Research Square

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Mastery Motivation in Young Children with Williams Syndrome or Down Syndrome

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Abstract

Mastery motivation supports goal-directed behavior and contributes to learning and development, yet little is known about this construct in children with intellectual and developmental disabilities. This study – the first to examine mastery motivation in individuals with Williams syndrome (WS) – compared 31 preschoolers with WS (M_{age}=4.12 years) to 31 preschoolers with Down syndrome (DS; M_{age}=4.22 years) using both a task-based observational measure of mastery motivation and a parent-report questionnaire. Standardized measures of intellectual ability and adaptive behavior were also administered. Children with WS demonstrated significantly less mastery persistence and mastery pleasure than children with DS on the task-based measure, despite having significantly higher overall intellectual ability. The groups did not differ significantly on task-based competence. Parents rated children with WS significantly lower than children with DS on overall persistence and general competence but not on mastery pleasure. Relative to the norming sample for the parent measure, both syndrome groups had lower overall persistence and general competence but did not differ significantly on mastery pleasure. Task-based and parent-reported measures of corresponding mastery motivation constructs were not significantly correlated, suggesting they capture different aspects of behavior across contexts. In a multiple regression, overall intellectual ability and parent-reported overall persistence each accounted for significant unique variance in adaptive behavior, whereas syndrome group did not. These findings establish mastery motivation as a meaningful developmental construct in children with WS and DS, beyond consideration of intellectual ability and diagnosis, and highlight the importance of assessing its instrumental and expressive/affective components across both structured and everyday contexts.

Research highlights

- First study of mastery motivation in individuals with Williams syndrome (WS) and first to compare children with Down syndrome (DS) with children with another genetic syndrome.
- Children with WS demonstrated lower overall persistence than children with DS on both task-based and parent-report measures, despite having significantly higher overall intellectual ability.
- Parent-reported overall persistence (mastery motivation) and intellectual ability each accounted for unique variance in adaptive behavior, whereas syndrome group did not.
- Mastery motivation is a meaningful developmental construct separate from intellectual ability and syndrome group, impacting daily life for children with intellectual disabilities.

Introduction

Mastery motivation, the intrinsic drive to explore and master one's environment, is of crucial importance for learning and development because it leads to engagement in a task and facilitates eventual mastery, which in turn is associated with the experience of pleasure while performing newly acquired behaviors and skills (Shonkoff & Phillips, 2000; Yarrow et al., 1982, 1983). Mastery motivation is positively associated with outcomes valued both by society and by individuals, including cognitive abilities (Banerjee & Tamis-Lemonda, 2007; Yarrow et al., 1982, 1983), academic achievement (Gilmore et al., 2003; Józsa & Molnár, 2013; Mokrova et al., 2013), social skills (Józsa & Barrett, 2018), executive function (Brock et al., 2009; Hauser-Cram et al., 2014; Mizuno et al., 2011), and adaptive functioning (Gilmore & Cuskelly, 2017; Warschausky et al., 2017).

Most of the literature on mastery motivation has focused on typically developing (TD) children (Barrett & Morgan, 2018; Deater-Deckard et al., 2005). The focus of the considerably smaller literature on children with intellectual and developmental disabilities (IDD) has been on Down syndrome (DS) (e.g., Gilmore & Cuskelly, 2009, 2011, 2014, 2017) and children with developmental delay or IDD of mixed or unknown etiology (e.g., Gilmore et al., 2015; Hauser-Cram, 1996; Hauser-Cram et al., 2014). To our knowledge, no studies of the mastery motivation of children with Williams syndrome (WS) have been published.

The present study addresses this gap by examining the mastery motivation of preschoolers with WS, a rare (1:7,500) genetic syndrome caused by a microdeletion of 25 – 27 genes on chromosome 7q11.23 and associated with mild to moderate intellectual disability (Kozel et al., 2021). The study also included a contrast group of preschoolers with DS matched for chronological age. This design allowed us to directly identify similarities and differences between two groups of children with IDD due to differing genetic etiologies regarding both levels of mastery motivation and relations between mastery motivation, intellectual ability, and adaptive behavior. We also consider the generalizability of mastery motivation theory (Barrett & Morgan, 2018) to children with IDD by comparing our findings to those previously reported for TD children.

Theoretical framework: Mastery motivation

Mastery motivation is a multifaceted construct that has two main components: instrumental and expressive/affective behaviors (Barrett & Morgan, 2018). Instrumental behavior refers to the degree to which a child persists on a task, as measured by engaging in goal-directed behavior. Behavioral persistence can be manifested as cognitive persistence, social persistence, or gross motor persistence (Józsa & Molnár, 2013). Expressive/affective behaviors involve demonstration of pleasure or excitement when completing and mastering a task or negative emotional responses such as anger, frustration, sadness, or shame in response to challenge (Barrett & Morgan, 2018). Although mastery pleasure may accompany persistent behavior and successful performance, it is conceptually distinct from both persistence and competence. A child may persist with limited overt positive affect or express pleasure following success without sustaining engagement with the task.

This two-aspect conceptual framework of mastery motivation is grounded in effectance motivation theory, which holds that humans have an innate, intrinsic drive to interact competently with their environment and derive a feeling of efficacy from mastering tasks, independent of biological drives such as hunger (White, 1959). Harter (1978) extended this idea into a developmental model, showing that mastery motivation is shaped by experiences of success and failure, by a child's perceived competence, and by socializing agents such as caregiver reinforcement, and that it varies across domains rather than operating

as a single generic trait. This developmental perspective is echoed in contemporary motivational theory. The self-determination theory (Ryan & Deci, 2000) identifies competence as one of three basic psychological needs, alongside autonomy and relatedness, underscoring the centrality of mastery-related processes to healthy development. Together, these foundational and contemporary theories provide the conceptual basis for mastery motivation as a measurable, developmentally meaningful construct, one that has since been tested and supported across studies conducted in several countries (see Morgan et al., 2020 for an overview).

Mastery motivation in TD children

For TD children, mastery motivation has repeatedly been shown to be positively associated with positive future outcomes such as later social skills and academic achievement (Gilmore et al., 2003; Martin et al., 2013). For example, a series of foundational studies demonstrated that early persistence at tasks is related to general cognitive development (Jennings et al., 1979, 1984; Yarrow et al., 1982). Józsa and colleagues conducted several studies of mastery motivation in TD children, demonstrating its positive relation with skill development, social competence, and school success (Amukune & Jozsa, 2023; Józsa et al., 2017, 2019; Józsa & Barrett, 2018; Józsa & Molnár, 2013). Other research groups have reported similar findings, with the cognitive persistence component of mastery motivation being predictive of both academic achievement and social functioning (Bae et al., 2014; Huang & Lay, 2017; Kai Fung & Kien Hoa Chung, 2023; MacPhee et al., 2018; Ramakrishnan & Masten, 2020).

Although research on mastery motivation in TD children has focused primarily on persistence, findings also support the developmental importance of mastery pleasure. Children display greater pleasure when actively solving challenging problems than when completing easy or previously mastered tasks, suggesting that mastery pleasure reflects satisfaction derived from overcoming challenge rather than success alone (Harter, 1974). In three-year-olds, expressions of pleasure following mastery were associated with subsequent persistence and were influenced by maternal behavior during the task (Lütkenhaus, 1984). Research with infants and toddlers similarly indicates that task pleasure varies according to task difficulty and context (Redding et al., 1988). More recently, preschool mastery pleasure predicted reading achievement during the early elementary school years even after taking into account IQ and SES, supporting the importance of expressive/affective mastery motivation for later development (Józsa & Barrett, 2018).

