Title

Measuring Motivation Orientation and School Readiness in Children Served by Head Start

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Introduction

There is an achievement gap between children from low-income families and their middle to high-income counterparts (Heckman, 2009; Magnuson & Duncan, 2006; National Assessment of Educational Process [NAEP], 2009). Head Start, which now serves over 1 million children and families living in poverty, measures its success as a program in "school readiness," which they define as "the skills, knowledge, and attitudes necessary for success in school and for later learning and life." The multidimensional construct of school readiness is comprised of 5 domains, language and literacy, cognition (math and science), approaches to learning, social and emotional development, and physical health and motor development (U.S. Department of Health and Human Services (USDHHS), 2015). Evidence indicates that the disparity in school readiness begins early, as observable differences exist prior to children beginning kindergarten (Magnuson & Duncan, 2006), and persist through later grades (NAEP, 2009). Given these realities, research with preschool aged children living in poverty is needed to help identify and foster skills that promote school readiness to address the achievement gap for this at-risk population.

Research highlights the importance of teachable and malleable skills for children from low-income families, especially those skills that impact multiple school readiness domains. These skills, often referred to as domain-general because they can contribute to learning in multiple domains of school readiness, play a central role in predicting academic attainment (Li-Grining, 2007; McClelland et al., 2007). One domain-general construct that has potential to positively influence school readiness and academic success is motivation orientation. Motivation orientation predicts academic achievement in older children (Blackwell, Trzesniewski & Dweck, 2007), relates to attention and persistence in preschoolers (Brown, 2009; Day & Burns, 2011),

and predicts gains in teacher ratings of school readiness across the preschool year (Berhenke et al., 2011).

Smiley and Dweck (1994) define two opposing orientations that characterize how people approach challenges and how they rationalize setbacks and failures during challenging tasks. At the crux of these motivational orientations are an individual's implicit theories of intelligence or whether they consider intelligence to be a fixed or malleable trait. One orientation, referred to as mastery motivated, reflects an incremental theorist perspective on intelligence meaning intelligence is malleable and independent of one's intrinsic ability; thus, everyone has the potential to improve and excel in any area with proper preparation and effort. Therefore, when mastery motivated individuals encounter a challenging task they view it as a chance to improve themselves and expand their abilities. Mastery motivated individuals embrace challenges, persist in the face of setbacks, view effort as a path to mastery, and utilize the feedback of others (Cain & Dweck, 1995).

The other orientation, performance motivated, reflects an entity theorist perspective of intelligence meaning intelligence is a fixed trait determined by innate ability level. Individuals with this orientation believe they should stick to the areas where they are competent, and avoid areas where they are not naturally adept. Therefore, when these individuals encounter a challenging task they evaluate their initial performance (fail or succeed) as a reflection of their fixed, innate ability. Performance motivated individuals, avoid challenges, are discouraged by setbacks, view effort as a lack of intelligence, and are reluctant to incorporate feedback from others (Cain & Dweck, 1995).

Research has demonstrated that motivation orientation is a malleable construct in the context of sustained intervention and has a direct relationship to academic outcomes in middle-

school children (Blackwell, Trzesniewski & Dweck, 2007; Dweck, 2008). Studies on motivation orientation have also been conducted with preschoolers from low-income families, demonstrating that the construct is relevant and applicable to children as young as three years old (Brown, 2009; Day & Burns, 2011). Additionally, negative motivational patterns in low-income preschool children are associated with chaotic living conditions and sleep deprivation, which are common predictors of low school readiness (Brown & Low, 2008). However, the relationships between direct assessments of motivation orientation and academic school readiness outcomes have yet to be examined in preschoolers and more research is needed to understand this construct in the early childhood context.

Some measures of motivation orientation for low-income children do exist. Berhenke and colleagues (2011) developed an observational assessment of motivation orientation, which analyzed children's facial and verbal expression, as well as, behavioral cues. Zigler and colleagues (2002) have a parent rating scale called the EZ-Personality Motivation Questionnaire that was designed to assess personality-motivational constructs associated with intellectual disability. Lastly, Morgan and colleagues (2009) developed the Dimensions of Mastery Questionnaire another parent rating scale of children's motivation. However, best practice in research encourages a multi-source, multi-method approach to measurement in which teachers, parents, and children, provide insight via observation, rating scales, and direct assessment, as each reporter and method comes with its own unique set of biases (Mowbray, Holter, Teague & Bybee, 2003). In order to gain a complete and accurate representation of young children's motivational approaches research is needed to evaluate the validity of existing measures for use with this population. A measure shown to be valid for addressing particular research questions with a particular population may not be valid for use with a different population (Mertens, 2014).

