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# *HERJ - Hungarian Educational Research Journal*

## ***Mastery Motivation:***

## ***Measures and Results across Cultures and Ages***

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## Introduction to the Special Issue on Mastery Motivation: Measures and Results across Cultures and Ages

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### Abstract

The goal of this special issue of the Hungarian Educational Research Journal (HERJ) is to provide a broad up-to-date overview of the current state of research about the important concept of mastery motivation, which is shown by a person's persistent attempts to solve problems and master skills and by his or her pleasure when solving problems. This special issue provides new research on mastery motivation in Hungary, the US, Taiwan, Malaysia, Bangladesh, Iran, and Australia, with several articles comparing mastery motivation in two or more of these countries. The articles cover a broad age span from infants to young adults and describe several methods for assessing mastery motivation, including new and revised methods.

**Keywords:** motivation, child development, students, mastery motivation, mastery tasks, Dimensions of Mastery Questionnaire, cultural comparisons, school achievement

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## Introduction

The U.S. National Academy of Science report *From Neurons to Neighborhoods* (Shonkoff & Phillips, 2000) identified mastery motivation as a key developmental concept, which should be included as part of a child's evaluation. Thus, mastery motivation is an important topic for the *Hungarian Educational Research Journal* (HERJ) to include as a special issue. In part this is because there is evidence that early mastery motivation leads to later competence and achievement in school. That is, children became more competent because of their early persistence at tasks, even if early on they are not highly competent. Yarrow, Klein, Lomonaco, and Morgan (1975) reported that cognitive-motivational behaviors in infancy, such as reaching for and manipulating novel objects, predicted preschool children's Stanford-Binet intelligence quotient (IQ); whereas, the whole Bayley Mental Developmental Index did not. Similarly, Józsa and Molnár (2013) found that mastery motivation was more predictive of school grades than IQ and tests of basic skills. Recently, Józsa and Barrett (2016) found that mastery motivation in preschool children predicted school performance in grades 1 and 2. Wang (2016) found that persistence at mastery tasks predicted both cognitive and fine motor ability six months later in preschool age children with global developmental delays. Thus, measuring mastery motivation has implications for education and early intervention. Most of the papers for this special issue of HERJ discuss such implications.

## Definition and Key Measures

Morgan, Harmon, and Maslin-Cole (1990) proposed that mastery motivation stimulates a child to attempt to master a skill or task that is at least moderately challenging for him or her. Mastery motivation has two major aspects: instrumental and expressive (Barrett & Morgan, 1995). The *instrumental aspect* motivates a person to attempt, in a focused and persistent manner, to solve a problem or master a skill or task. The *expressive aspect* of mastery motivation produces affective reactions while the person is working at such a task or just after completing it. This affect may or may not be overtly expressed and may assume different forms in different children as they develop. Busch-Rossnagel and Morgan (2013) described the strengths and weaknesses of the two main measurement techniques to assess mastery motivation, individualized challenging behavioral tasks and the Dimensions of Mastery Questionnaires (DMQ).

## Studies with Behavioral Mastery Tasks

In early mastery motivation research, the general procedure was to begin the tasks with the tester demonstrating how to use a problem-posing toy. Then the toy, such as a puzzle, was given to the infant who had the opportunity to try to complete it with little encouragement and no help from the experimenter. The duration of task-directed behaviors, called persistence, was the primary measure of mastery motivation. In the Yarrow et al. studies (1982, 1983) all children of a certain age were given the same tasks or problems. These tasks were intended to be challenging for the average child, but due



to individual differences in children's abilities, the same task could be very hard for some children and easy for others. This problem led to the development of the individualized moderately challenging task method.

Morgan, Busch-Rossnagel, Maslin-Cole, and Harmon (1992) developed procedures that attempted to deal with the problem of controlling for cognitive differences between children and also made longitudinal analysis more meaningful. This strategy involved the use of sets of similar tasks/toys, such as puzzles, which had several levels of difficulty. The child's motivation was assessed with one level of each set of tasks that was found to be moderately difficult for that individual child. Specifically, a task was selected because the child had successfully completed at least part of it, but had not finished all parts of the task too quickly. Thus, the level chosen for a given child was moderately challenging but not so hard that partial completion was not achieved. The child's persistence and pleasure at those moderately difficult tasks were the main measures of mastery motivation. McCall (1995) called this individualized approach, with its identification and use of moderately difficult tasks "one of the most important measurement advances" (p. 288), in part because it facilitates the separation of ability or competence from motivation. This individualized method has been used by a number of researchers and led to an increasing understanding of mastery motivation in young children developing typically and, especially, atypically (e.g., Gilmore & Cuskelly, 2011; Young & Hauser-Cram, 2006; Wang, Morgan, Hwang, & Liao, 2013).

Hashmi, Seok, and Halik (2017, this issue) used these individualized mastery tasks as the outcome variables for their "I can" mastery motivation classroom program with young preschool children in Malaysia. In their paper, they describe and evaluate their intervention to enhance children's persistence and pleasure when trying to complete challenging tasks using a randomized pretest-posttest experimental design. They believe that the "I can" intervention program should lead to better school performance later.

Green and Morgan (2017, this issue) expanded the age range of the individualized tasks to be suitable for school-age children 7 to 10 years old. Using a person-oriented statistical approach, they identified four patterns of the children's behavior on the mastery tasks that produced distinct profiles of task behavior. Then they looked at how well mothers' and teachers' DMQ ratings and also teachers' ratings of intrinsic motivation predicted the child's task behavior profiles.

Wang, Morgan, Liao, Chen, Hwang, and Lu (2016) reported evidence for reliability and validity of an improved individualized task method. For example, these revised Individualized Moderately Challenging Tasks (IMoT) allowed for the possibility of identifying several moderately difficult tasks for a given child. Wang, Liao, and Morgan (2016) provided an example of how this revised individualized task procedure was used to assess one child with developmental delays.

Wang, Liao, and Morgan (2017, this issue) described this individualized challenging task method in detail for use with 15 to 48 month-old children, and they included information on reliability, validity, and descriptive statistics. Wang (2016) used these revised tasks to assess young preschool children who had global developmental delays and found that there were bidirectional relationships between mothers' interactive teaching behavior and the child's mastery motivation over a 6-month time period. More importantly, she found that mastery motivation mediated the relationship between mother's teaching behaviors and the child's later cognitive and also fine motor ability.

Barrett, Józsa, and Morgan (2017, this issue) described in detail a new computer-tablet procedure for assessing pre-academic knowledge, mastery motivation, and executive functions in 3 to 8 year-old American and Hungarian children as a school readiness predictor. The procedure described by Barrett et al. is designed to be an assessment that could become a complement to the nationally used Hungarian readiness test, DIFER, Diagnostic Assessment Systems for Development (Nagy, Józsa, Vidákovich, & Fazekasné Fenyvesi, 2016). Józsa, Barrett, Józsa, Kis, and Morgan (2017, this issue) focused on the results from testing Hungarian children with the mastery motivation tasks described by Barrett et al. (2017, this issue). They report an initial evaluation of the tablet tasks based on a computed measure of persistence on tasks that were actually moderately challenging for each individual child. Future plans for the assessment are that it become available for parents and teachers who would receive feedback about their child's "approaches to learning" and suggestions for enhancing them.

### **Studies with Mastery Questionnaires**

The Dimensions of Mastery Questionnaire (DMQ) assesses mastery motivation by having a parent or teacher rate their perceptions of the child's mastery motivation (and/or school-aged children rate their own behavior) in mastery contexts. The DMQ is a key measure in three of the papers in this special issue, and is the basis of the related questionnaires in the last two articles (Józsa, Kis, & Huang, 2017, this issue; Gilmore, Islam, Younesian, Bús, & Józsa, 2017, this issue).

When development of this mastery motivation questionnaire began, there were no parental report questionnaires designed to assess the motivation of toddlers and preschool children. Temperament questionnaires did assess perceptions of persistence, but none of them provided adequate coverage of the *motivational* aspects of preschoolers' attempted problem solving and mastery. Over time the DMQ was expanded to include parent and teacher ratings of infants and also school-age children. The school-age versions also had a form for the child to rate him or herself. All the age versions of the DMQ have common items that were thought to be appropriate across ages. The remaining items varied somewhat by age version but paralleled the items in the preschool version.

More than 20,000 children from 6 months to 19 years of age were rated with DMQ 17, the penultimate version (Morgan, 1997; Morgan, Busch-Rossnagel, Barrett, & Wang, 2009). These included more than a thousand children with a variety of delays or at risk due to low social economic status (SES), prematurity, or other factors. Geographically and linguistically, these children were very diverse. Participants included English speakers from the United States, Canada, the UK, and Australia. Chinese speakers were from mainland China and Taiwan. In Hungary, more than 10,000 mostly typically developing school-age children rated themselves and/or were rated by their parents and teachers.

A number of journal articles, dissertations, and presentations have included the DMQ; some are noted in the reference list. Józsa (2007) published a book in Hungarian on his large sample studies of mastery motivation, cognitive skills, IQ, and school achievement. Overviews of DMQ 17 research on the Hungarian-, English-, and Chinese-speaking samples were published by Józsa and Molnár (2013), Morgan, Wang, Liao, and Xu (2013), Józsa and Morgan (2014), and Józsa, Wang, Barrett, and Morgan (2014). These papers summarized evidence for reliability and validity, relationships to other variables, and also compared the three cultures at similar ages and across ages.