Mastery motivation in individuals with IDD other than DS

Individuals with IDD frequently encounter challenges leading to experiences of failure when completing challenging tasks, which may negatively affect motivation to engage with difficult tasks in the future (Cuskelly & Gilmore, 2014). Along these lines, there is evidence that individuals with IDD are more motivated to avoid failure than to achieve success (Bennett-Gates & Zigler, 1999) and they might seek social approval more often than task mastery (Brinker & Lewis, 1982; Merighi et al., 1990). Consistent with this view, studies that have focused on mastery motivation in individuals with IDD have reported lower motivation for challenge and mastery among children with IDD compared to TD peers, although findings are less consistent when groups are matched on mental age (Blair et al., 2001; Hauser-Cram, 1996; Harter & Zigler, 1974).

Research also indicates that pursuing challenging tasks, or having instrumental mastery motivation, is associated with positive developmental outcomes for individuals with IDD. Higher levels of persistence and competence have been linked to stronger cognitive and adaptive functioning (Blair et al., 2001; Hauser-Cram 1996; Wang et al., 2016). Longitudinal evidence further suggests that early mastery motivation predicts later intellectual and adaptive outcomes beyond cognitive ability alone (Hauser-Cram et al., 2001). On parent-report measures, children with IDD are typically rated lower than TD children in persistence and competence, although findings for mastery pleasure are less consistent (Cuskelly et al., 2013; Majnemer et al., 2010; Morgan et al., 2013, 2017). Some studies suggest that children with IDD may continue to experience and express pleasure during mastery activities even when their persistence or competence is lower than that of TD peers (Gilmore et al., 2003, 2015). These findings reinforce the importance of considering the instrumental and expressive/affective components of mastery motivation separately.

Mastery motivation in individuals with DS

Most of the research on mastery motivation in children with IDD has focused on DS, the most common genetic syndrome associated with intellectual disability (1:700). In 95% of the cases, it is caused by an extra chromosome 21 (trisomy 21). DS is characterized by relative strengths in some aspects of visual processing, receptive language, and nonverbal social functioning, and relative weaknesses in gross motor skills and expressive language skills (Fidler, 2005). Numerous studies have examined the relation between mastery motivation and cognitive ability in children with DS, indicating strong correlations in early infancy (Veitze et al., 1983) and beyond (Hauser-Cram, 1993, 1996; Niccols et al., 2003; Schwethelm & Mahoney, 1986). Cognitive skills and adaptive competence in children with DS have been associated with mastery motivation in both cross-sectional (Niccols et al., 2003) and longitudinal (Hauser-Cram, 1993) studies. A series of longitudinal studies demonstrated that early instrumental mastery motivation made unique contributions to academic competence in adolescence (Gilmore & Cuskelly, 2009) and to adult adaptive behavior (Gilmore & Cuskelly, 2017), above and beyond the effects of general cognitive skills.

Relative to TD children, previous studies suggest that similarly to findings for children with IDD of other or unknown etiology (Hauser-Cram, 1996), individuals with DS display similar performance in task-based mastery motivation when compared to mental-age matched TD children but have lower general mastery motivation based on parental ratings (Cuskelly et al., 2013; Gilmore et al., 2003; Gilmore et al., 2015; Gilmore & Cuskelly, 2009, 2011, 2014, 2017).

Previous research also suggests that the instrumental and expressive/affective components of mastery motivation may operate differently in children with DS. Although children with DS may display lower persistence or competence in some contexts, their expressions of pleasure during mastery activities may be relatively preserved (Gilmore et al., 2003, 2015; Gilmore & Cuskelly, 2011, 2014). Gilmore et al. (2003) further emphasized that overt displays of mastery pleasure may reflect not only enjoyment derived from successful task performance but also the child's response to social attention or reinforcement. This distinction is especially important when studying children with highly social behavioral profiles because observable positive affect may be influenced by the interpersonal context in which the task is completed. More broadly, differences between observational and parent-report findings suggest that mastery pleasure may vary across settings and may be captured differently by structured tasks and ratings of everyday behavior (Gilmore & Cuskelly, 2011; Morgan et

al., 2020). It should be noted that while it is important to study individuals with DS, it is hard to draw conclusions about individuals with other forms of IDD based solely on the findings of this group.

Current Study

In contrast to the many studies of mastery motivation of individuals with DS, to our knowledge there have been no published studies of mastery motivation of individuals with WS. Similarly to children with DS, children with WS typically are gregarious (e.g., Klein-Tasman & Mervis, 2003) and have adaptive function in the mild to moderate disability range (Brawn & Porter, 2018). Compared to children and young adults with DS matched for overall cognitive ability and chronological age, individuals with WS display relative strengths in the grammatical aspects of language and in verbal short-term memory and relative weaknesses in visuospatial construction and visuospatial short-term memory (Edgin et al., 2010; Klein & Mervis, 1999; Kozel et al., 2021). On average, individuals with WS have somewhat higher overall cognitive ability than individuals with DS of similar chronological age (Edgin et al., 2010; Klein & Mervis, 1999, Thurman & Mervis, 2013). WS also is associated with social disinhibition, impulsivity, and attention problems (e.g., Kozel et al., 2021). It is unclear if these patterns of similarities and differences between children with WS and children with DS will affect the instrumental and/or expressive/affective components of mastery motivation. It also is unknown if mastery motivation relates to outcomes such as cognition and adaptive functioning in similar ways across the two syndromes.

Morgan et al. (2020) suggest that the combination of observational measures based on individualized moderately challenging mastery tasks and rating measures completed by parents or other caregivers provides the most comprehensive picture of a child's mastery motivation. Laboratory-based observational measures such as the Individualized Assessment of Mastery Motivation (IAMM; Morgan et al., 1992) provide a snapshot of a child's behavior in a controlled environment, whereas parent-report measures such as the Dimensions of Mastery Questionnaire-17 (DMQ-17; Morgan, 1997; Morgan et al., 2009) may have higher ecological validity since they focus on the child's behavior in the everyday real-world context, in various settings (Isquith et al., 2013). In the present study we used both the IAMM and the DMQ-17 to better capture children's mastery motivation skills.