Currently, there is a dearth of direct assessments for the construct of motivation orientation for preschoolers; the Mastery Motivation Puzzle Task (MMPT; Smiley & Dweck, 1994) is the most widely used of the few that do exist (Brown, 2009; Chang & Burns; 2005; Day, 2012; Day & Burns, 2011; Burhans & Dweck, 1995). The MMPT employs a set of unsolvable puzzles with one solvable puzzle to assess children's reactions to failure and willingness to accept challenging tasks. While most psychological constructs exist on a continuum, the MMPT yields a dichotomous outcome, leaving questions about its ability to capture a range of individual differences among children. This measure has been administered in numerous studies, however, its test-retest reliability has yet to be examined and there is little or no evidence to support its concurrent or predictive validity. Additionally, the MMPT was developed and implemented in a sample of white middle to high-income children. It has been subsequently utilized in racially and ethnically diverse low-income samples without research to demonstrate validity for use in those populations. Without reliable and valid measurement for diverse young children from low-income families there is no way to evaluate the efficacy of interventions aimed at this powerful domain general construct at the preschool level.

This study extends the work on motivation orientation in low-income preschoolers by examining the test-retest reliability as well as the concurrent and predictive validity of the MMPT in a sample of children served by Head Start. Concurrent validity was assessed by relating motivation orientation and approaches to learning. Approaches to learning is one of Head Start's core school readiness domains, and is conceptually similar to motivation orientation, because it is a domain-general construct that encompasses motivation, persistence, acceptance of novelty and risk, openness to trying challenging tasks, which are all fundamental to motivation orientation (Fantuzzo, Perry, & McDermot, 2004). Predictive validity was assessed

by using motivation orientation as a predictor of academic school readiness outcomes (e.g. early science, math, and literacy skills).

Motivation Orientation in Preschoolers

Research on motivation orientation suggests that preschool children already have an internalized investment in either the evaluation of their achievement or in the process of learning; the investment in evaluation or process can influence how children approach challenging tasks (Burhans & Dweck, 1995; Ames, 1992; Gilmore, Cuskelly & Purdie, 2003). Smiley and Dweck (1994), using the MMPT, separated preschool children from middle-income families into two groups by their motivation orientation. Out of the 78 subjects, 33 (42%) were considered performance motivated, and 45 (58%) were considered mastery motivated. The mastery motivated group expressed significantly less performance worries, were more engaged in the task, reported more positive emotion, made higher self-evaluations of puzzle ability following failure, and expressed higher confidence in future success with puzzles than the performance motivated group.

Studies of motivation orientation in middle- to high-income preschool samples consistently report these same relationships of a mastery motivated orientation with engagement, persistence, and self-confidence, as well as approximately 60% of children endorsing a mastery motivated orientation (Cain & Dweck, 1995; Herbert & Dweck, reviewed in Burhans & Dweck, 1995; Smiley & Dweck, 1994). However, more recent studies conducted among preschoolers from low-income backgrounds using the same direct assessment of motivation orientation (MMPT) report inconsistent distributions of mastery vs. performance motivated children (Brown, 2009; Chang & Burns, 2005; Day, 2012).

Motivation Orientation in Preschoolers from Low-Income Families

More recent research on motivation orientation with preschoolers from low-income families using the MMPT demonstrates positive relationships between mastery motivation and other useful skills, such as, persistence in the face of challenge, attention, task engagement, and reduced negative self-evaluations of ability (Brown, 2009; Day & Burns, 2011) as well as, teacher ratings of children's school readiness (Berhenke et al., 2011). However, in contrast to higher-income samples, distributions of mastery vs. performance motivated children among preschoolers from low-income backgrounds have been inconsistent (e.g., Brown, 2009; Chang & Burns, 2005; Day, 2012).

One study, for example, compared low- and middle-income preschoolers and found these two income groups differed in the verbalizations they made during the MMPT, despite no differences in the proportion of each income group that endorsed a mastery motivated orientation versus a performance motivated orientation (Day & Burns, 2011). Other studies with low-income samples have found a much higher proportion of children assigned to a master motivated orientation (Day, 2012). These results call into question the validity of the MMPT for low-income preschool populations. Despite its continued use with low-income preschool population, no study to date as evaluated the reliability or validity of the MMPT for this population.