Huang and Lay (2017, this issue) used the DMQ 17 to follow young children in Taiwan from 10 to 53 months, longitudinally. They examined the stability over time of the various DMQ scales, and they also used the DMQ and demographic variables to predict the child's later competence.

Hwang Wang, Józsa, Wang, Liao, & Morgan (2017, this issue) examined the measurement invariance of the DMQ 17 ratings of preschool children from Hungary, Taiwan, and the US in order to find out which items did and didn't work well in all three cultures. Confirmatory factor analyses for all cultures together were conducted, indicating a good fit for the expected five-factor model. Finally, multiple-group confirmatory factor analyses were conducted to examine the measurement invariance of the children's DMQ scores among the English-, Chinese-, and Hungarian-speaking samples combined. Measurement invariance was confirmed.

The Hwang et al. paper provided empirical evidence used to revise and strengthen the DMQ, which is now DMQ 18 (Józsa & Morgan, 2015, Morgan et al., 2015). In addition, to English, Hungarian, and Chinese versions of DMQ 18, there is now a Spanish version, and translations into other languages also are being used to assess children from at least Iran, Israel, Korea, and Turkey.

Morgan Liao, Nyitrai, Huang, Wang, Blasco, Ramakrishnan, & Józsa (2017, this issue) used this revised DMQ to describe and compare five samples of infants, toddlers, and preschool children with and without risks or delays from Hungary, Taiwan, and the US. The paper examined gender, age, parent education, prematurity, and developmental delay as variables that might affect DMQ ratings and cultural similarities and differences among these samples.

There are well documented declines (from elementary to middle to high school) in intrinsic motivation by self-rated American children (e.g., Gottfried, 1985; Harter, 1981). Józsa (2007), Józsa and Molnár (2013), Józsa and Morgan (2014), and Józsa, Wang, Barrett, and Morgan (2014) found similar age-related declines in several aspects of mastery motivation in Hungarian, American, and Chinese school-age children and teens. These declines were found in both cross-sectional and longitudinal studies, across cultures, and in the ratings of parents and teachers as well as children's self-ratings.

Józsa, Kis, and Huang (2017, this issue) used a questionnaire based on the DMQ (Józsa, 2014) to examine age and cultural differences in motivation for school subjects in Hungary and Taiwan. This Subject Specific Mastery Motivation scale (SSMM) has subscales to assess the school child's motivation to try hard and to express pleasure in school subjects such as reading, math, science, and English as a foreign language. Similar to the DMQ studies described in the preceding paragraph, in most school subjects, mastery motivation decreased from grade 4 to 8. However, in both Hungary and Taiwan, the mastery motivation for English as a foreign language did not decline from grade 6 to grade 10, leading to speculation about why middle and high school students remained motivated to learn English.

Doherty-Bigara and Gilmore (2015) used the DMQ as the basis for a new instrument, the Dimensions of Adult Mastery Motivation Questionnaire (DAMMQ), which they used to collect data from Australian adults aged 18-90 years. They found that the DAMMQ had acceptable psychometric properties and produced some interesting differences. Gilmore, Islam, Younesian, Bús, and Józsa (2017, this issue) used the DAMMQ to compare university students in Hungary to those in Australia, Bangladesh, and Iran. The paper examined the psychometric properties of the DAMMQ in the four cultures and compared cultural differences on the several DAMMQ scales.

## **Discussion**

A questionnaire completed by parents, teachers, or the child/teen themselves can augment the usually short observational/behavioral task measures of mastery motivation because such raters have the opportunity to observe the child in other contexts and for longer periods and over time. The DMQ has proven to be useful for predicting school performance so several articles in this HERJ issue, which use mastery questionnaires, have important implications for educational institutions (e.g., Gilmore et al., 2017; Green & Morgan, 2017; Huang & Lay, 2017, and Józsa, Kis, & Huang, 2017).

On the other hand, behavioral measures are less filtered through the personality of the rater. Thus, we recommend, when feasible, that practitioners and investigators interested in mastery motivation use individualized moderately challenging mastery tasks and also the DMQ, as have several article in this issue: Green and Morgan (2017); Józsa, Barrett et al. (2017), and Wang et al. (2017). This combination of methods should prove even more helpful in providing implications for education.

There has been considerable recent interest among special educators and clinicians in assessing the concept of mastery motivation (e.g., Blasco & Guy, 2016; Gilmore & Cuskelly, 2011; Majnemer et al., 2013; Miller, Ziviani, & Boyd, 2014; Wang et al., 2013, 2016). Miller et al. (2014) conducted a systematic review of the properties of instruments designed to assess motivation in school-age children with a physical disability or motor delay; they concluded that the DMQ provides evidence of good clinical utility. Wang et al. (2016) has shown strong evidence for the reliability and validity of the revised individualized moderately challenging mastery tasks in children with global developmental delays. Also, Józsa, Barrett et al. (2017) provided evidence for the reliability and validity of the individualized moderately challenging measure derived from their computer tablet mastery tasks. Thus, research with the mastery assessments provides important implications for clinical practice and early intervention as indicated by several articles in this issue (e.g., Hashmi et al., 2017; Morgan et al., 2017; Wang et al., 2017).

In some DMQ research (e.g., Morgan, et al., 2013), parent ratings of English-speaking children with and without various delays have been compared. Children with delays were rated lower on the DMQ persistence scales and on competence than children developing typically who were similar in mental age. However, several research studies using both the DMQ and the individualized tasks have indicated that although parents (and no doubt teachers) tend to rate children with delays lower on mastery motivation, there were no differences in motivation on the individualized moderately challenging behavioral tasks (Gilmore & Cuskelly, 2011; Wang, Morgan, Hwang, & Liao, 2013). This later finding is probably because in these studies children with delays were given tasks that were appropriately difficult for them individually; i.e., were moderately challenging. Parents probably rate their children with delays lower because they compare them to children developing typically. These studies provide an important message and a caution for educators. There is good evidence for the validity of individual differences resulting from the mastery questionnaires. However, it should be remembered that the scores are based on raters' perceptions of mastery motivation. As such, the scores are influenced by the rater's frame of reference and culture. This caution is pointed out in several articles in this issue (e.g., Gilmore et al., 2017; Józsa, Kis, & Huang, 2017; Morgan et al., 2017). The positive message is that the motivation of children with delays seems, in general, to be as strong as that of children developing typically, if they are provided tasks that are moderately challenging for them personally.

## **Conclusion**

Mastery motivation is a fundamental developmental construct that should be used as part of a comprehensive evaluation of children. The DMQ, SSMM, and DAMMQ questionnaires provide useful and easily obtained mastery motivation information for persons from infancy through adulthood, in home, school, and across cultures. The individualized moderately challenging mastery task procedures provide valuable behavioral measures for young children which can complement the ratings from

mastery questionnaires. The papers in this special issue of HERJ provide valuable new information about mastery motivation methods and results across cultures and ages. They also discuss some of the implications for educational practices and outcomes.

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## References

- Barrett, K. C., Józsa, K., & Morgan, G. A. (2017). New computer-based mastery motivation and executive function tasks for school readiness and school success in 3 to 8 year-old children. *Hungarian Educational Research Journal*, 7(2), 86–105.
- Barrett, K. C., & Morgan, G. A. (1995). Continuities and discontinuities in mastery motivation in infancy and toddlerhood: A conceptualization and review. In R. H. MacTurk, & G. A. Morgan (Eds.), *Mastery motivation: Origins, conceptualizations, and applications* (pp. 67–93). Norwood, NJ: Ablex.
- Blasco, P. M., & Guy, S. (2016, June). *Executive function in infants and toddlers born low in birth weight (LBW) and preterm*. Presented at the International Society of Early Intervention (ISEI). Stockholm, Sweden.
- Busch-Rossnagel, N. A., & Morgan, G. A. (2013). Introduction to the mastery motivation and self-regulation section. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook of self-regulatory processes in development: New directions and international perspectives* (pp. 247–264). New York, NY: Psychology Press.
- Doherty-Bigara, J., & Gilmore, L. (2015). Development of the Dimensions of Adult Mastery Motivation Questionnaire. *The Australian Educational and Developmental Psychologist*, 32(2), 142–157. <https://doi.org/10.1017/edp.2015.18>
- Gilmore, L., & Cuskelly, M. (2011). Observational assessment and maternal reports of motivation in children and adolescents with Down syndrome. *American Association on Intellectual and Developmental Disabilities*, 116(2), 153–164. <https://doi.org/10.1352/1944-7558-116.2.153>
- Gilmore, L., Islam, S. Younesian, S., Bús, E., & Józsa, K. (2017). Mastery motivation of university students in Australia, Hungary, Bangladesh and Iran. *Hungarian Educational Research Journal*, 7(2), 178–191.
- Gottfried, A. E. (1985). Academic intrinsic motivation in elementary and junior high school students. *Journal of Educational Psychology*, 77(6), 631–645. <https://doi.org/10.1037/0022-0663.77.6.631>
- Green, S., & Morgan, G. A. (2017). Patterns of mastery task behavior in early school-age children in the United States. *Hungarian Educational Research Journal*, 7(2), 142–157.
- Harter, S. (1981). A new self-report scale of intrinsic versus extrinsic orientation in the classroom: motivational and informational components. *Developmental Psychology*, 17(3), 300–312. <https://doi.org/10.1037/0012-1649.17.3.300>
- Hashmi, S. I., Seok, C. B., & Halik, M. H. (2017). Enhancing persistence on mastery tasks among young preschool children by implementing the "I Can" Mastery Motivation Classroom Program. *Hungarian Educational Research Journal*, 7(2), 127–141.