The overall aim of this study was to compare the mastery motivation of young children with WS and DS and examine similarities and differences in predictors of adaptive competence for the two groups. To do so, we addressed four research questions:

1. Are there significant group differences between children with WS and same-aged children with DS in mastery motivation as assessed by a task-based measure (IAMM)? Given the lack of previous studies of mastery motivation in children with WS, no predictions were made.
2. Are there significant group differences between children with WS and same-aged children with DS in mastery motivation as assessed by a parent-report measure (DMQ-17)? Furthermore, do parental ratings on the DMQ-17 for one or both syndrome groups differ significantly from those for same-aged TD children in the DMQ-17 norming sample? Based on previous findings for children with DS (e.g., Gilmore et al., 2003, 2015; Glenn et al., 2001) and on anecdotal reports from parents of children with WS of concerns with limited mastery motivation, we hypothesized that caregivers would report lower mastery motivation for both children with DS and children with WS than same-aged TD children. No prediction was made regarding the comparison of DMQ-17 scores for the two syndrome groups.
3. What are the relations between mastery motivation, overall intellectual ability, and adaptive behavior for preschoolers with WS and preschoolers with DS? Based on prior literature, we predicted that standard scores (SSs) for both overall intellectual ability (Edgin et al., 2010; Klein & Mervis, 1999; Thurman & Mervis, 2013) and overall adaptive behavior (Edgin et al., 2010) would be significantly higher for the WS group than the DS group. Based on previous literature for children with WS (Brawn & Porter, 2018) and DS (Schworer et al., 2022), we expected that children with higher overall intellectual ability would also demonstrate higher overall adaptive skills. Based on previous literature for individuals with DS (Gilmore & Cuskelly, 2017) we expected that children with higher mastery motivation (in particular persistence and competence) would have higher overall intellectual ability and stronger adaptive skills. We also predicted that the relation between adaptive behavior (which is measured by what the child does on her/his own in the real world) and mastery motivation was likely to be stronger when mastery motivation was measured by the DMQ-17 (which addresses mastery motivation in a variety of real-world situations) than when it was measured by the lab-based IAMM.
4. Does mastery motivation as measured by overall persistence contribute significant unique variance to adaptive behavior beyond the contributions of overall intellectual ability and syndrome group? Based on previous literature for children with WS (Brawn & Porter, 2018) and DS (Schworer et al., 2022), we expected that overall intellectual ability would account for a significant amount of unique variance in overall adaptive skills. Based on previous literature for individuals with DS, we expected that for the DS group, a significant amount of unique variance in adaptive skills, beyond that contributed by overall intellectual ability, would be accounted for by DMQ-17 persistence scores (Gilmore & Cuskelly, 2017) and overall persistence as measured by the IAMM (Hauser-Cram et al., 2001; Niccols et al., 2003). Similarly, we predicted that the relation between mastery motivation and adaptive behavior would be stronger when mastery motivation was measured by the DMQ-17 rather than the IAMM. No predictions regarding mastery motivation were made for the WS group, and no prediction was made regarding whether the effect of syndrome group (WS or DS) would be significant.

Method

Participants

The final sample included 31 children with genetically-confirmed classic WS deletions (13 girls, 18 boys; M_{age} = 4.12 years, *SD* = 0.84, range: 3.00 – 5.46 years) and 31 children with trisomy 21 DS (15 girls, 16 boys; M_{age} = 4.22 years, *SD* = 0.78, range: 3.02 – 5.49 years). Eight additional children in this age range were excluded: six because they had a comorbid gold-standard autism spectrum disorder diagnosis (four with WS, two with DS) and two because their Early Learning Composite (ELC) standard scores (SS) were greater than 3 SDs higher than the sample mean (one with WS, one with mosaic DS).

The racial/ethnic background of the final sample was: 80.6% White non-Hispanic, 9.7% Asian non-Hispanic, 6.5% Black/African American non-Hispanic, and 3.2% White Hispanic for the WS group and 83.9% White non-Hispanic, 3.2% Asian non-Hispanic, 9.7% Black/African American non-Hispanic, and 3.2% White Hispanic for the DS group. The participants with DS lived in the South or Midwest USA census regions, and the participants with WS lived in the South, Midwest, or Northeast USA census regions. All participants lived in urban or suburban locations, and most were from middle-class backgrounds. All of the children with DS and 15 of the children with WS were tested in Louisville, KY, USA. The remaining children with WS were tested in Richmond, VA, USA. Data collection began in February 2006 and ended in January 2007.

Measures

Intellectual ability. The Mullen Scales of Early Learning (MSEL; Mullen, 1995), a comprehensive measure of cognitive functioning for children from birth to 70 months, was used to evaluate children's overall intellectual ability. The MSEL estimates a child's ELC (a measure of development quotient) based on their performance on the subtests measuring Visual Reception, Fine Motor, Receptive Language, and Expressive Language abilities. Performance on each of the four cognitive scales is reported as a T-score (general population M = 50, SD = 10), and performance on the ELC is reported as a SS (general population M= 100, SD = 15).

Mastery motivation – Individualized Assessment of Mastery Motivation. (IAMM; Morgan et al., 1992). The IAMM consists of three structured, individualized tasks (puzzles, shape sorters, and cause-effect toys), each with six levels of difficulty. The easiest level is considered moderately challenging for TD 15-month-olds, and the hardest is considered moderately challenging for TD 36-month-olds. The child's behavior was coded on one "moderately challenging" toy for each of the three tasks, following procedures suggested by Morgan et al. (1992) and used by others (e.g., Gilmore et al., 2003; Hauser-Cram, 1996; Hauser-Cram et al., 2014; Wang et al., 2013). The initial moderately challenging toy level was selected based on the child's MSEL nonverbal developmental level (nonverbal mental age). MSEL nonverbal age equivalent (AE) was determined by averaging the AEs obtained on the Visual Reception and Fine Motor subtests (Morgan et al., 1992). If the child completed at least one part of the task at that level within 2 minutes but did not complete all of the task in that time span, the task was considered to be moderately challenging. Following Morgan et al.'s (1992) procedure, if the child could not solve any part of the task at that level within 2 minutes, the next lower-level task was administered; if all parts were completed in less than 2 minutes, the next higher-level task was given. Based on this procedure, 26% of the children with WS and 26% of the children with DS required a one-level change from the initially assigned level on at least one task. No child required more than a one-level change on any task.

After the completion of the tasks, *persistence*, *mastery pleasure*, and *competence* were coded from videotape using an adapted version of Morgan et al.'s (1992) coding system. Rather than rating the child's modal behavior within each 15-second block, a continuous rating system was used. The Noldus Observer 5.0 (Noldus et al., 2000) was used to classify, at each moment in time, what behavior the child was engaging in. This procedure was used to increase accuracy. *Persistence* was operationalized as the child's attempts (successful or not) to solve the problem posed by the toy. *Mastery pleasure* was scored by counting nonverbal (e.g., smiles) and verbal (e.g., excited vocalizations) expressions of positive affect during or immediately following the completion of one of the steps of the task. Each nonverbal display or verbal statement earned a point, with a maximum of two points for each step. A *competence* score that took into account both the level of difficulty and the number of solutions completed was calculated separately for each task, using Morgan's (1992) formula: competence = [(number of solutions obtained by the child/number of possible solutions) X 100 + task level X 100]. Competence scores based on this formula are provided in Appendix E of Morgan (1992).

The IAMM has been shown to have good inter-observer reliability (Busch-Rossnagal, 1990; Barrett et al., 1993). For the present study, inter-rater reliability was calculated based on the coding of videos for three randomly selected children from each group. Cohen's Kappa was high for all coded behaviors: Persistence, 0.99; Mastery pleasure, 1.0; Competence, 0.97.

Mastery motivation – Dimensions of Mastery Questionnaire-17. (DMQ-17; Morgan, 1997; Morgan et al., 2009). The DMQ-17 is a normed questionnaire that allows parents to rate their children on several aspects of mastery motivation. The Preschool Form of the questionnaire and its normative data were used. The Preschool Form was normed on 244 children, 18 months to 5 years of age (Morgan et al., 2009). On the DMQ-17, 45 statements are rated according to how typical each statement is of the child's usual play behavior on a 5-point scale from "not at all typical" (1) to "very typical" (5). As reported by Morgan et al. (2009), the DMQ-17 scales have good internal consistency (Cronbach alpha > .70). The DMQ-17 has three composites and six factors. In this study we focused on the DMQ-17 Overall Persistence composite, the four factors that load onto this composite, the Mastery Pleasure factor, and the General Competence factor (see Table 1). We did not include the Negative Reaction to Failure factor due to the problems identified by previous researchers with items on this scale (see Morgan et al., 2009). Standardized scores [T-scores for each factor (M = 50, SD = 10) and SSs for the Overall Persistence Composite (M = 100, SD = 15)] were computed based on the distributional parameters reported by Morgan et al. (2009) for the TD norming sample, as described in the Supplementary Materials. Unlike averaged raw scores, standardized scores provide an estimate of relative standing on a continuous, equal-interval scale. For this reason, standardized scores were used in the analyses.