Motivation Orientation and Approaches to Learning

Morgan and colleagues (2009) developed "The Dimensions of Mastery Questionnaire" (DMQ) which is a teacher rating scale of mastery motivation. However, the DMQ has not been validated for use among preschool children from low-income families. The normative sample of children ranged from 6 months to 19 years old and were described as "mostly middle-class, white, normally developing American children" (Morgan, Busch-Rossnagel, Barrett & Wang, 2009). Therefore, due to the population that was drawn from for this study a teacher rating scale

of approaches to learning that has been validated for use among preschoolers from low-income families was utilized for concurrent validity. Approaches to learning, a set of teachable and malleable domain-general skills that encompasses motivation and persistence, as well as strategies and attitudes towards learning have a strong theoretical link to motivation orientation (Fantuzzo, Perry, & McDermot, 2004). Head Start defines approaches to learning as "the skills and behaviors that children use to engage in learning" (USDHHS, 2015). The Learning to Learn Scale which is used to measure approaches to learning in this study has seven dimensions, strategic planning, effectiveness motivation, interpersonal responsiveness in learning, vocal engagement in learning, sustained focus in learning, acceptance of novelty and risk, and group learning (McDermott, Fantuzzo, Warley, Waterman, Angelo, Gadsden, & Sekino, 2011).

Approaches to learning is a valid construct among ethnically diverse children served by Head Start, that predicts school readiness in math and literacy, as well as executive functioning skills (McWayne, Fantuzzo, & McDermott, 2004; Nayfeld, Fuccillo, & Greenfield, 2013). Motivation orientation and approaches to learning share various core components, such as tolerance for frustration and failure, persistence, and the motivation to approach and succeed in challenging tasks (Fantuzzo et al. 2004; Smiley & Dweck, 1994). Despite the theoretical overlap, the two constructs also differ in that approaches to learning is more broad and includes social aspects such as, interpersonal responsiveness in learning, vocal engagement in learning, and group learning. For this reason, it is important to validate the MMPT because while it is theoretically related to approaches to learning it is distinct and makes a meaningful contribution by providing a direct assessment for preschoolers. Due to the established nature of approaches to learning in this population and the theoretical ties between motivation orientation and approaches to learning, this study examined the relationship between these two constructs in order to test the

concurrent validity of the MMPT using a measure validated for use among preschool children from low-income families (McDermott, Fantuzzo, Waterman, Angelo, Warley, Gadsden, et al., 2009).

Motivation Orientation and School Readiness

Research has demonstrated that motivation orientation is malleable, susceptible to intervention and directly related to academic achievement in older children (Blackwell, Trzesniewski & Dweck, 2007; Dweck, 2008). Studies with preschoolers suggest a relationship between motivation orientation and other cognitive skills that relate to school readiness, like attention and persistence, as well as, teacher ratings of children's school readiness (Berhenke et al., 2011; Brown, 2009; Day & Burns, 2011). However, to date no studies have examined motivation orientation in relation to direct assessments of academic school readiness, in preschoolers. Considering that other malleable and domain-general skills like approaches to learning and executive functioning have been demonstrated to relate to academic school readiness in children served by Head Start, and observational measures of motivation orientation have predicted teacher ratings of school readiness, it is reasonable to expect a predictive relationship between a direct assessment of motivation orientation, and gains in academic school readiness from the beginning to the end of the school year (Berhenke et al., 2011; McWayne, Fantuzzo, & McDermott, 2004; Nayfeld, Fuccillo, & Greenfield, 2013). Given the academic achievement gap, identifying domain-general skills that predict academic school readiness is a critical research area, with profound implications for children from low-income families. This study examined the relationship between motivation orientation and school readiness outcomes (i.e. early science, math, and literacy), in order to test the predictive validity of the MMPT.

Current Study

This study examined the distribution of mastery vs. performance motivated children served by Head Start, using the MMPT, with a sample size three times larger than any study to date using this measure. This study was also the first to examine the test-retest reliability of the MMPT, the first to examine concurrent validity by relating it to approaches to learning, and the first to examine predictive validity by using motivation orientation as a predictor of academic school readiness outcomes. First, it was hypothesized that mastery and performance motivated children would be equally represented in the sample. Additionally, since this study was the first to examine the test-retest reliability of the MMPT this aim was exploratory and no hypothesis was made. Second, it was hypothesized that the MMPT would display concurrent validity by significantly relating to approaches to learning. Third, it was hypothesized that the MMPT would display predictive validity by predicting gains in early science, math, and literacy outcomes from the beginning to the end of the Head Start school year.