- Huang S.-Y., & Lay, K.-L. (2017). Mastery motivation in infancy and early childhood: The consistency and variation of its stability and predictability of general competence. *Hungarian Educational Research Journal*, 7(2), 15–31.
- Hwang, A.-W., Wang, J., Józsa, K., Wang, P.-J., Liao, H.-F., & Morgan, G. A. (2017). Cross cultural invariance and comparisons of Hungarian-, Chinese-, and English-speaking preschool children leading to the revised Dimensions of Mastery Questionnaire (DMQ 18). *Hungarian Educational Research Journal*, 7(2), 32–47.
- Józsa, K. (2007). *Az elsajátítási motiváció [Mastery motivation]*. Budapest, Hungary: Műszaki Kiadó. (in Hungarian)
- Józsa, K. (2014). Developing new scales for assessing English and German language mastery motivation. In J. Horváth, & P. Medgyes (Eds.), *Studies in honour of Marianne Nikolov* (pp. 37–50). Pécs: Lingua Franca Csoport.
- Józsa, K., & Barrett, K. C. (2016). *Predicting school related skills and early school achievement in Hungarian school-age children from mastery motivation, IQ, and parental education: A longitudinal study*. Unpublished manuscript.
- Józsa, K., Barrett, K. C., Józsa, G., Kis, N., & Morgan, G. A. (2017). Development and initial evaluation of an individualized moderately challenging computer-tablet mastery motivation measure for 3-8 year-olds. *Hungarian Educational Research Journal*, 7(2), 106–126.
- Józsa, K., Kis, N., & Huang, S.-Y. (2017). Mastery motivation in school subjects in Hungary and Taiwan. *Hungarian Educational Research Journal*, 7(2), 158–177.
- Józsa, K., & Molnár, É. D. (2013). The relationship between mastery motivation, self-regulated learning and school success: A Hungarian and European perspective. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook of self-regulatory processes in development: New directions and international perspectives* (pp. 265–304). New York, NY: Psychology Press. <https://doi.org/10.4324/9780203080719.ch13>
- Józsa, K., & Morgan, G. A. (2014). Developmental changes in cognitive persistence and academic achievement between grade 4 and grade 8. *European Journal of Psychology of Education*, 29(3), 521–535. <https://doi.org/10.1007/s10212-014-0211-z>
- Józsa, K., & Morgan, G. A. (2015). An improved measure of mastery motivation: Reliability and validity of the Dimensions of Mastery Questionnaire (DMQ 18) for preschool children. *Hungarian Educational Research Journal*, 5(4), 87–103. <https://doi.org/10.14413/herj2015.04.08>
- Józsa, K., Wang, J., Barrett, K. C., & Morgan, G. A. (2014). Age and cultural differences in mastery motivation in American, Chinese, and Hungarian school-age children. *Child Development Research*, 2014. Article ID 803061, 1–16. <https://doi.org/10.1155/2014/803061>
- Majnemer, A., Shikako-Thomas, K., Lach, L., Shevell, M., Law, M., Schmitz, N., & The QUALA group (2013). Mastery motivation in adolescents with cerebral palsy. *Research in Developmental Disabilities*, 34(10), 3384–3392. <https://doi.org/10.1016/j.ridd.2013.07.002>
- McCall, R. B. (1995). On definitions and measures of mastery motivation. In R. H. MacTurk, & G. A. Morgan (Eds.), *Mastery motivation: Origins, conceptualizations, and applications* (pp. 273–292). Norwood, NJ: Ablex.
- Miller, L., Ziviani, J., & Boyd, R. N. (2014). A systematic review of clinometric properties of measurements of motivation for children aged 5-16 years with a physical disability or motor delay. *Physical & Occupational Therapy in Pediatrics*, 34(1), 90–114. <https://doi.org/10.3109/01942638.2013.771720>
- Morgan, G. A. (1997). *Dimensions of Mastery Questionnaire (Database Record)*. Retrieved from PsycTESTS.
- Morgan, G. A., Busch-Rossnagel, N. A., Barrett, K. C., & Wang, J. (2009). *The Dimensions of Mastery Questionnaire (DMQ): A manual about its development, psychometrics and use*. Colorado State University, Fort Collins. Retrieve from <http://mycahs.colostate.edu/George.Morgan/MasteryMotivation.htm>
- Morgan, G. A., Busch-Rossnagel, N. A., Maslin-Cole, C. A., & Harmon, R. J. (1992). *Mastery motivation tasks: Manual for 15- to 36-month-old children*. Bronx: Fordham University Psychology Department. (Updated 1993).



- Morgan, G. A., Harmon, R. J., & Maslin-Cole, C. A. (1990). Mastery motivation: Definition and measurement. *Early Education and Development*, 1(5), 318–339. [https://doi.org/10.1207/s15566935eed0105\\_1](https://doi.org/10.1207/s15566935eed0105_1)
- Morgan, G. A., Liao, H.-F., Nyitrai, Á., Huang, S.-Y., Wang, P.-J., Blasco, P., Ramakrishnan, J., & Józsa, K. (2017). The revised Dimensions of Mastery Questionnaire (DMQ 18) for infants and preschool children with and without risks or delays in Hungary, Taiwan, and the US. *Hungarian Educational Research Journal*, 7(2), 48–67.
- Morgan, G. A., Wang, J., Barrett, K. C., Liao, H.-F., Wang, P.-J., Huang, S.-Y., & Józsa, K. (2015). *The Revised Dimensions of Mastery Questionnaire (DMQ 18)*. <https://sites.google.com/a/rams.colostate.edu/georgemorgan/mastery-motivation>
- Morgan, G. A., Wang, J., Liao, H.-F., & Xu, Q. (2013). Using the Dimensions of Mastery Questionnaire to assess mastery motivation of English- and Chinese- speaking children: Psychometrics and implications for self-regulation. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook of self-regulatory processes in development: New directions and international perspectives* (pp. 305–335). New York, NY: Psychology Press. <https://doi.org/10.4324/9780203080719.ch14>
- Nagy, J., Józsa, K., Vidákovich, T., & Fazekasné Fenyvesi, M. (2016). *DIFER Programcsomag: Diagnosztikus fejlődésvizsgáló és kritériumorientált fejlesztő rendszer 4–8 évesek számára. [DIFER: A diagnostic system of assessment and criterion-referenced improvement of basic skills between the ages of 4–8.]* 2nd Edition. Szeged: Mozaik Kiadó. (in Hungarian)
- Shonkoff, J. P., & Phillips, D. A. (2000). *From neurons to neighborhoods: The science of early childhood development*. Washington DC: National Academy Press.
- Wang, P.-J. (2016). *Bidirectional relations among maternal interactive behavior, mastery motivation, and developmental ability in children with global developmental delay*. Unpublished doctoral dissertation. School and Graduate Institute of Physical Therapy, National Taiwan University.
- Wang, P.-J., Liao, H.-F., & Morgan, G. A. (2016) Assessing mastery motivation in a young child with global developmental delay. *International Journal of Physical Medicine and Rehabilitation*, 4(6), 1103, <https://doi.org/10.4172/2329-9096.10001103>
- Wang, P.-J., Liao, H.-F., & Morgan, G. A. (2017). The Revised Individualized Moderately Challenging Mastery Tasks for 15 to 48 month-old children. *Hungarian Educational Research Journal*, 7(2), 68–85.
- Wang, P.-J., Morgan, G. A., Hwang, A.-W., & Liao, H.-F. (2013). Individualized behavioral assessments and maternal ratings of mastery motivation in mental-age matched toddlers with and without motor delays. *Physical Therapy*, 93(1), 79–87. <https://doi.org/10.2522/ptj.20120068>
- Wang, P.-J., Morgan, G. A., Liao, H.-F., Chen, L.-C., Hwang, A.-W., & Lu, L. (2016). Reliability and validity of the revised individualized structured mastery tasks in children with developmental delay. *International Journal of Physical Medicine and Rehabilitation*, 4(6), 1–7. <https://doi.org/10.4172/2329-9096.1000374>
- Yarrow, L. J., Klein, R. P., Lomonaco, S., & Morgan, G. A. (1975). Cognitive and motivational development in early childhood. In B. Z. Friedlander, G. M. Sterritt, & G. E. Kirk (Eds.), *Exceptional infant, assessment and intervention* (pp. 491–502). New York: Bruner/ Mazel.
- Yarrow, L. J., McQuiston, S., MacTurk, R. H., McCarthy, M. E., Klein, R. P., & Vietze, P. M. (1983). Assessment of mastery motivation during the first year of life. Contemporaneous and cross-age relationships. *Developmental Psychology*, 19(2), 159–171. <https://doi.org/10.1037/0012-1649.19.2.159>
- Yarrow, L. J., Morgan, G. A., Jennings, K. D., Harmon, R. J., & Gaiter, J. L. (1982). Infants' persistence at tasks: Relationships to cognitive functioning and early experience. *Infant Behavior and Development*, 5(2-4), 131–142. [https://doi.org/10.1016/S0163-6383\(82\)80023-4](https://doi.org/10.1016/S0163-6383(82)80023-4)
- Young, J. M., & Hauser-Cram, P. (2006). Mother-child interaction as a predictor of mastery motivation in children with disabilities born preterm. *Journal of Early Intervention*, 28(4), 252–263. <https://doi.org/10.1177/105381510602800402>