Adaptive behavior. The Vineland Adaptive Behavior Scales-Second Edition (Vineland-II; Sparrow et al., 2005) is an individually administered measure of adaptive behavior for individuals aged birth through 90 years. The Survey Interview Form, which was used in this study, is a semi-structured interview administered by a trained examiner to a parent. Items are scored on a three-point scale: 0 (child never performs the behavior or never performs it independently), 1 (child sometimes performs the behavior independently or partially performs the behavior independently), 2 (child usually performs the behavior independently – without physical help or reminders). For children aged birth through 6 years, the Vineland-II measures adaptive behavior in four domains: Communication, Daily Living Skills, Socialization, and Motor Skills. The Adaptive Behavior Composite (ABC) is based on scores from these four domains. For the general population, the ABC has a mean SS of 100 and a standard deviation of 15.

Procedure

The study protocol was reviewed and approved by the university's Institutional Review Board. All procedures were performed in accordance with the ethical standards of this Institutional Review Board and with the US Federal Policy for the Protection of Human Subjects. Parents or legal guardians of all participants provided written informed consent and children provided oral assent. All of the children with DS and 15 of the children with WS were evaluated at the senior author's laboratory. Sixteen children with WS were tested in a quiet room at the 2006 Williams Syndrome Association Family Convention in Richmond, VA, USA. The Vineland-II was administered by the senior author. All other measures were administered by trained doctoral students or research assistants, and all measures were scored according to the standardized or experimental procedures. The IAMM tasks were presented one at a time by the experimenter while the child was seated (unrestrained) in a child-sized chair at a low table and were videorecorded for later coding. To obtain an accurate measure of mastery motivation during the IAMM tasks, limited social interaction and no encouragement from the experimenter was displayed.

Data Analysis

Data were analyzed using IBM SPSS v. 28.0.1.1. To answer the first research question, three independent sample *t*-tests between the two groups (WS vs DS) were conducted for each of the three IAMM measures (i.e., persistence, mastery pleasure, and competence). To answer the second research question, we first conducted three independent sample *t*-tests between the two groups (WS vs DS) for the DMQ-17 Overall Persistence SS, the DMQ-17 Mastery Pleasure T, and the DMQ-17 General Competence T. In addition, a repeated measures analysis of variance (ANOVA) was conducted with group (WS vs DS) as the between-subjects factor and each of the four DMQ-17 persistence factors (Object-Oriented Persistence T, Social Persistence with Adults T, Social Persistence with Children T, Gross Motor Persistence T) as the within-subjects factors, followed by pairwise comparisons using the Sidak adjustment for multiple comparisons. Finally, seven one sample *t*-tests were computed between each of the two groups (WS and DS) and the DMQ-17 norms: one for the DMQ-17 Overall Persistence composite and one for each of the six DMQ-17 factors considered in this study. To account for multiple testing, Holm-Bonferroni corrections were applied separately to conceptually related families of *t*-tests, as indicated in the Results section.

To answer the third research question, bivariate Pearson correlations (α = 0.01, two-tailed) were computed separately for each group. Alpha was set at .01 rather than the conventional .05 to reduce the likelihood of Type I error given the number of correlations examined. Correlations between the following variables were investigated: chronological age, overall intellectual ability (as measured by MSEL ELC), overall adaptive behavior (as measured by Vineland-II ABC), the three IAMM mastery motivation measures, the DMQ-17 Overall Persistence composite, DMQ-17 Object-Oriented Persistence T, DMQ-17 Mastery Pleasure T, and DMQ-17 Competence T. DMQ-17 Object-Oriented Persistence T was included in addition to the DMQ-17 Overall Persistence Composite because several prior studies of children with DS (e.g., Gilmore & Cuskelly, 2009) reported correlations with Object-Oriented Persistence rather than Overall Persistence Composite. Exploratory two-tailed Fisher *r*-to-*z* tests (Lenhard & Lenhard, 2014) compared four selected correlations between the independent syndrome groups: task-based persistence with intellectual ability, task-based competence, and task-based mastery pleasure; and parent-reported overall persistence with parent-reported mastery pleasure. The Holm–Bonferroni procedure was applied across the four comparisons, with familywise α set at .05.

In addition, to determine if there were group differences in overall intellectual ability and/or overall adaptive behavior, we conducted independent sample *t*-tests between the two groups (WS vs DS) for the MSEL ELC and the Vineland-II ABC. To understand whether there were group differences in Vineland-II ABC (dependent variable) after controlling for MSEL ELC (covariate), an analysis of covariance (ANCOVA) was conducted with group (WS vs DS) as the between-subject variable. Finally, to evaluate the difference between the two groups on each of the four Vineland-II domains, a repeated measures ANOVA was conducted with group (WS vs DS) as the between-subjects factor and each of the four Vineland-II domains (Communication, Daily Living Skills, Socialization, Motor Skills) as the within-subjects factors, followed by pairwise comparisons using the Sidak adjustment for multiple comparisons.

To answer the fourth research question, a multiple regression analysis was conducted with Vineland-II ABC as the dependent variable and MSEL ELC, group (WS vs DS), and DMQ-17 Overall Persistence as the independent variables. Mullen ELC and DMQ-17 Overall Persistence were mean centered. In addition, the same multiple regression analysis was computed with IAMM persistence as an independent variable, in place of DMQ-17 Overall Persistence.

For the *t*-tests, Cohen's *d* was calculated as a measure of effect size (0.20 = small effect, 0.50 = medium, 0.80 = large; Cohen, 1988). For the ANOVAs, group comparisons were made using the Sidak adjustment for multiple comparisons and effect size was measured by partial eta-squared (η^2_p; 0.04 = small effect, 0.06 = medium, 0.14 = large; Cohen, 1988). Cohen's f^2 was used to measure effect size for regression analyses (0.02 = small effect, 0.15 = medium, 0.35 = large; Cohen, 1988). All assumptions were met.

Results

Descriptive statistics for all measures are provided in Table 2. The groups did not differ significantly in chronological age or proportion of girls (χ^2 (1, 61) = 0.26, p = .799). Although there was substantial variability in performance for both children with WS and DS on all measures, the *SD*s for MSEL ELC and Vineland-II ABC were considerably smaller than for the general population. In contrast, on the DMQ-17, both the WS and DS groups showed greater variability than the norming sample (Morgan et al., 2009) on all measures except General Competence T.

Question 1: Group differences in mastery motivation as measured by the IAMM

As reported in Table 2, on the IAMM, the WS group displayed significantly fewer instances of persistence (medium effect size, Holm-adjusted p = .046) and significantly fewer instances of mastery pleasure (medium effect size, Holm-adjusted p = .009) than the DS group. The general competence T-scores for the two groups did not differ significantly.