Method

Participants

The participants in this study were 334 children selected from 37 classrooms (*M= 9.05 children per classroom*, *Min = 8 Max = 11*) in 13 Head Start centers in Miami-Dade County. Children were stratified by age and gender to achieve a representative sample of the local population. The sample was comprised of predominantly African American (71%) and Latino children (27%), was 51% female, and ages ranged from 36 to 59 months (*M = 48, SD = 7.11*). All children met the federal income requirement for enrollment in Head Start indicating a sample of children from low-income families. The re-test sample was comprised of 113 children and was stratified by motivation orientation on first assessment and gender, 51% of re-test sample originally endorsed mastery motivation and 49% originally endorsed performance. The re-test

sample was representative of the larger sample in ethnicity (69% African American and 28% Latino), gender (54% female), and age (*range= 36 to 59 months, M = 49, SD = 6.68*).

Measures

Math and Literacy School Readiness. The Learning Express (McDermott, Fantuzzo, Waterman, Angelo, Warley, Gadsden, et al., 2009) is an academic direct assessment designed and validated specifically for low-income, at-risk preschool children. Children are assessed individually by a trained assessor using a large flip-book of pages that depict pictures, letters, and/or numbers. The test has four subscales that are administered in the following order: Vocabulary (58 items), Mathematics (57 items), Listening Comprehension (37 items), and Alphabet Knowledge (52 items). The two available forms (A and B) were counterbalanced (i.e., half of the children received form A first, followed by form B and vice versa). Each form includes a set of items ordered by difficulty, and each item is scored as either correct or incorrect. Raw scores are converted to an interval-level score according to Item Response Theory (IRT) analysis. Reliability across subscales ranges from .93 to .98. External and predictive validity was established for all subscales using established measures such as, the PPVT-III (Dunn & Dunn, 1997), TERA-3 (Reid et al., 2001), TEMA-3 (Ginsberg & Baroody, 2003), and the OWLS (Carrow-Woolfolk, 1995) (McDermott et al., 2009).

Science School Readiness. The Lens on Science assessment (LENS; Greenfield et al., 2011) is an individually administered computer-adaptive, IRT-based direct assessment of science delivered on a touch-screen tablet. This assessment was specifically designed to detect growth in the Head Start population. Items were created based on a review of preschool and kindergarten state and national standards as well as current preschool science curricula. The assessment was designed to cover a range of difficulty appropriate for Head Start preschoolers, as well as a range

of science practice skills, cross-cutting concepts, and science content from “life science,” “earth and space sciences” and, “physical and energy sciences”.

Children are placed in front of a touch-screen monitor and given headphones to listen to prompts instructing them to respond. A trained researcher supervises the test administration process. An IRT ability score is obtained in approximately fifteen minutes with the administration of approximately 35 – 40 items. The assessment contained an item bank of 389 items calibrated using the dichotomous Rasch model scaled to have a mean item difficulty of zero and unit-logit metric. Item difficulties (*b*-parameters) range from -2.7 to 4.4, with 80% of items having difficulty values between -1.40 and 1.42. The item-measure correlation (correlation between the item and the ability estimate) exceeds .20 for 87% of items, and exceeds .30 for 65% of items, reflecting effective discrimination of the items in the bank and evidence of a common trait measured by the items of the assessment. For a sample of 1,753 students, the average standard error of the Rasch ability estimate was 0.31 (on the unit-logit metric), which corresponds to a reliability of .87.

Approaches to Learning. The Learning-to-Learn Scales (LTLS; McDermott, Fantuzzo, Warley, Waterman, Angelo, Gadsden, & Sekino, 2011) is a measure of approaches to learning and learning related behaviors specifically designed to detect growth in Head Start populations. The LTLS is a teacher-completed scale with 55 items rated on a three point Likert scale (“consistently applies”; “sometimes applies”; “does not apply”). Teachers are asked to answer questions thinking about each child’s behaviors during the past month. Exploratory factor analyses revealed a general factor as well as seven dimensions: Strategic Planning, Effectiveness Motivation, Interpersonal Responsiveness in Learning, Vocal Engagement in Learning,

Sustained Focus in Learning, Acceptance of Novelty and Risk, and Group Learning. This measure has been shown to have external validity and concurrent validity when compared with the cognitive subscales scores of the Learning Express, which is aligned to the content of Head Start's National Reporting System (both fall and spring forms; USDHHS, 2003), in addition to high empirical reliability of .97 (McDermott et al., 2011).

Motivation Orientation. The Mastery Motivation Puzzle Task (MMPT; Smiley & Dweck, 1994) employs a set of puzzles to assess children's motivation orientations. All included puzzles have 24 pieces. In order to make the puzzle developmentally appropriate, 16 of the pieces are glued down, leaving only eight for children to manipulate. Three of the puzzles are made unsolvable by swapping out three of the eight pieces for similar pieces that do not fit.