## Mastery Motivation in Infancy and Early Childhood: The Consistency and Variation of Its Stability and Predictability of General Competence

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### Abstract

Infant mastery motivation has been regarded as an important developmental precursor for later achievement and adaptability. This longitudinal study examined the cross-wave stability of mastery motivation and its association with general competence in different periods of infancy and early childhood. Fifty-three 10-month-old infants and their mothers participated in this study. Children's mastery motivation and general competence were rated by mothers using the Dimensions of Mastery Questionnaire at each wave of testing at 10, 21, 26, 37, and 53 months. The cross-wave analyses of stability and predictability were conducted on three sets of 16-month intervals (i.e., 10 to 26 mo., 21 to 37 mo., and 37 to 53 mo.) and from 10 to 53 months of age. Results indicated that children's task persistence, especially in the cognitive and physical domains, remained stable throughout infancy and early childhood. The domain of negative reactions to failure showed consistent stability in all three sets of 16-month intervals while mastery pleasure was only stable when children were younger than two years of age. In terms of the predictability of mastery motivation, task persistence remained a significant predictor of competence across different periods in infancy and early childhood even after controlling for participants' demographic backgrounds and prior competence.

**Keywords:** competence, infants, longitudinal studies, mastery motivation, preschool children, stability

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## **Introduction**

Mastery motivation is rooted in the desire to effectively interact with environment (i.e., effectance motivation; White, 1959) and acts as a propeller for children to master problem-solving tasks. Previous studies have indicated that individual differences in mastery motivation are already manifested in early childhood (e.g., Kelley, Brownell, & Campbell, 2000; Smiley & Dweck, 1994; Yarrow, McQuiston, MacTurk, McCarthy, & Vietze, 1983). Different researchers have documented the presence of early individual differences in mastery motivation and its stability across time as well as its predictability of later competence in mastering the environment. Although the above studies emphasized different aspects of competence (Messer, McCarthy, MacTurk, Yarrow, & Vietze, 1986; Yarrow et al., 1983; Niccols, Atkison, & Pepler, 2003), they seem to converge in regarding competence as an organism's capacity to interact effectively with the environment. In this vein, Morgan, Busch-Rossnagel, Barrett, and Wang (2009) postulated that the concept of "general competence" was indicated by children's ability to master their environment. Similarly, various studies have used different methods to investigate mastery motivation. Jennings, Harmon, Morgan, Gaiter, and Yarrow (1979) used free play; Yarrow et al. (1983) used age-appropriate structured tasks; Morgan, Busch-Rossnagel, Maslin-Cole, and Harmon (1992) used individualized moderately challenging tasks; Morgan et al. (2009) used adult ratings of the child's motivation and competence; and Huang, Lay, and Chen (2009) used q-sort observation of the child's problem solving behaviors.

Aside from mastery motivation and competence being defined and measured differently in different research, the realization of the stability and the predictability of early mastery motivation may depend on how empirical data are collected. For example, the age of the subjects, the interval of the across-time assessments, the task domain (e.g., cognitive vs. social domains) applied to assess mastery, the compatibility of the measurements used at different ages, and the informant of data collection (e.g., experimenter vs. caregiver) may all be factors that lead to different empirical results.

This study used mothers as the informant of children's mastery motivation and competence from infancy to the preschool period. With the ultimate goal of understanding whether individuals maintain their order of mastery motivation relative to other individuals at different points in early childhood and whether mastery motivation assessed at different ages early in life remains an essential precursor of later competence, the aim of this study was twofold. The first was to demonstrate the stability of mastery motivation in different periods of infancy and early childhood. The second is to examine the consistency and variation of the predictability of early assessments of mastery motivation to later development, by using "general competence" reported by mothers as the target outcome.

## **Definition and Assessment of Mastery Motivation**

Mastery motivation activates and maintains children's endeavors in regard to skill learning and problem solving, which are important contributors to children's adaptation and the development of competence. The manifestation of mastery motivation can include both instrumental and expressive aspects (Morgan et al., 2009; Morgan, Józsa, & Liao, 2017). The instrumental aspect includes indicators such as staying focused on and persistent in tasks. The expressive aspect includes indicators such as mastery pleasure and frustration while facing failure (Barrett & Morgan, 1995). Moreover, mastery motivation may also comprise different domains from early in life, such as object/cognitive, social, and physical domains (Wachs & Combs, 1995). Empirical research has not only shown individual differences across different domains but also indicated that children with different developmental problems react differently in different domains of mastery tasks (Morgan et al., 2017; Morgan, Wang, Liao, & Xu, 2013).

Children's mastery motivation can be assessed either through observation in the contexts of free play (e.g., Jennings, Connors, & Stegman, 1988) and structured challenging tasks (e.g., Barrett, Józsa, & Morgan, 2017; Józsa, Barrett, Józsa, Kis, & Morgan, 2017; Morgan et al., 1992; Wang, Liao, & Morgan, 2017) or through rating scales by parent, teacher (Hwang et al., 2017; Józsa, & Molnár, 2013; Morgan et al., 2017), or students' self-ratings (Józsa & Morgan, 2014, 2017; Józsa, Wang, Barrett, & Morgan, 2014). Among them, the rating scale method has the advantage of ease of data collection without lengthy behavioral assessment and thus makes it possible to apply repetitive assessments, which is necessary in longitudinal designs. The Dimensions of Mastery Questionnaire (DMQ; Morgan et al., 2009) assesses six domains of adults' perceptions of children's mastery related behaviors; among them, four domains assess the instrumental aspects, namely, cognitive/object-oriented persistence, gross motor persistence, and social persistence with adults and also with children. The other two domains, mastery pleasure and negative reactions to failure in mastery situations, are for assessing the expressive aspects of mastery motivation. The DMQ also provides another scale for assessing children's ability (in contrast to motivation) to master tasks (i.e., general competence).

Aside from the ease of data collection, another advantage of the DMQ is that, with the same conceptual framework, this measurement system includes different versions to assess individuals at different ages as early as infancy. Hence, children's mastery motivation at different ages can be measured and compared based on the same theoretical construct. On the same landscape, the DMQ can also be used to investigate cross-age correlations and provide domain-specific stability of mastery motivation.

### ***Stability of Mastery Motivation in Infancy and Early Childhood***

Barrett and Morgan (1995) have divided the development of mastery motivation into three age ranges: birth to 9 months, 9 to 24 months, and 24 to 36 months. They found the characteristics of instrumental and expressive mastery behavior across the different age ranges transform rapidly as children grow. Moreover, individual differences in mastery motivation have been documented as early as during the first year of life (Yarrow et al., 1983). Toddlers and preschoolers are also different in the way they face challenge and novelty; some rise to the challenge while others avoid challenge (Kelley & Jennings, 2003; Smiley & Dweck, 1994).

Although early individual differences of mastery motivation in infancy and early childhood have been well documented, there are theoretical and empirical issues yet to be resolved in understanding the stability of individual differences of mastery motivation. For example, Shiner (2000) suggested that mastery motivation is a personality trait and therefore is generally stable. By contrast, other researchers have emphasized the effect of environmental stimulation and the interaction between child's characteristics and experience, which, in turn, make the development of mastery motivation somewhat malleable and flexible (Busch-Rossnagel, Knauf-Jensen, & DesRosiers, 1995; Deci & Ryan, 1985).

Prior empirical findings could not reject either side of the above notions. For example, although different tasks across the two assessment points were used to measure mastery motivation, significant but modest stability was found from six to twelve months (Yarrow et al., 1983) and from six to fourteen months (Banerjee & Tamis-LeMonda, 2007). Moderate stability of children's persistence in structured tasks was also found from one year to 3.5 years of age (Jennings, Yarrow, & Martin, 1984). Both high and low stability of mastery motivation across one year were shown in Jennings et al. (1988) depending on whether it was assessed through structured tasks or free play sessions, respectively. Similarly, although task persistence was stable across six years for girls but not boys, maternal report from the DMQ was not stable over the same period (Gilmore, Cuskelly, & Purdie, 2003). Conversely, other studies documented moderate stability using the DMQ to measure different aspects of mastery motivation over a period of one year from two to three years of age (Wang, Hwang, Liao, Chen, & Hsieh, 2011) and a period of 21 months from 1.5 years to 3.25 years of age (Wang, Morgan, & Biringen, 2014).

It should be noted that the stability of mastery may be domain specific. As shown in Wang et al. (2011), the DMQ stabilities of total persistence (i.e., the aggregated score of the four domains in the instrumental aspect) and persistence in object-oriented tasks and in gross-motor tasks were higher than that of social persistence and of indicators in the expressive aspect of mastery motivation. Maslin-Cole, Bretherton and Morgan (1993) conducted a longitudinal study of 18-, 24-, and 39-month-old children and also found domain specific stability of the DMQ; specifically, although all of the DMQ

subscales had cross-time stability, persistence in object-oriented tasks and mastery pleasure demonstrated higher stability than persistence in gross motor tasks and social persistence.