Question 2: Group differences in mastery motivation as measured by the DMQ-17

As reported in Table 2, the WS group scored significantly lower than the DS group on DMQ-17 Overall Persistence SS (medium effect size, Holm-adjusted p = .034) and on DMQ-17 General Competence *T* (large effect size, Holm-adjusted p = .003). The two groups did not differ significantly on DMQ-17 Mastery

Pleasure T-score. ANOVA results indicated a significant main effect of factor, $F_{2.57,180} = 25.07$, $p < .001$, $\eta^2_p = 0.30$, with no significant interaction between factor and group, $F_{3,180} = 1.19$, $p = .312$, $\eta^2_p = 0.02$ (Greenhouse-Geisser adjustment was used since sphericity assumption was violated). Pairwise comparisons, with Sidak adjustment for multiple comparisons, indicated that the DS group performed significantly higher than the WS group on the DMQ-17 persistence factors overall; overall mean difference = 5.68, *SE* = 2.25, $p = .014$. Finally, between-group pairwise comparisons for each factor indicated that the WS group scored significantly lower than the DS group on DMQ-17 Object-Oriented Persistence and Social Persistence with Children. No significant differences were found for DMQ-17 Social Persistence with Adults or DMQ-17 Gross Motor Persistence.

As shown in Table 3, both groups performed significantly below the DMQ-17 norming sample on Overall Persistence (large effect sizes) and General Competence (large effect sizes). Similarly, both groups performed significantly below the DMQ-17 norming sample on three of the four Persistence factors (Object-Oriented Persistence, Social Persistence with Adults, Social Persistence with Children). There were no significant differences between either group and the DMQ-17 norming sample in Gross Motor Persistence or Mastery Pleasure. Bar charts representing these group comparisons are shown in Figure 1.

Question 3: Relations between mastery motivation, overall intellectual ability, and adaptive behavior

Results of the group comparisons for the MSEL and the Vineland-II are shown in Table 2. As reported in the table, both MSEL ELC (large effect size) and Vineland-II ABC (medium effect size) were significantly higher for the WS group than the DS group. However, after controlling for MSEL ELC, the between-group difference in Vineland-II ABC was no longer statistically significant, F (1,59) = 0.27, $p = .607$, $\eta^2_p = 0.01$. Adjusted means, standard errors, and 95% confidence interval for Vineland-II ABC (controlling for MSEL ELC) are reported in Table 2.

To determine if SSs for the four Vineland-II domains differed significantly between the groups (WS vs DS), a repeated measures ANOVA was conducted. There was a significant main effect of domain, $F_{3,180} = 27.73$, $p < .001$, $\eta^2_p = 0.32$, with a significant interaction between domain and group, $F_{3,180} = 4.19$, $p = .007$, $\eta^2_p = 0.07$. As indicated in Table 2, pairwise comparisons, with Sidak adjustment for multiple comparisons, indicated that the WS group performed significantly better than the DS group on Communication SS, but no significant differences were found for Daily Living Skills SS, Socialization SS, or Motor Skills SS.

Pearson bivariate correlations among the measures included in the study are reported separately for each group in Table 4. For both groups, IAMM competence was positively correlated with chronological age, MSEL ELC was positively correlated with Vineland-II ABC, and DMQ-17 object-oriented persistence was positively correlated with DMQ-17 competence. For the WS group, IAMM persistence was positively correlated with both IAMM mastery pleasure and IAMM competence, and DMQ-17 overall persistence was positively correlated with DMQ-17 competence. For the DS group, MSEL ELC was negatively correlated with chronological age but positively correlated with IAMM persistence. Vineland-II ABC was positively correlated with DMQ competence. In addition, DMQ-17 overall persistence was positively correlated with DMQ-17 mastery pleasure. All other correlations, including correlations between corresponding IAMM and DMQ measures, were not significant at $p < .01$.

Exploratory comparisons using two-tailed Fisher *r*-to-*z* tests indicated that task-based persistence was more strongly associated with intellectual ability in the DS group ($r = .62$) than in the WS group ($r = .11$), $z = -2.30$, Holm-adjusted $p = .044$. Conversely, task-based persistence was more strongly associated with task competence in the WS group ($r = .49$) than in the DS group ($r = -.08$), $z = 2.31$, Holm-adjusted $p = .044$. Between-group differences in the associations between persistence and mastery pleasure were not significant for either the task-based measure (WS: $r = .53$; DS: $r = .15$), $z = 1.64$, Holm-adjusted $p = .100$, or the parent-report measure (WS: $r = .35$; DS: $r = .48$), $z = -0.59$, Holm-adjusted $p = .278$.

Question 4: Mastery motivation and adaptive skills

Table 5 shows the multiple regression analysis predicting Vineland-II ABC from MSEL ELC, Group (WS, DS), and DMQ-17 Overall Persistence. The model explained 41% of the variance. Mullen ELC (large effect size) and DMQ-17 Overall Persistence (small to medium effect size) accounted for significant unique variance in Vineland-II ABC, but Group did not. As reported in the Supplementary Materials (Table S1), in the multiple regression analysis predicting Vineland-II ABC from MSEL ELC, Group (WS, DS), and IAAM Persistence, only the effect of MSEL ELC (medium effect) was significant.

Discussion

This study is the first to examine mastery motivation in individuals with WS. To consider similarities and differences in mastery motivation and its relations to intellectual ability and adaptive behavior as a function of genetic syndrome, comparisons between children with WS and same-aged children with DS were made using both task-based and parent-report measures. Overall, children with WS demonstrated lower mastery motivation than children with DS, particularly in persistence, across both task-based and parent-report assessments. Both groups exhibited lower persistence and perceived competence than the TD norming sample for the parent-report measure. Notably, parent-reported persistence accounted for unique variance in adaptive behavior above and beyond intellectual ability and syndrome group, supporting mastery motivation as a distinct and meaningful contributor to crucial functional outcomes.

Instrumental Mastery Motivation: Persistence

Across both task-based and parent-report measures, children with WS were less persistent than children with DS despite having significantly higher intellectual ability. In the DS group, task-based persistence positively correlated with intellectual ability but not with task competence. In contrast, in the WS group, task-based persistence was positively correlated with task competence but not intellectual ability. These findings suggest that cognitive ability alone does not account for persistence. Rather, persistence appears to represent a distinct motivational construct that may be influenced by autonomy, prior experiences, and reinforcement processes (Harter, 1978; Ryan & Deci, 2000; Shogren et al., 2015; White, 1959). Exploratory two-tailed comparisons suggested that task-based persistence was more strongly associated with intellectual ability in children with DS and with task competence in children with

WS. This pattern raises the possibility that the correlates of persistence may vary across syndrome groups. However, because these findings are based on cross-sectional correlations in relatively small samples, they should be interpreted as preliminary.

Parent-reported persistence: Syndrome comparisons and comparisons with TD norms

Children with WS were rated significantly lower than children with DS on two of the four parent-report persistence domains: object-oriented persistence and social persistence with other children. However, the two syndrome groups did not differ significantly on social persistence with adults or gross motor persistence. Both children with DS (Gulranick et al., 2011) and children with WS (Gillooly et al., 2021, 2024; Klein-Tasman et al., 2011) evidence greater peer-relationship challenges than their TD peers. At the same time, the significantly higher social persistence with peers among children with DS relative to children with WS may reflect relatively stronger peer engagement for children with DS. Although children with WS typically evidence strong social interest and social motivation (Jones et al., 2000; Klein-Tasman & Mervis, 2003; Klein-Tasman et al., 2011), they have considerable difficulty with both social reciprocity (Klein-Tasman et al., 2011) and social cognition (Kinney & Mervis, 2025), resulting in disproportionate difficulty sustaining reciprocal peer interactions and friendships (Gillooly et al., 2021; 2024).