Assessment takes place over two sessions within a week. During the first session participants complete a pretest puzzle to establish baseline puzzle ability; the amount of time taken by the child to complete the puzzle is recorded, where higher times are indicative of lower baseline puzzle ability. During the second session, participants are first asked to complete three unsolvable puzzles and then the one solvable puzzle. Participants are given two-minutes to complete each of the unsolvable puzzles and unlimited time to complete the solvable one. Upon completion of the final puzzle children are shown all four puzzles in the exact state that they left them and told, "You can do one of these again. Which one would you like to do?" After the child selects a puzzle they are told, "Good choice. Why did you pick that puzzle?" After the child's response is recorded they are given the correct pieces to the puzzle they selected and allowed as much time as they need to complete it. Children are subsequently asked, "If you had lots of time right now, could you finish any of these (unsolvable) puzzles?" Children who respond, "no" are

marked as low confidence and children who respond, “yes” are marked high confidence. Children’s verbalizations are also recorded during puzzle completion and all verbalizations are coded (see Table 1).

Assessors were instructed not to speak to children during puzzle completion and if children asked for help assessors responded, “I want to see you do it. Just do the best you can.” Similarly, if children expressed they didn’t want to continue assessors responded, “you’re almost done. Just do the best you can.” If children became upset and overly frustrated we would have discontinued the assessment, however, that was not necessary in this study. If children appeared disinterested or stopped working on the puzzle assessors directed them back to the task and asked them to try their best to complete it. In the case that children had successfully placed all five of the possible pieces in the unsolvable puzzle and the assessor thought the children might notice that the final three pieces do not fit before the two minute time limit was up, the assessor was instructed to move the child on to the next puzzle by saying, “okay time’s up! Let’s try the next puzzle.” This situation only came up three times during this study and it was handled appropriately so none of the children realized the puzzles were not solvable.

Children’s reasons for choosing the puzzle to try for a second time are divided into one of four categories: challenge, want/like, no challenge, and no reason. Responses that indicate an interest in taking on a challenge (e.g., “Because I want to try to finish it.”) are coded as, “Challenge.” Responses that indicate the child had an affinity for that particular puzzle (e.g., “Because I like that one.”) are coded as, “Want/Like.” Responses that indicate an interest in avoiding challenge or selecting the easiest one (e.g., “Because that one is easy” or, “Because I can already do that one.”) are coded as, “No Challenge.” Finally, responses that indicate the child has no reason for their choice, (“I don’t know” or, “Just because.”) are coded as, “No

Reason" (Smiley & Dweck, 1994). Children's puzzle choice and reason for selection are used to determine their motivation orientation. Children who selected the solvable puzzle to try for a second time are placed in the performance motivated group regardless of their explanation. Additionally, children who give a, "No Challenge" explanation for their choice are also placed in the performance motivated group regardless of their puzzle choice (this did not occur in the current sample). Children who select one of the unsolvable puzzles and give a, "Challenge," Want/Like" or, "No Reason" response are placed in the mastery motivated group. The original task included an additional aspect where children chose from an array of smiley faces to convey their affect after each puzzle (Smiley & Dweck, 1994). This part of the MMPT was omitted in this study due to more recent research with preschoolers served by Head Start demonstrating that part of the task did not reveal meaningful information (Day, 2012; Day & Burns; 2011).

Pilot Study to Insure Comparable Puzzle Difficulty and Developmental Appropriateness

Although the MMPT has been used in multiple studies following the protocol described above, researchers have used a variety of different puzzles for this task. In order to ensure that the puzzles used for the present study were comparable, five puzzles featuring "Winnie the Pooh" in various scenarios (see Figure 1) were evaluated at the end of the 2012 school year, prior to the beginning of this study. Each of these five puzzles were administered to ten (n = 5 male) children ranging from three to five years old, enrolled in Head Start. Each child was given the puzzles in a different order and each of the five puzzles was presented first in the order for two different children. Children were not given any assistance in completing the puzzles and the time it took for them to complete the puzzles was recorded.

The mean puzzle completion time in minutes and seconds was (*M = 4:11, SD = 2:58*), and the mean completion times for each of the five puzzles (3:35, 4:50, 3:39, 4:07, 4:23), were

not significantly different, $F(4,36) = .73$, $p = .578$. In the majority of cases children would take the longest amount of time to complete the first puzzle administered and their times would get progressively faster on subsequent puzzles. This pilot study showed that the five puzzles are comparable to each other and developmentally appropriate for preschool aged children served by Head Start.