In summary, prior research has provided fruitful results about the stability of mastery motivation during infancy and early childhood. However, the consistency of stability of mastery motivation across different periods in early childhood can only be speculated about based on different studies that have used different measurements and different subjects with different ages, and were measured at different intervals. No empirical study has yet systematically compared the stability of mastery motivation in different periods of infancy and early childhood using the same group of children at different ages and with the same length of time between measurements.

### ***The Association between Mastery Motivation and Competence***

The connection of mastery motivation and later competence has been suggested in different research. For example, White (1959) suggested that mastery motivation provides children with the psychological force to improve competence and self-efficacy. Yarrow et al. (1983) proposed that motivation and competence are interrelated, especially in early life. However, the empirical correlation between mastery motivation and competence may be affected by how the two variables are measured. In terms of the measurements for competence, one option is to use standardized developmental or intelligence tests (Messer et al., 1986; Yarrow et al., 1983). Alternatively, competence has been conceptualized as adaptation in daily life (Niccols et al., 2003). Another option for competence measurement is to ask caregivers to rate their child's ability in daily activities, which is the indicator of general competence in the DMQ (Morgan et al., 2009). In terms of measurements of mastery motivation, various studies (Gilmore & Cuskelly, 2009; Yarrow et al., 1983) indicated that persistence has a more direct impact on competence than does the expressive aspect of mastery motivation.

Another factor that may affect the empirical correlation between mastery motivation and competence is the age when children's mastery motivation is assessed. In general, the relation between mastery motivation and cognitive functioning seems to weaken as infants get older (Morgan, MacTurk, & Hrncir, 1995). For example, persistence in mastering tasks shown by six-month-olds was significantly correlated with cognitive level assessed by the Bayley Mental Development Index at 12 months of age (Yarrow et al., 1983). Moreover, persistence, one of the common indicators of mastery motivation, assessed at 6 months of age was significantly correlated with children's cognitive level at 14 months (Banerjee & Tamis-LeMonda, 2007). However, mastery motivation measured beyond infancy seemed to be not as strongly correlated with later cognitive competence; for example, Redding, Morgan and Harmon (1988) indicated mastery motivation assessed at 24 and 36 months was not significantly correlated with concurrent cognitive ability.

Furthermore, the empirical correlation between mastery motivation and later competence may also depend on the time interval between the two variables that are measured. Prior studies mostly examined the relation between mastery motivation and competence by means of short-term longitudinal design, which involved two waves of data collection with mastery motivation measured at the first wave and competence at the second wave. For example, both Messer et al. (1986) and Yarrow et al. (1983) assessed children ranging in age from infants at six months to toddlerhood. Gilmore and Cuskelly (2009) tested children with Down syndrome from early childhood to early adolescence. The above results are not easily comparable since the time intervals were different. Moreover, even when the measurement tool and the time intervals are similar, results from different groups of children may not be comparable so it will be hard to interpret the variation of the predictability of mastery motivation assessed at different ages during infancy and early childhood.

### ***Goal of This Study***

The present study applied a longitudinal design to examine both the stability of mastery motivation and how well mastery motivation predicts competence in early life. Goal-directed activities emerge around nine to ten months of age correspondent with infants entering the cognitive stage of coordination of secondary circular reaction (Piaget, 1962), which makes it easier for caregivers to detect infant intention to master the environment. Therefore, this study collected mothers' rating on the DMQ starting when children were ten months of age. When infants enter toddlerhood, the manifestation of mastery motivation may transform due to both maturation and environmental influences, which may affect the stability and the power of the predictability of mastery motivation. Thus, the period from infancy to preschool provides an important window for understanding variation in the stability of mastery motivation and its association with competence. Consequently, this study collected five waves of maternal report of children's mastery motivation and general competence at 10 months, 21 months, 26 months, 37 months, and 53 months of age. Three sets of age ranges with the same interval of 16 months were selected for analyses; specifically, the age ranges of 10 to 26 months, 21 to 37 months, and 37 to 53 months. The stability and predictability from the first measurement to the last (i.e., from 10 to 53 months) were also analyzed.

For the analysis of stability, cross-wave correlations of each of the six domains in the DMQ and general competence were examined. Based on Barrett and Morgan's (1995) age range of the three early phases of mastery motivation, this study hypothesized that the age range of 21 months to 37 months may reveal the lowest stability among the three 16-month intervals, since the first and second assessment was conducted at the beginning of the second and beyond the third phase. On the other hand, each of the other two 16-month intervals was located at adjacent phases proposed by Barrett and Morgan. Furthermore, based on findings from Wang et al. (2011) and Maslin-Cole et al. (1993), this study expected that stability of mastery motivation would most likely be revealed in the domain of object-oriented persistence.

For the analysis of predictability, three DMQ indicators of total persistence, mastery pleasure and negative reactions to failure served as the predictors while general competence from the DMQ served as the outcome variable. Based on Morgan et al. (1995) and the other studies reviewed above, we anticipated that the predictability shown in the youngest 16-month interval (i.e., from 10 months to 26 months) would be stronger than the predictability shown in the analysis for the older intervals. Additionally, according to Gilmore and Cuskelly (2009) and Yarrow et al. (1983), we expected that, although the predictive effect would decline across domains when the subjects got older, persistence would show higher predictability to general competence than the expressive aspects of mastery motivation.

## **Method**

### ***Participants***

A total of 53 children and their mothers residing in the Taipei area participated in this study. All of the recruited children were born full term, showed normal developmental milestones, and had no diagnosed medical conditions. The mothers filled out the age-appropriate version of DMQ when her child was at 10 months, 21 months, 26 months, 37 months, and 53 months of age. Due to sample attrition, the number of participants included in each set of 16-month intervals and the interval from 10 to 53 months was different. The specific sample size (range of  $n = 40$  to 53) for each set of intervals as well as the demographic backgrounds of the participants are shown in Table 1.

### ***Measures***

#### *Dimensions of Mastery Questionnaire (DMQ-C 17 Chinese infant version)*

The DMQ-C infant version (Morgan, 1997; Morgan et al., 2009) was used to assess infant mastery motivation and general competence at wave 1. This version has 45 items across seven subscales, six of them assess different domains of mastery motivation, including four indicators for the instrumental aspect (object-oriented persistence, gross motor persistence, social persistence with adults, and social persistence with children), and two indicators for the expressive aspect (mastery pleasure, and negative reactions to failure). The seventh subscale measures general competence. In addition to the above seven indicators, total persistence was derived from the average of the four instrumental indicators. The scores were based on mothers' ratings on a five-point Likert scale from one (not at all typical) to five (very typical).

#### *Dimensions of Mastery Questionnaire (DMQ-C 17 Chinese preschool-age version)*

The DMQ-C preschool-age version was designed to assess children between 18 and 60 months of age. The subscales and the number of items in each subscale are similar to the infant version with several items being different in content to reflect the distinctive characteristics and mastery activity of preschoolers. In addition, five items, instead of

three items in the infant version, were included to assess preschoolers' negative reactions to failure. In this study, the preschool version DMQ was given to mothers to report their child's mastery motivation and general competence when their child was 21 months to 53 months of age.

### **Procedure**

Informed consent was obtained from all mothers in advance. When the children were 10 months of age, child-mother dyads visited the laboratory where the children participated in a series of structured tasks and the mothers filled out the DMQ-C infant version. When the children were 21, 26, and 37 months of age, the DMQ-C preschool-age version was post-mailed to the mothers. When the children were 53 months of age, the mothers again filled out DMQ-C when the child-mothers dyads visited the laboratory to complete a series of structured tasks. The task data are not reported in this paper, but were in Huang et al. (2009).

### **Results**

Descriptive statistics regarding the studied variables are presented in Table 1. There were no significant differences in maternal educational levels or the sex ratio of children among different sets of 16-month intervals and from 10 to 53 months of age. Aside from girls displaying higher general competence than boys at age 53 months ( $t(39) = -3.22, p = .003$ ), no other statistically significant gender difference was found on the DMQ subscales.

#### ***Stability of Mastery Motivation***

The cross-wave correlation coefficients (i.e., stability) of each indicator of mastery motivation in each set of 16-month intervals (i.e., 10 to 26 months, 21 to 37 months, and 37 to 53 months) as well as in the interval from 10 to 53 months of age are presented in Table 2. Across more than 3.5 years from 10 to 53 months of age, except for negative reactions to failure ( $r = .25, ns$ ), cross-wave correlations of the other domains were all significant ( $r_s = .32 \sim .61, p_s < .05$ ).

Significant correlations were found in total persistence ( $r_s = .57 \sim .69, p_s < .001$ ), object-oriented persistence ( $r_s = .52 \sim .66, p_s < .01$ ), and gross motor persistence ( $r_s = .44 \sim .58, p_s < .001$ ) in all three sets of 16-month intervals. Cross-wave correlations of social persistence with both adults and children were significant from 10 to 26 months ( $r_s = .48, .50, p_s < .001$ ) and from 21 to 37 months ( $r_s = .40, .53, p_s < .01$ ), respectively, but only significant at  $p_s < .06$  from 37 to 53 months ( $r_s = .30, .31, p_s = .059, .055$ ).