Relative to parent-reported TD norms, both syndrome groups were reported to have lower overall, object-oriented, and social persistence with both adults and children. This pattern is consistent with prior reports of reduced persistence in children with DS and other IDDs (Cuskelly et al., 2013; Gilmore et al., 2003, 2015; Gilmore & Cuskelly, 2009, 2011, 2014, 2017; Majnemer et al., 2010; Morgan et al., 2013, 2017). For children with IDD, repeated experiences with challenging tasks and failure may reduce willingness to engage in moderately challenging activities, while increasing motivation to avoid failure or seek social approval (Bennett-Gates & Zigler, 1999; Brinker & Lewis, 1982; Cuskelly & Gilmore, 2014; Merighi et al., 1990). In contrast, gross motor persistence as reported by parents was at similar levels for the two syndrome groups as for the TD norming sample. The relative preservation of gross motor persistence for both children with WS and children with DS further underscores the value of examining specific motivational domains separately.

Parent-reported object-oriented persistence was positively associated with parent-reported competence in both syndrome groups. Although parent-reported overall persistence was significantly positively associated with competence only in the WS group, the correlation value for the DS group indicated a moderate effect and was almost as high as the correlation value for object-oriented persistence. For the WS group, task-based persistence also was significantly associated with task-based competence. These findings are broadly consistent with research linking persistence with competence, skill development, and later achievement (Banerjee & Tamis-LeMonda, 2007; Gilmore et al., 2003; Józsa & Molnár, 2013; Mokrova et al., 2013; Yarrow et al., 1982, 1983).

Persistence across contexts and environments

Corresponding task-based and parent-report indicators were not significantly correlated in either group. Similar inconsistencies in convergence have been reported in previous studies, including in individuals with DS, where the pattern of associations among task-based and parent-report measures diverges and maternal ratings tend to be lower than task-based performance would predict (Gilmore & Cuskelly, 2011; Gilmore et al., 2003; Niccols et al., 2003; Wang et al., 2013, 2024). Together, these findings suggest that task-based and parent-reported measures provide complementary perspectives on persistence and should be used in combination (Morgan et al., 2020).

The task-based vs everyday distinction extended to adaptive behavior, where parent-reported persistence explained unique variance in adaptive behavior beyond intellectual ability and syndrome group, although task-based persistence did not. This result extends prior findings that mastery motivation contributes to functional outcomes above and beyond cognitive ability in individuals with IDD (Hauser-Cram et al., 2001; Niccols et al., 2003; Warschausky et al., 2017). The findings partially align with previous longitudinal studies linking persistence to later functional outcomes in DS. Both task-based and parent-reported persistence when the participants were 4 – 6 years old were positively correlated with later academic competence as measured by word reading performance on the Wechsler Individual Achievement Test-II (WIAT-II; Wechsler, 2001) during early adolescence, although after controlling for cognitive ability at Time 1, only the correlation between task-based persistence and later word reading remained statistically significant (Gilmore & Cuskelly, 2009). Gilmore and Cuskelly (2017) found that early task-based persistence predicted adaptive behavior in adulthood above and beyond intellectual ability. (Early parent-reported persistence was not considered.) In contrast, task-based persistence did not explain significant unique variance in adaptive behavior in the present study, potentially reflecting its relatively strong relationship with intellectual ability, particularly for the DS group. The significant association between parent-reported persistence and adaptive behavior even after controlling for cognitive ability may reflect the shared focus of the DMQ-17 and the Vineland on children's behavior in everyday contexts (Isquith et al., 2013; Morgan et al., 2020). Similarly, the significant association between task-based persistence and word reading as measured by a standardized assessment may reflect the shared focus of the IAMM and the WIAT on objective measurement under controlled conditions. Together, these findings suggest that persistence is highly context-dependent and that parent-report and direct assessment provide complementary perspectives on children's motivational functioning.

Expressive/Affective Mastery Motivation: Mastery Pleasure

The expressive/affective component of mastery motivation concerns children's emotional responses to challenge and success. On the task-based measure, children with WS displayed less mastery pleasure than children with DS, despite higher intellectual ability and comparable task-based competence. This finding supports the conceptual distinctions among competence, persistence, and mastery pleasure, indicating that successful performance alone may not be sufficient to elicit expressions of pleasure (Barrett & Morgan, 2018; Harter, 1978; Ryan & Deci, 2000). The lower task-based mastery pleasure observed in children with WS is notable given the heightened sociability and interest in interpersonal interaction associated with this syndrome (Jones et al., 2000; Klein-Tasman & Mervis, 2003). Because the tasks involved limited examiner interaction, they likely provided fewer opportunities for the social engagement that is especially rewarding for children with WS. Consistent with self-determination theory, successful performance may not be sufficient to elicit overt mastery pleasure when opportunities for relatedness or socially mediated reinforcement are limited (Ryan & Deci, 2000). This remains tentative as the study did not

distinguish task-directed from socially-directed positive affect, an important distinction to be made in future research, as visible mastery pleasure may reflect social attention seeking rather than mastery itself (Gilmore et al., 2003).

In contrast, parents reported similar levels of mastery pleasure in children with WS and DS, and neither syndrome group differed significantly from the TD norming sample. Thus, the lower task-based mastery pleasure observed for children with WS did not generalize to parents' perceptions of their child's mastery pleasure during everyday activities. This pattern supports the possibility that mastery pleasure during everyday life may be relatively preserved among children with IDD even when persistence or competence is lower than that of TD peers (Cuskelly et al., 2013; Gilmore et al., 2003, 2015; Gilmore & Cuskelly, 2011, 2014; Majnemer et al., 2010; Mazor-Karsenty et al., 2026; Morgan et al., 2013, 2017).

Mastery pleasure across contexts and environments

As observed for persistence, task-based and parent-reported mastery pleasure were not significantly correlated for either syndrome group, likely reflecting differences in mastery pleasure between brief structured assessments and everyday experiences that involve greater familiarity, choice, support, and social reinforcement (Isquith et al., 2013; Morgan et al., 2020). Correlational patterns between persistence and mastery pleasure also differed across groups: Task-based persistence and mastery pleasure were associated for the WS group, whereas parent-reported persistence and mastery pleasure were associated for the DS group. However, direct comparisons did not establish significant between-group differences in either association after Holm correction. Thus, these findings do not provide sufficient evidence that the relations between instrumental and expressive/affective mastery motivation differ across syndromes.

Future studies could clarify these processes by separately coding task-directed and socially directed positive affect and systematically varying the availability of adult encouragement or feedback.

Our findings suggest that mastery pleasure is a distinct, context-sensitive component of mastery motivation rather than a direct reflection of persistence, competence, or general positive affect. Assessing mastery pleasure separately from persistence and across multiple methods provides a more complete understanding of motivational functioning in children with IDD.