Procedure

Data were collected during the 2012-2013 school year. Consent was obtained from teachers and parents who agreed to participate. The MMPT was collected in the middle of the school year on the entire sample before children went on their four week winter break. Children in the re-test sample were administered the MMPT for a second time when they returned from the break. Thus, the gap between test and retest was longer than the typical standard of within two weeks, we discuss this further in the limitations section of this manuscript. Teachers were asked to fill out the Learning-to-Learn Scale in the middle of the school year (also before the winter break). Children were assessed on the four subscales of the Learning Express (mathematics, listening comprehension, alphabet knowledge, and vocabulary), as well as, the Lens on Science Assessment, in the beginning of the school year and again at the end of the school year. During the beginning of the school year, the Learning Express, and the Lens on Science Assessment were administered on two different days. Each session lasted approximately 20-30 minutes. All testing took place in children's schools in a quiet and secluded room.

Results

Distribution and Test-Retest Reliability of MMPT

Of the 334 children assessed 77% (n = 259) endorsed a mastery motivated orientation and 23% (n = 75) endorsed a performance motivated orientation (see Figure 2). One hundred and thirteen children were retested on the MMPT, 51% (n = 58) whom originally endorsed mastery and 49% (n = 55) whom originally endorsed performance. Ninety percent (n = 52) of the 58 children who were initially classified as mastery motivated, maintained this classification at retest. However, only 51% (n = 28) of the children who were initially classified as performance motivated remained performance motivated at retest. Although the overall Cohen's Kappa statistic calculated (K= .392, p < .01), suggests poor test-retest reliability, this was a result of high reliability for the mastery group and poor reliability for the performance group (see Table 2).

Concurrent Validity of the MMPT

The MMPT did not correlate significantly with any of the school readiness outcomes from the beginning of the school year (see Table 3). Linear regression was utilized to examine the relationship between approaches to learning and motivation orientation controlling for children's gender, race, age, and puzzle solving ability. The covariates age, race, gender and puzzle solving ability were included in all regressions to control for basic demographic characteristics, as well as, children's cognitive ability as these factors are commonly related to academic school readiness. Motivation orientation did not significantly predict approaches to learning controlling for age, race, gender, and baseline puzzle ability, t = -.86, p = .39 (see Table 4).

Additional linear regressions were conducted in order to examine the relationship between motivation orientation and the verbalizations (see Table 1) that children made during

the puzzle task. Motivation orientation significantly predicted "negative ability evaluations" which are statements indicating the child doubts their ability to complete the task, meaning that mastery motivated children made significantly less negative ability evaluations, t = -2.95, p = .01, than their performance motivated peers controlling for age, race, gender, and baseline puzzle solving ability (see Table 4). The number of puzzle pieces' children correctly placed in the insolvable puzzles was tracked; however, it was not a significant predictor of children's motivation orientation.

Predictive Validity of the MMPT

The MMPT did not correlate significantly with any of the school readiness outcomes at the end of the school year (see Table 5). For descriptive data on school readiness outcomes (see Table 6) and children's verbalizations during the puzzle task (see Table 7). Linear regressions were used to examine the relationships between motivation orientation and end of the year academic readiness, controlling for beginning of the year readiness, which allows us to predict gains across the Head Start school year. Motivation orientation was not a significant predictor of end of year science scores, after controlling for baseline science scores, age, race, gender, and baseline puzzle ability, t = -1.66, p = .10 (see Table 8).

The next four models examined the subscales of the Learning Express using linear regression. Motivation orientation was not a significant predictor of end of year alphabet knowledge after controlling for baseline alphabet knowledge, age, race, gender, and baseline puzzle ability, t = -.06, p = .95. Similarly, motivation orientation was not a significant predictor of end of year vocabulary after controlling for baseline vocabulary, age, race, gender, and baseline puzzle ability, t = .059, p = .95. Motivation orientation was also not a significant

predictor of end of year math scores after controlling for baseline math scores, age, race, gender, and baseline puzzle ability, $t = 1.05$, $p = .30$. Finally, motivation orientation was not a significant predictor of end of year listening comprehension after controlling for baseline listening comprehension, age, race, gender, and baseline puzzle ability, $t = .64$, $p = .53$ (see Table 8).

Discussion

In the present study the Mastery Motivation Puzzle Task (MMPT) was used to categorize low-income preschool children enrolled in a large urban Head Start program into two motivational categories. This study was the first to collect the MMPT at multiple time points in order to assess the test-retest reliability of the measure. This adapted version of the MMPT displayed poor test-retest reliability in this sample, however, this does not mean the measure is unreliable under all conditions. The MMPT was developed in the context of a research study with preschool children who were mostly white and from middle to high-income families. It is critical to remember that construct reliability and validity are not solely a product of a measure (AERA/APA/NCME, 1999). The method of delivery and the demographics of the participants can play a huge role in the reliability and validity of a measure and early childhood researchers must remember to take that into consideration when selecting measures for future research.