Table 1. Means and Standard Deviations (in parenthesis) of Central Variables in Each Set of Analyses

Variables	Age range of cross-wave analysis							
	10 to 26 months (n = 53)		21 to 37 months (n = 43)		37 to 53 months (n = 40)		10 to 53 months (n = 40)	
	10 months	26 months	21 months	37 months	37 months	53 months	10 months	53 months
Child gender (boy/girl)	28/25		25/18		25/15		22/18	
Child's age (months)	9.53 (0.64)	26.00 (1.57)	20.77 (0.95)	37.02 (1.50)	37.16 (1.24)	52.50 (2.46)	9.53 (0.62)	52.70 (1.41)
Mother's educational level (year)	15.26 (1.71)		15.98 (1.75)		15.97 (1.89)		15.65 (1.56)	
General competence	3.45 (0.56)	3.73 (0.53)	3.77 (0.57)	4.01 (0.61)	4.02 (0.58)	3.64 (0.50)	3.51 (0.56)	3.59 (0.46)
Total persistence	3.74 (0.51)	3.70 (0.51)	3.73 (0.46)	3.80 (0.39)	3.82 (0.39)	3.79 (0.39)	3.83 (0.48)	3.79 (0.39)
Instrumental aspects:								
Object-oriented persistence	3.37 (0.53)	3.42 (0.57)	3.48 (0.48)	3.59 (0.64)	3.74 (0.58)	3.59 (0.53)	3.45 (0.51)	3.45 (0.49)
Gross motor persistence	3.67 (0.59)	3.71 (0.59)	3.80 (0.54)	3.82 (0.46)	3.79 (0.46)	3.53 (0.65)	3.75 (0.58)	3.64 (0.58)
Social persistence (with adults)	4.03 (0.60)	4.06 (0.60)	3.96 (.65)	4.19 (0.41)	4.18 (0.45)	4.23 (0.42)	4.10 (0.60)	4.11 (0.45)
Social persistence (with children)	3.90 (0.75)	3.62 (0.78)	3.68 (0.77)	3.58 (0.41)	3.58 (0.40)	3.83 (0.66)	4.03 (0.73)	3.96 (0.68)
Expressive aspects:								
Mastery pleasure	3.97 (0.66)	4.36 (0.56)	4.41 (0.59)	3.39 (0.44)	3.43 (0.44)	4.62 (0.38)	4.09 (0.66)	4.55 (0.43)
Negative reactions to failure	2.58 (0.72)	2.69 (0.56)	2.63 (0.52)	2.96 (0.57)	2.92 (0.51)	2.99 (0.63)	2.59 (0.72)	2.99 (0.53)

Regarding the indicators for the expressive aspects of mastery motivation, significant cross-wave correlations were found in negative reactions to failure in all three sets of 16-month intervals ( $r_s = .39$  to  $.48$ ,  $p_s < .05$ ). While significant cross-wave correlation was found for mastery pleasure from 10 to 26 months ( $r = .29$ ,  $p = .036$ ), this was not the case from 21 to 37 months nor from 37 to 53 months ( $r_s = .28$ ,  $.21$ ,  $ns$ ).

Table 2. Cross-Wave Correlation Coefficients for DMQ Scales

Indicators of mastery motivation	10 to 26 months (N = 53)	21 to 37 months (N = 43)	37 to 53 months (N = 40)	10 to 53 months (N = 40)
Total persistence	.69***	.61***	.57***	.61***
Object-oriented persistence	.66***	.63***	.52**	.47**
Gross motor persistence	.44***	.58***	.56***	.41**
Social persistence with adults	.48***	.53***	.30†	.36*
Social persistence with children	.50***	.40**	.31†	.35*
Mastery pleasure	.29*	.28	.21	.32*
Negative reactions to failure	.39**	.48**	.40*	.25

Note. The  $p$  value of all the Fisher's  $z$  tests comparing sets of 16-month intervals were  $> .05$   
 $†p < .06$ .  $*p < .05$ .  $**p < .01$ .  $***p < .001$ .

The above results indicated that almost all indicators assessed by the DMQ were stable up to age three. However, beyond 37 months of age, children's social persistence and mastery pleasure were not stable, at least for the repeated measurements that were conducted 16 months apart but they were stable from 10 to 53 months. It should be noted that, none of the cross-wave correlations of the indicators from DMQ were

significantly different across different sets of 16-month intervals, as indicated by Fisher's z tests.

### ***Bivariate Correlations between Predictor and Outcome Variables***

Zero-order correlation coefficients of five predictor variables, namely, mother's education, general competence, total persistence, mastery pleasure, and negative reactions to failure at Time 1 with the outcome variable of general competence at Time 2 in each set of intervals are presented in Table 3. Prior total persistence positively correlated with general competence 16 months later in all three sets of 16-month intervals ( $r_s = .48 \sim .64, p_s < .01$ ) while total persistence at 10 months was correlated at  $p < .06$  with general competence at 53 months of age ( $r = .31, p = .056$ ). Neither mastery pleasure nor negative reactions to failure correlated with later general competence in any set of intervals. The control variable of maternal educational level also did not correlate with general competence in any set of intervals. Prior general competence was significantly correlated with later general competence in all three sets of 16-month intervals ( $r_s = .38 \sim .56, p_s < .05$ ); however, there was no significant association of general competence between age 10 months and age 53 months ( $r = .27, p = .097$ ).

Table 3. Correlation Coefficients between Predictor Variables (PV) and General Competence (GC)

Predictor Variables	PV → GC 10 to 26 months	PV → GC 21 to 37 months	PV → GC 37 to 53 months	PV → GC 10 to 53 months
Mother's Educational Level	.24	.06	-.10	.10
General Competence	.53***	.38*	.56***	.27
Total Persistence	.64***	.48**	.60***	.31†
Mastery Pleasure	.08	.26	.25	-.18
Negative Reactions to Failure	-.15	-.26	-.21	-.02

Note. † $p < .06$ . \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

### ***Regression Analyses on Children's General Competence***

Hierarchical regression analysis was conducted to examine the contribution of the three indicators of mastery motivation to later general competence. Four separate regression models for the three sets of 16-month intervals and for the interval from 10 to 53 months were examined. Child's gender, mother's educational level, and general competence assessed at the first wave in the particular interval were entered in the first step as control variables. In the second step, the three indicators of mastery motivation assessed at the first wave in that interval entered the model simultaneously. General competence at the second wave in that interval was the outcome variable.

The control variables accounted for 33% ( $F(3, 49) = 8.06, p < .001$ ), 16% ( $F(3, 39) = 2.52, p = .072$ ), 33% ( $F(3, 36) = 6.04, p = .002$ ), and 24% ( $F(3, 36) = 3.77, p = .019$ ) of later general competence in the three sets of 16-month intervals and from 10 to 53 months, respectively. As shown in Table 4, none of the main effects of gender or maternal educational level were significant in any of the three sets of 16-month intervals. However, girls' general competence was higher than that of boys at 53 months

( $\beta = 0.41, t(39) = 2.73, p = .01$ ). Similar to the results of the correlation analyses, prior general competence significantly predicted later general competence in all three sets of 16-month intervals (10 to 26 months:  $\beta = 0.50, t(42) = 4.26, p < .001$ ; 21 to 37 months :  $\beta = 0.38, t(42) = 2.62, p = .013$ ; 37 to 53 months:  $\beta = 0.57, t(39) = 4.15, p < .001$ ). However, general competence at 10 months did not predict that at 53 months ( $\beta = 0.15, t(39) = .10, ns$ ).

When the three prior mastery motivation variables were added at step 2, the increase in the variance of later competence accounted for was 22% ( $F(3, 46) = 7.35, p < .001$ ), 9% ( $F(3, 36) = 1.58, p = .22$ ), 9% ( $F(3, 33) = 1.76, p = .17$ ), and 17% ( $F(3, 33) = 3.18, p = .037$ ) in each of the 16-month intervals and from 10 to 53 months, respectively. Specifically, in combination with the other five variables entered at step 2, prior total persistence added positively to the prediction of later general competence in all three sets of 16-month intervals ( $\beta = 0.63, t(52) = 6.33, p < .001$ ;  $\beta = 0.43, t(42) = 2.14, p = .039$  ;  $\beta = 0.54, t(39) = 2.12, p = .042$ ). The predictability of total persistence at 10 months to later general competence at 53 months was significant only at  $p = .07$  ( $\beta = 0.35, t(39) = 1.91, p = .07$ ). Mastery pleasure at 10 months in combination with other predictor variables negatively predicted general competence both at 26 months and 53 months ( $\beta = -0.33, t(52) = -2.83, p = .007$ ;  $\beta = -0.42, t(39) = -2.74, p = .01$ ). There was no significant predictive power for negative reactions to failure to later general competence at any age.

Table 4. Hierarchical Regression Analyses on General Competence

Predictors	10 to 26 months (N = 53)		21 to 37 months (N = 43)		37 to 53 months (N = 40)		10 to 53 months (N = 40)	
	$\beta$	$\Delta R^2$	$\beta$	$\Delta R^2$	$\beta$	$\Delta R^2$	$\beta$	$\Delta R^2$
Step 1		.33***		.16 <sup>†</sup>		.33**		.24*
Child's gender	0.12		0.09		0.00		0.41*	
Mother's educational level	0.16		0.11		-0.14		0.07	
General competence	0.50***		0.38*		0.57***		0.15	
Step 2		.22***		.09		.09		.17*
Child's gender	0.13		0.06		0.00		0.43**	
Mother's educational level	0.13		0.11		-0.20		0.10	
General competence	0.23		0.14		0.24		0.09	
Total persistence	0.63***		0.43*		0.54*		0.35 <sup>†</sup>	
Mastery pleasure	-0.33**		-0.07		-0.19		-0.42*	
Negative reactions to failure	0.04		-0.02		0.01		0.14	

Note. For the categorical predictor variable of gender, male was 1 and female was coded as 2.