Limitations and future directions

The cross-sectional design used in the present study precludes causal conclusions about relations among mastery motivation, intellectual functioning, and adaptive behavior. Longitudinal studies are needed to determine whether early mastery motivation, particularly persistence, predicts subsequent changes in adaptive functioning. The relatively small sample sizes (although large for studies of children with genetic syndromes) also limited statistical power, estimate precision, and generalizability, particularly for correlations calculated separately by syndrome. The young, predominantly White sample further limits generalizability to older and more diverse populations. Associations between parent-reported mastery motivation and adaptive behavior may also have been strengthened by shared-informant and shared-method variance.

Future experimental and longitudinal studies should test whether interventions targeting persistence and other components of mastery motivation improve adaptive functioning for children with IDD. Promising approaches include modifying social and physical contexts, embedding moderately challenging activities in family routines, and using structured classroom activities targeting persistence and mastery pleasure (Hashmi et al., 2017; Liao et al., 2021; Waldman-Levi & Erez, 2015).

Conclusions

These findings advance understanding of mastery motivation by demonstrating its unique contribution to adaptive behavior beyond intellectual ability. Importantly, syndrome group did not account for significant unique variance in adaptive behavior, indicating that the same pattern was found for both children with WS and children with DS. Furthermore, overall intellectual ability was significantly higher for the group with WS, but overall persistence, whether assessed by lab-based tasks or parent report, was significantly higher for the group with DS. These findings highlight the relevance of mastery motivation to everyday functioning beyond intellectual ability or diagnostic classification and support its distinction from intellectual functioning.

Declarations

Data availability statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Tables

Table 1 *Dimensions of Mastery Questionnaire-17 (DMQ-17): Composite and Factors*

Composite	Factors	Example item
DMQ-17 Overall Persistence: Instrumental Mastery Motivation	Object-Oriented (Task) Persistence (9 items)	If a toy or task is hard to do, stops trying after a short time
	Social Persistence with Adults (6 items)	Enjoys talking with adults, and tries to keep them interested
	Social Persistence with Children (6 items)	Tries hard to make friends with other kids
	Gross Motor Persistence (8 items)	Tries to do well in physical activities even when they are hard
	Mastery Pleasure (6 items)	Smiles when he or she makes something happen
	General Competence (5 items)	Solves problems quickly

Table 2 *Descriptive Statistics and Group Comparisons*

	Williams syndrome (N=31)				Down syndrome (N=31)				
Variable	**Mean**	**Median**	**SD**	**Range**	**Mean**	**Median**	**SD**	**Range**	**Group comparisons**
Chronological age - years	4.12	4.05	0.84	3.00 – 5.46	4.22	4.47	0.78	3.02 – 5.49	$t(60)$= -0.07, p=.787, d=0.13
MSEL ELC	59.84	59.00	7.72	49 – 78	51.87	50.00	4.15	49 – 65	$t(60)$= -5.06, p<.001, d=1.29*
Vineland-II ABC	69.48	69.00	6.49	57 – 81	66.00	66.00	5.87	55 – 77	$t(60)$= -2.22, p=.030, d=0.56*
Communication SS	76.19	78.00	7.05	57 – 89	69.19	69.00	8.36	52 – 95	*MD* = -7.00, *SE*=1.96, p<.001*
Daily Living Skills SS	69.81	69.00	9.18	55 – 93	65.77	64.00	8.09	51 – 85	*MD* = -4.03, *SE*=2.20, p=.072
Socialization SS	75.23	74.00	8.26	61 – 90	74.81	75.00	7.52	61 – 90	*MD* = -0.42, *SE*=2.01, p=.835
Motor Skills SS	69.87	70.00	6.39	59 – 84	66.74	67.00	7.08	56 – 81	*MD* = -3.13, *SE*=1.71, p=.073
Adjusted Vineland-II ABC (controlling for ELC)	67.33		1.03 (SE)	65.26 – 69.41 (95% CI)	68.15		1.03 (SE)	66.08 – 70.23 (95% CI)	$F(1,59)$=0.27, p=.607, d=0.13
IAMM									
Persistence	8.20	7.67	3.59	1.00 – 14.67	11.13	11.00	5.96	3.67 – 39.00	$t(60)$ = 2.34, p=.023, d=0.60*
Mastery pleasure	0.80	0.67	0.88	0 – 2.67	1.60	1.33	1.15	0 – 4.00	$t(60)$ = 3.10, p=.003, d=0.79*
Competence	521.04	553.33	114.46	307.67 – 691.33	472.25	467.67	121.25	283.33 – 659.00	$t(60)$ = -1.63, p=.108, d=0.41
DMQ-17									
Overall Persistence SS	72.32	76.00	17.54	31 – 116	83.90	86.00	19.52	49 – 114	$t(60)$ = 2.46, p=.017, d=0.63*
Object-oriented T	33.00	33.00	12.55	11 – 66	40.13	39.00	12.65	15 – 66	*MD* = 7.13, *SE*=3.20, p=.030*
Social – Adults T	33.42	35.00	12.34	10 – 58	38.19	38.00	13.49	11 – 67	*MD* = 4.77, *SE*=3.28, p=.151
Social – Children T	33.58	30.00	12.42	13 – 61	42.00	43.00	11.14	23 – 61	*MD* = 8.42, *SE*=2.99, p=.007*
Gross Motor T	47.55	49.00	11.49	22 – 67	49.97	51.00	10.71	22 – 67	*MD* = 2.42, *SE*=2.82, p=.394
Mastery Pleasure T	47.39	51.00	13.9	13 – 61	49.13	54.00	12.61	11 – 61	$t(60)$ = 0.52, p=.607, d=0.13
General Competence T	22.39	19.00	7.22	11 – 39	32.16	34.00	9.13	11 – 53	$t(60)$=4.68, p<.001, d=1.19*

Note. WS = Williams syndrome; DS = Down syndrome; MSEL = Mullen Scales of Early Learning; ELC = Early Learning Composite; T = T-score; SS = standard score; ABC = Adaptive Behavior Composite; SE = standard error; IAMM = Individualized Assessment of Mastery Motivation; DMQ-17 = Dimensions of Mastery Questionnaire; *MD* = mean difference, *SE* = standard error. *Indicates that results remain statistically significant after corrections for multiple comparisons.

Table 3 *Comparisons between each Syndrome Group (WS and DS) and the DMQ-17 Normative Sample*

	TD	WS	*t*-test (TD vs WS)	DS	*t*-test (TD vs DS)
Variable	**Mean (SD)**	**Mean (SD)**		**Mean (SD)**	
DMQ-17 Overall Persistence SS	100 (15)	72.32 (17.54)	$t(30)=8.79$, $p<.001$, $d=1.58$*	83.90 (19.52)	$t(30)=4.59$, $p<.001$, $d=0.83$*
Object-oriented T	50 (10)	33.00 (12.55)	$t(30)=7.54$, $p<.001$, $d=1.36$*	40.13 (12.65)	$t(30)=4.35$, $p<.001$, $d=0.78$*
Social – Adults T	50 (10)	33.42 (12.34)	$t(30)=7.48$, $p<.001$, $d=1.34$*	38.19 (13.49)	$t(30)=4.87$, $p<.001$, $d=0.88$*
Social – Children T	50 (10)	33.58 (12.42)	$t(30)=7.36$, $p<.001$, $d=1.32$*	42.00 (11.14)	$t(30)=3.99$, $p<.001$, $d=0.72$*
Gross Motor T	50 (10)	47.55 (11.49)	$t(30)=1.19$, $p=.244$, $d=0.21$	49.97 (10.71)	$t(30)=0.02$, $p=.987$, $d=0.003$
DMQ-17 Mastery Pleasure T	50 (10)	47.39 (13.90)	$t(30)=1.05$, $p=.304$, $d=0.19$	49.13 (12.61)	$t(30)=0.39$, $p=.703$, $d=0.07$
DMQ-17 General Competence T	50 (10)	22.39 (7.22)	$t(30)=21.30$, $p<.001$, $d=3.83$*	32.16 (9.13)	$t(30)=10.88$, $p<.001$, $d=1.96$*

Note. DMQ-17 = Dimensions of Mastery Questionnaire; TD = typically developing; WS = Williams syndrome; DS = Down syndrome. Alpha was set at .007 (two-tailed) after Bonferroni correction. *Indicates that results remain statistically significant after corrections for multiple comparisons.

