBQ12~0
IBQ17~0 IBQ18~0 IBQ19~0 IBQ20~0
IBQ21~0 IBQ22~0 IBQ23~0 IBQ24~0 (*1);

CT BY
IBQ17 IBQ18 IBQ19 IBQ20~0.5
IBQ1~0 IBQ2~0 IBQ3~0 IBQ4~0
IBQ5~0 IBQ6~0 IBQ7~0 IBQ8~0
IBQ9~0 IBQ10~0 IBQ11~0 IBQ12~0
IBQ13~0 IBQ14~0 IBQ15~0 IBQ16~0
IBQ21~0 IBQ22~0 IBQ23~0 IBQ24~0 (*1);

RT BY
IBQ21 IBQ22 IBQ23 IBQ24
IBQ1~0 IBQ2~0 IBQ3~0 IBQ4~0
IBQ5~0 IBQ6~0 IBQ7~0 IBQ8~0
IBQ9~0 IBQ10~0 IBQ11~0 IBQ12~0
IBQ13~0 IBQ14~0 IBQ15~0 IBQ16~0
IBQ17~0 IBQ18~0 IBQ19~0 IBQ20~0 (*1);

OUTPUT:
Stdyx tech1 tech4 mod(10);