While it is universally critical that researchers obtain evidence of reliability and validity of a measure in the specific population they intend to study, and pay careful attention to the delivery of the measure, in the current study there is another perspective that should be considered. Results showed that 90% of children who endorsed mastery motivation during their first MMPT assessment utilized the same orientation at retest. Conversely, only 50% of children who endorsed performance motivation during their first assessment utilized the same orientation

at retest. This despite the relatively short gap between test and retest. Thus, these results may suggest that mastery motivation is a more stable trait than performance motivation. This could be due to the confidence of mastery motivated children, which makes them less likely to hesitate in the face of challenge, whereas, performance motivated children may approach a challenge with more trepidation causing them to waver back and forth, on whether they are willing to experience failure on that particular day.

This finding could have important implications for intervention work; if the less adaptive performance motivated orientation is less stable, then it may be more sensitive to intervention. Additionally, if the mastery motivation orientation is more stable, then children may be more likely to continue utilizing the more adaptive orientation post-intervention. However, this perspective should be interpreted with caution due to the poor test-retest reliability in this sample and a few other limitations of using the MMPT with this population, discussed below. Prior studies utilizing the MMPT in low-income samples have reported children endorsing mastery motivation approximately 50% of the time (Brown, 2009; Day & Burns, 2011). However, in the current study which has a sample size three times larger than any study to date using this measure, mastery motivation was endorsed by 77% of children. This distribution replicates the finding of Day (2012) who reported 76% of children endorsing mastery motivation. This distribution highlights a potential issue of the measure as it reflects the same distribution that would occur if children were selecting puzzles at random.

During the MMPT administration, children are given three consecutive unsolvable puzzles and are made to move along to the next puzzle once the two-minute time limit is reached. The fourth puzzle they are given is solvable and they are allowed as much time as they

need to complete it. Children are then shown all four of the puzzles they engaged with and are asked which one they would like to try again. The assumption is that children will remember their experience with each puzzle and choose one based on either their success or failure with that puzzle, indicating mastery, or performance motivated orientation. This assumption may not be appropriate for preschoolers from low-income families; asking them to hold four different puzzles in their working memory and assuming they will pick based on their success or failure, and not some other factor, is an assumption that may introduce considerable measurement error.

Given that children are picking from four different puzzles and three of them indicate mastery motivation while the fourth indicates performance, if children were merely selecting at random 75% would appear to be mastery motivated. This number is strikingly similar to the actual percentage of mastery motivated children in this study, 77% and in the study of Day (2012), 76%. If children were truly selecting at random, that would indicate that the MMPT is neither developmentally appropriate nor valid for use with the children in this sample and may explain the lack of concurrent validity (in relation to approaches to learning), and predictive validity (in relation to academic school readiness outcomes), shown by the MMPT in this study. Future research should focus on development of direct assessments of motivation orientation that reduce the cognitive demand to ensure they are developmentally appropriate and valid for children from low-income families.

Despite the appearance that children in this study may have been selecting puzzles purely at random, there is some evidence that suggests otherwise. If children were truly selecting at random, the retest sample would have reflected the same ratio of 75% mastery and 25% performance. However, retest results suggested that children who endorsed mastery motivation were 90% reliable, while children who endorsed performance were 50% reliable. Additional

evidence to support that the MMPT is measuring some aspect of children's motivational orientations comes from children's self-talk. All verbalizations children made during the MMPT were coded, and results replicated a previous finding that mastery motivated children make fewer negative evaluations of their ability during challenging tasks (Day & Burns, 2011). In combination, this evidence implies that the MMPT is capturing motivation orientation to some extent. However, findings in regards to the predictive and concurrent validity were null, which could be due to a lack of sensitivity in the measurement properties of the MMPT, which yields a dichotomous outcome.

The vast majority of cognitive constructs exist on a continuum and mastery motivation is not a likely exception. One would assume that certain children are highly motivated to take on challenges and persist in the face of setbacks, while others waver back and forth depending on the circumstances, and some children shy away from challenges all together. The dichotomous nature of the MMPT is likely limiting its sensitivity. By dividing children into only two groups, critical variation between children is being lost, and this lack of sensitivity could explain why motivation orientation did not relate to approaches to learning or predict gains in school readiness. Future research should explore more sensitive direct assessments of motivation orientation that yield continuous outcomes and capture more variability between children.