<sup>†</sup> $p < .08$ . \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

## Discussion

The present study investigated the stability of mastery motivation early in life and its association with general competence. By using a multiple-wave longitudinal design with the same range of age intervals, this study extended the findings from previous studies to demonstrate the variation of stability and predictability of multiple domains of mastery motivation in different periods of infancy and early childhood.

The present analysis of stability partially concurred with prior research (Maslin-Cole et al., 1993; Wang et al., 2011). That is, especially compared with the social domains and the expressive aspects of mastery motivation, persistence in object-oriented and gross motor domains were stable in early childhood. Specifically, throughout the five waves of assessment, moderate to high stability and moderate stability were found in the persistence of the cognitive/object-oriented domain and in the physical/gross-motor domain, respectively. In contrast, the domains of social persistence showed moderate stability up to age three but low stability beyond 3 years of age. Age 3 is the end point of the third age range of the development of mastery motivation suggested by Barrett and Morgan (1995). It is also about the time for most young children to start going to preschool, meeting new teachers and peers, and facing all kinds of novelty in new environments. Consequently, it seems not surprising that children's motivation to manage social interaction with adults and peers changes, which may, in turn, affect individuals' ranking of social persistence compared to other individuals.

For the findings of stability in the expressive aspect, contrary to Maslin-Cole et al. (1993) where mastery pleasure demonstrated higher stability than negative reactions to failure, in this study, the domain of negative reactions to failure remained mildly to moderately stable throughout the three sets of 16-month intervals. Negative reactions to failure can be attributed to child temperament (e.g., the subscale of frustration in the Early Childhood Behavior Questionnaire; Putnam, Gartstein, & Rothbart, 2006) as well as parental standards, both of which may not be easily changeable in a short period of time and lead to the stability of this expressive domain.

Modest or no stability in mastery pleasure across the three 16-month intervals found in this study is in conflict with Wang et al. (2011) where mastery pleasure was significantly stable between 24 to 36 months of age. On the contrary, the long-term stability of mastery pleasure was surprisingly significant from age 10 months to 53 months in this study. The last half of the second year has been suggested as a turning point of mastery pleasure (Kagan, 1992). The fact that the cross-wave (e.g., 10 and 26 months; 21 and 37 months) correlations of mastery pleasure cutting across the age suggested by Kagan were low may indicate that the construct of mastery pleasure is heterotypic with development. Subsequently, the expression of mastery pleasure during early childhood may need to be captured by a more sensitive assessment tool with enough breadth of descriptions including both pure expression of happiness from accomplishment to sense of pride and superiority (Lewis, Alessandri, & Sullivan, 1992).

Curiously, all of the indicators for task persistence and task pleasure, which may be the two most commonly referred markers of mastery motivation, demonstrated long-term stability from age 10 months to 53 months. The 3.5 years between the first and the final wave of the assessment not only stretch over the three early phases of mastery motivation (Barrett & Morgan, 1995) but also comprise major transformations in physical, cognitive, emotional, and social development. Despite sporadic findings of low or non-significant stabilities at some of the 16-month intervals of analysis, the existence

of long-term stability points to the value of assessing domain-specific mastery motivation before one year of age and the contribution of early behavioral patterns in the development of mastery motivation (Shiner, 2000).

Regarding the association between mastery motivation and general competence, concordant with prior research (Gilmore & Cuskelly, 2009; Yarrow et al., 1983), this study indicated task persistence had a stronger connection with later competence than did the expressive aspects of mastery motivation. When considered as a group, the three mastery motivation indexes increased the predictability of competence only in the 10 to 26 and 10 to 53 month intervals. However, persistence significantly contributed to the prediction of general competence even after controlling for participants' demographic backgrounds, the expressive variables, and earlier competence. The present results once again imply that tenacious attempts to master the environment lead to proficiency and competence, at least across each of the 16-month intervals.

Although domains in the expressive aspect did not correlate with later general competence, mastery pleasure negatively predicted later general competence in two of the four sets of regression analysis. This novel result may be attributed to the collinearity between total persistence and mastery pleasure (same-wave correlations between mastery pleasure and total persistence:  $r_s = .36$  to  $.59$ ). Alternatively, maybe young children who are easily satisfied with and delighted by current accomplishment would be less ambitious in striving for further success in more advanced and difficult tasks, which is essential for competence improvement.

In terms of the cross-interval consistency and variation of the predictability of mastery motivation, total persistence remained a strong predictor of general competence across different periods in early childhood even when controlling for early competence and the other mastery motivation indexes. Additionally, total persistence assessed before one year of age still marginally predicted a child's competence at age four and a half years when all the other predictor variables were accounted for. Thus, this study seemed not in concert with the conclusion from prior studies with infants and preschool children (e.g., Morgan et al., 1995; Redding et al., 1988) that indicated the association between mastery motivation and cognitive functioning is lower as these children get older. Consistent with the current study, Józsa and Molnár (2013) and Morgan et al. (2009) found quite high correlations between persistence and competence measures on the DMQ for school age children.

Finally, although the only significant sex difference found in this study was that girls' general competence at 53 months was higher than that of boys, the mean score of girls' general competence measured in every wave was somewhat higher than that of boys. These results, on the one hand, implied that there may be a general relation between gender and competence across ages in early childhood of parent's perceptions that favors girls. The findings of the current study were concordant with prior studies (Józsa et al., 2014; Morgan et al., 2013) that indicated both Chinese and English speaking

parents rated girls higher on DMQ general competence than boys, even though the effect sizes of the significant sex differences were generally small.

In summary, by using an across-wave, longitudinal design with the same time interval in each set of analyses, the present study was able to compare the stabilities/predictabilities of mastery motivation across the same length of time but at different ages in early childhood. The present results demonstrated that parental perceptions of children's mastery motivation, especially of object and gross motor persistence, appeared to be stable throughout infancy and early childhood. Furthermore, in the domains of negative reactions to failure and mastery pleasure, short-term stability did not guarantee long-term stability and lack of short-term stability did not necessarily lead to long-term instability, indicating further research is needed to understand the development of the expressive (emotional) aspects of mastery motivation. In terms of the association between mastery motivation and later competence, the present study found that, throughout the assessment period, task persistence is an important predictor of later competence. The negative predictive effect of mastery pleasure on competence should be further investigated in future research.

## Conclusion

An important message for parents and educators is that the results of this study revealed that early competence in infancy was not a valuable predictor of preschooler's capability. In contrast, tenacious attempts to master the environment in early childhood, from infancy to the preschool years, contributed to the development of general competence and probably to school readiness. Young children's negative reactions to failure, although they may exasperate parents and teachers when they work with the child, was not an important factor leading to the development of competence.

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## References

- Banerjee, P. N., & Tamis-LeMonda, C. S. (2007). Infants' persistence and mothers' teaching as predictors of toddlers' cognitive development. *Infant Behavior and Development, 30*(3), 479–491.  
<https://doi.org/10.1016/j.infbeh.2006.12.001>
- Barrett, K. C., & Morgan, G. A. (1995). Continuities and discontinuities in mastery motivation during infancy and toddlerhood: A conceptualization and review. In R. H. MacTurk, & G. A. Morgan (Eds.), *Mastery motivation: Origins, conceptualizations, and applications* (pp. 57–93). Norwood, NJ: Ablex.
- Barrett, K. C., Józsa, K., & Morgan, G. A. (2017). New computer-based mastery motivation and executive function tasks for school readiness and school success in 3 to 8 year-old children. *Hungarian Educational Research Journal, 7*(2), 86–105.
- Busch-Rossnagel, N. A., Knauft-Jensen, D. E., & DesRosiers, F. S. (1995). Mothers and others: The role of the socializing environment in the development of mastery motivation. In R. H. MacTurk, & G. A.