Table 4 *Bivariate Correlations Among the Measures Included in the Study as a Function of Group*

	1	2	3	4	5	6	7	8	9	10
1. Chronological age	–	-.11	.10	.40	.08	.82**	-.01	-.14	-.03	-.09
2. MSEL ELC	-.59**	–	.55*	.11	.25	.30	.21	.04	.22	.06
3. Vineland-II ABC	-.30	.59**	–	.21	.23	.35	.40	.29	.28	.26
4. IAMM persistence	-.35	.62**	.38	–	.53*	.49*	.08	.34	.34	.11
5. IAMM mastery pleasure	.12	.10	-.11	.15	–	.19	.24	.30	.10	.28
6. IAMM competence	.74**	-.21	.13	-.08	.12	–	.02	-.09	.12	-.04
7. DMQ-17 Overall Persistence SS	.14	.04	.26	.17	-.43	.24	–	–	.35	.47*
8. DMQ-17 Object-oriented T	-.20	.23	.26	.28	-.31	-.09	–	–	.30	.49*
9. DMQ-17 Mastery Pleasure T	.21	-.23	.08	.04	-.27	.30	.48*	.26	–	.20
10. DMQ-17 Competence T	-.12	.29	.46*	.37	-.25	.21	.45	.48*	.38	–

Note: Results for the Williams syndrome group ($n=31$) are shown above the diagonal. Results for the Down syndrome group ($n=31$) are shown below the diagonal.

MSEL = Mullen Scales of Early Learning; ELC = Early Learning Composite; ABC = Adaptive Behavior Composite; IAMM = Individualized Assessment of Mastery Motivation; DMQ-17 = Dimensions of Mastery Questionnaire; SS = standard score; T = T-score.

*$p<.01$; **$p<.001$. Alpha was set at .01 to adjust for the number of correlations examined.

Table 5 *Multiple Regression Analysis Predicting Vineland-II Adaptive Behavior Composite*

Predictor	*B*	*t*	*p* value	95% CI for *B*	Semi-partial *r*	Cohen's f^2
Constant	32.38	5.45	< .001	[20.49, 44.27]		
MSEL ELC	0.51	4.79	< .001	[0.29, 0.72]	.48	0.39
Group (WS vs DS)	0.47	0.29	.770	[-2.75, 3.70]	.03	<0.01
DMQ-17 Overall Persistence SS	0.09	2.50	.015	[0.02, 0.16]	.25	0.11

$R^2 = .41$, adjusted $R^2 = .38$, $F(3,58) = 13.46$, $p < .001$

Note. MSEL = Mullen Scales of Early Learning; ELC = Early Learning Composite; WS = Williams syndrome; DS = Down syndrome; DMQ-17 = Dimensions of Mastery Questionnaire; SS = standard score. Mullen ELC and DMQ-17 overall persistence were mean centered. The WS group was coded as 1 and the DS group as 0.

Figures

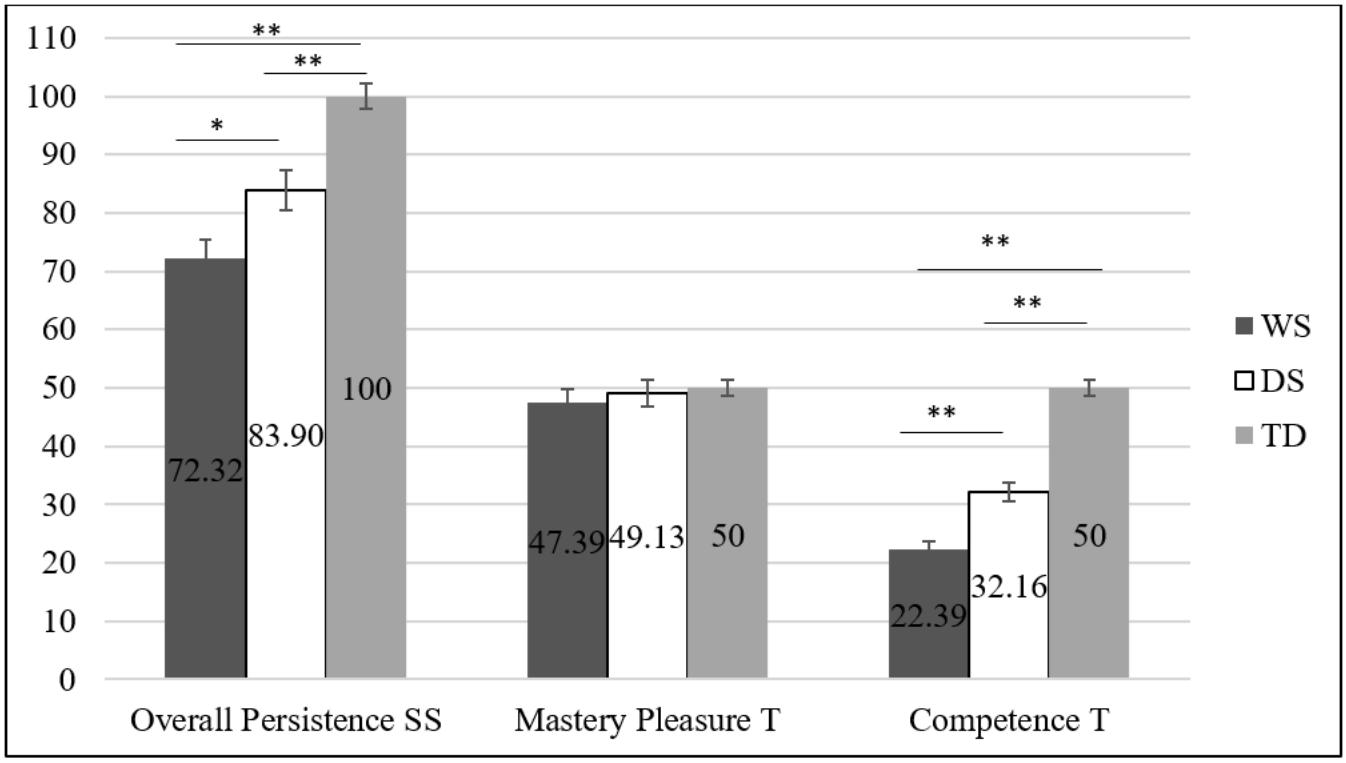


Figure 1

Dimensions of Mastery Questionnaire-17: Group Comparisons

Note. WS = Williams syndrome; DS = Down syndrome; TD = Typically developing; SS = standard score; T = T-score. Numbers on the bars indicate the group mean, and error bars represent the standard error of the mean.

*p<.01; **p<.001.

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