Another limitation of the MMPT is that it employs only puzzles when assessing motivation orientation making it unidimensional in nature. Children's previous experience with puzzles may affect their level of comfort in attempting a difficult task, and although baseline puzzle ability was controlled for in all analyses, children's choices when dealing with puzzles may not reflect their choices with different tasks. For example, if a child who is typically

reluctant to attempt a challenging task has vast experience with puzzles, he or she may be willing to attempt a challenging puzzle due to confidence drawn from prior experience. This would not reflect their typical response, and thus would not be a valid indicator of their overall motivation orientation. Future direct assessments of motivation orientation should employ multi-dimensional tasks to reduce the risk of previous experience with a single task limiting the generalizability of children's motivational classifications.

Limitations

This study advances the literature by conducting the largest and most detailed examination of the most widely used direct assessment of motivation orientation for preschoolers. However, this study also has several limitations. The sample was predominantly African American (71%) and Latino (27%), and all children attended Head Start, indicating children come from low-income families. While research should target these at-risk populations, this sample is not nationally representative and results cannot be generalized to children from other socio-economic, racial, and ethnic backgrounds. Future research should replicate this study in samples of children from different racial and ethnic backgrounds and family income levels.

Another limitation of this study was the gap between the initial administration of the MMPT and the retest. Typically, to assess test-retest reliability the second administration is given within two weeks of the first. In this study the average amount of time between the first and second administration of the MMPT was approximately six weeks. This is because the first wave of MMPT data was collected before the students four week holiday break and the second wave was collected after the children returned from this break. The gap between test and retest was longer than is typical; however, children spent that time on holiday break outside of the

classroom setting experiencing fewer interactions with teachers who play such an important role in the development and maintenance of their motivational attitudes. Further, although motivation orientation has been shown to be malleable to sustained intervention (Blackwell, Trzesniewski & Dweck, 2007; Dweck, 2008), it is thought to be a generally stable construct and this study was not conducted in the context of an intervention. Thus, it is unlikely that children's motivation orientations would greatly shift even inside the classroom setting.

Additionally, previous studies administering the MMPT have used different puzzles (with different fictional characters and different amounts of pieces) and this study is the first to report pilot work to ensure the difficulty level of puzzles were comparable. Due to these minor procedural variations, results require replication in other samples of low-income preschoolers to ensure generalizability of results within this group. Despite these limitations the current study is a valuable resource for investigators aiming to develop novel measures of this powerful domain-general skill that are sensitive, reliable, and developmentally appropriate for preschool children from low-income families. The ability to identify early intervention methods that will aid in closing the academic achievement gap is contingent upon access to developmentally appropriate and valid measures for children from diverse backgrounds and levels of family income (Fantuzzo, McDermott, Manz, Hampton, & Burdick, 1996).

Conclusion

Previous research has demonstrated the need for domain-general skills, which are teachable, malleable, and can contribute, to the general learning of children from low-income families (Li-Grining, 2007; McClelland et al., 2007). Motivation orientation is one such skill that has been shown to be malleable in the context of intervention for older children (Blackwell,

Trzesniewski & Dweck, 2007; Dweck, 2008) and related to teacher ratings of children's school readiness in Head Start populations (Berhenke et al., 2011). However, the most widely used direct assessment of this construct for preschoolers had yet to be examined for reliability, validity, and developmental appropriateness for use in ethnically diverse, low-income samples. This study examined the distribution of mastery vs. performance motivated children, the test-retest reliability, as well as, concurrent and predictive validity of the MMPT in a sample of children from low-income families. The adapted MMPT demonstrated poor reliability, and did not show concurrent nor predictive validity. Results serve as a reminder to researchers that reliability and validity must be re-examined when conducting research with new populations. The assumption that a measure that is developmentally appropriate and valid for the population it was developed for will continue to be such in new and different populations can be a costly one. This study also highlights potential reasons that this measure that may lack sensitivity and not be developmentally appropriate or valid for use in this population of preschoolers from low-income families.

Despite the null findings, results further our understanding of a widely used direct assessment of motivation orientation, and lend guidance towards the next steps for further research on this construct among preschoolers from low-income families. In order to conduct research aimed at fostering this powerful domain-general skill among a vulnerable population, measures of motivation orientation should be evaluated for reliability and validity for young, ethnically diverse, children from low-income families. Results of this line of research have the potential to inform and offer support for the development and implementation of motivation orientation interventions. These interventions aimed at fostering adaptive motivational strategies in at-risk preschool aged children have implications for narrowing the school readiness

achievement gap, and ensuring that children from low income backgrounds do not enter kindergarten already behind their peers from higher income backgrounds.

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