- Morgan (Eds.), *Mastery motivation: Origins, conceptualizations, and applications* (pp. 117–145). Norwood, NJ: Ablex.
- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum Press. <https://doi.org/10.1007/978-1-4899-2271-7>
- Gilmore, L., & Cuskelly, M. (2009). A longitudinal study of motivation and competence in children with Down syndrome: Early childhood to early adolescence. *Journal of Intellectual Disability Research*, 53(5), 484–492. <https://doi.org/10.1111/j.1365-2788.2009.01166.x>
- Gilmore, L., Cuskelly, M., & Purdie, N. (2003). Mastery motivation: Stability and predictive validity from ages two to eight. *Early Education and Development*, 14(4), 411–424. [https://doi.org/10.1207/s15566935eed1404\\_2](https://doi.org/10.1207/s15566935eed1404_2)
- Huang, S.-Y., Lay, K.-L., & Chen, Y.-C. (2009). The assessment of the organizational construct of mastery motivation: The reliability and validity in infants of 9 months old. *Chinese Journal of Psychology*, 51(4), 501–526. <https://doi.org/10.6129/CJP.2009.5104.07>
- Hwang, A.-W., Wang, J., Józsa, K., Wang, P.-J., Liao, H.-F., & Morgan, G. A. (2017). Cross cultural invariance and comparisons of Hungarian-, Chinese-, and English-speaking preschool children leading to the revised Dimensions of Mastery Questionnaire (DMQ 18). *Hungarian Educational Research Journal*, 7(2), 32–47.
- Jennings, K. D., Conner, R. E., & Stegman, C. E. (1988). Does a physical handicap alter the development of mastery motivation during the preschool years? *Journal of the American Academy of Child and Adolescent Psychiatry*, 27(3), 312–317. <https://doi.org/10.1097/00004583-198805000-00008>
- Jennings, K. D., Harmon, R. J., Morgan, G. A., Gaiter, J. L., & Yarrow, L. J. (1979). Exploratory play as an index of mastery motivation: Relationships to persistence, cognitive functioning and environmental measures. *Developmental Psychology*, 15(4), 386–394. <https://doi.org/10.1037//0012-1649.15.4.386>
- Jennings, K. D., Yarrow, L. J., & Martin, P. P. (1984). Mastery motivation and cognitive development: A longitudinal study from infancy to 3 1/2 years of age. *International Journal of Behavioral Development*, 7(4), 441–461. <https://doi.org/10.1177/016502548400700404>
- Józsa, K., Barrett, K. C., Józsa, G., Kis, N., & Morgan, G. A. (2017). Development and initial evaluation of an individualized moderately challenging computer-tablet mastery motivation measure for 3-8 year-olds. *Hungarian Educational Research Journal*, 7(2), 106–126.
- Józsa, K., & Molnár, É. D. (2013). The relationship between mastery motivation, self-regulated learning and school success: A Hungarian and European perspective. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook on self-regulatory processes in development: New directions and international perspectives* (pp. 265–304). New York, NY: Psychology Press. <https://doi.org/10.4324/9780203080719.ch13>
- Józsa, K., & Morgan, G. A. (2014). Developmental changes in cognitive persistence and academic achievement between grade 4 and grade 8. *European Journal of Psychology of Education*, 29(3), 521–535. <https://doi.org/10.1007/s10212-014-0211-z>
- Józsa, K. & Morgan, G. A. (2017). Reversed items in Likert scales: Filtering out invalid responders. *Journal of Psychological and Educational Research*, 25(1), 7–25.
- Józsa, K., Wang, J., Barrett, K. C., & Morgan, G. A. (2014). Age and cultural differences in self-perceptions of mastery motivation and competence in American, Chinese, and Hungarian school age Children. *Child Development Research*, Vol. 2014, Article ID 803061, 16 pages. <https://doi.org/10.1155/2014/803061>
- Kagan, J. (1992). *Unstable ideas: Temperament, cognition, and self*. Cambridge, MA, US: Harvard University Press.
- Kelley, S. A., & Jennings, K. D. (2003). Putting the pieces together: Maternal depression, maternal behavior, and toddler helplessness. *Infant Mental Health Journal*, 24(1), 74–90. <https://doi.org/10.1002/imhj.10044>

- Kelley, S. A., Brownell, C. A., & Campbell, S. B. (2000). Mastery motivation and self-evaluative affect in toddlers: Longitudinal relations with maternal behavior. *Child Development, 71*(4), 1061–1071. <https://doi.org/10.1111/1467-8624.00209>
- Lewis, M., Alessandri, S. M., & Sullivan, M. W. (1992). Differences in shame and pride as a function of children's gender and task difficulty. *Child Development, 63*(3), 630–638. <https://doi.org/10.2307/1131351>
- Maslin-Cole, C., Bretherton, I., & Morgan, G. A. (1993). Toddler mastery motivation and competence: Links with attachment security, maternal scaffolding, and family climate. In D. J. Messer (Ed.), *Mastery motivation in early childhood: Development, measurement, and social processes* (pp. 205–229). London: Routledge.
- Messer, D., McCarthy, M. E., MacTurk, R., Yarrow, L. J., & Vietze, P. (1986). Relations between mastery behavior in infancy and competence in early childhood. *Developmental Psychology, 22*(3), 366–372. <https://doi.org/10.1037/0012-1649.22.3.366>
- Morgan, G. A. (1997). *Dimensions of Mastery Questionnaire (Database Record)*. Retrieved from PsycTESTS. <https://doi.org/10.1037/t04950-000>
- Morgan, G. A., Busch-Rossnagel, N. A., Barrett, K. C., & Wang, J. (2009). *The Dimensions of Mastery Questionnaire: A manual about its development, psychometrics and use*. Colorado State University, Fort Collins.
- Morgan, G. A., Busch-Rossnagel, N. A., Maslin-Cole, C. A., & Harmon, R. J. (1992). *Mastery motivation tasks: Manual for 15- to 36-month-old children*. Bronx: Fordham University.
- Morgan, G. A., Józsa, K., & Liao, H.-F. (2017). Introduction to the HERJ Special Issue on Mastery Motivation: Measures and Results across Cultures and Ages. *Hungarian Educational Research Journal, 7*(2), 5–14.
- Morgan, G. A., Liao, H.-F., Nyitrai, Á., Huang, S.-Y., Wang, P.-J., Blasco, P., Ramakrishnan, J., & Józsa, K. (2017). The revised Dimensions of Mastery Questionnaire (DMQ 18) for infants and preschool children with and without risks or delays in Hungary, Taiwan, and the US. *Hungarian Educational Research Journal, 7*(2), 48–67.
- Morgan, G. A., MacTurk, R. H., & Hrcir, E. J. (1995). Mastery motivation: Overview, definitions, and conceptual issues. In R. H. MacTurk, & G. A. Morgan (Eds.), *Mastery motivation: Origins, conceptualizations, and applications* (pp. 1–18). Norwood, NJ: Ablex.
- Morgan, G. A., Wang, J., Liao, H. F., & Xu, Q. (2013). Using the Dimensions of Mastery Questionnaire to assess mastery motivation of English- and Chinese- speaking children: Psychometrics and implications for self-regulation. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer. (Eds.), *Handbook of self-regulatory processes in development: New directions and international perspectives* (pp. 305–335). New York, NY: Psychology Press/Taylor and Francis. <https://doi.org/10.4324/9780203080719.ch14>
- Niccols, A., Atkison, L., & Pepler, D. (2003). Mastery motivation in young children with Down's syndrome: Relations with cognitive and adaptive competence. *Journal of Intellectual Disability Research, 47*(2), 121–133. <https://doi.org/10.1046/j.1365-2788.2003.00452.x>
- Piaget, J. (1962). The stages of the intellectual development of the child. *Bulletin of the Menninger Clinic, 26*, 120–128.
- Putnam, S. P., Gartstein, M. A., & Rothbart, M. K. (2006). Measurement of fine-grained aspects of toddler temperament: The Early Childhood Behavior Questionnaire. *Infant Behavior & Development, 29*(3), 386–401. <https://doi.org/10.1016/j.infbeh.2006.01.004>
- Redding, R. E., Morgan, G. A., & Harmon, R. J. (1988). Mastery motivation in infants and toddlers: Is it greatest when tasks are moderately challenging? *Infant Behavior and Development, 11*(4), 419–430. [https://doi.org/10.1016/0163-6383\(88\)90003-3](https://doi.org/10.1016/0163-6383(88)90003-3)
- Shiner, R. L. (2000). Linking childhood personality with adaptation: Evidence for continuity and change across time into late adolescence. *Journal of Personality and Social Psychology, 78*(2), 310–325. <https://doi.org/10.1037//0022-3514.78.2.310>
- Smiley, P. A., & Dweck, C. S. (1994). Individual differences in achievement goals among young children. *Child Development, 65*(6), 1723–1743. <https://doi.org/10.2307/1131290>



- Wachs, T. D., & Combs, T. T. (1995). The domains of infant mastery motivation. In R. H. MacTurk, & G. A. Morgan (Eds.), *Mastery motivation: Origins, conceptualizations, and application* (pp. 147–164). Norwood, NJ: Ablex.
- Wang, J., Morgan, G. A., & Biringen, Z. (2014). Mother-infant affect exchange and mastery motivation in toddlerhood. *Infant and Child Development, 23*(2), 139–152. <https://doi.org/10.1002/icd.1825>
- Wang, P.-J., Hwang, A.-W., Liao, H.-F., Chen, P.-C., & Hsieh, W.-S. (2011). The stability of mastery motivation and its relationship with home environment in infants and toddlers. *Infant Behavior and Development, 34*(3), 434–442. <https://doi.org/10.1016/j.infbeh.2011.04.005>
- Wang, P.-J., Liao, H.-F., & Morgan, G. A. (2017). The Revised Individualized Moderately Challenging Mastery Tasks for 15 to 48 month-old children. *Hungarian Educational Research Journal, 7*(2), 68–85.
- White, R. W. (1959). Motivation reconsidered: The concept of competence. *Psychological Review, 66*(5), 297–333. <https://doi.org/10.1037/h0040934>
- Yarrow, L. J., McQuiston, S., MacTurk, R. H., McCarthy, M. E., & Vietze, P. M. (1983). Assessment of mastery motivation during the first year of life: Contemporaneous and cross-age relationships. *Developmental Psychology, 19*(2), 159–171. <https://doi.org/10.1037//0012-1649.19.2.159>



## Cross Cultural Invariance and Comparisons of Hungarian-, Chinese-, and English-speaking Preschool Children Leading to the Revised Dimensions of Mastery Questionnaire (DMQ 18)

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### Abstract

The Dimensions of Mastery Questionnaire (DMQ) was designed to measure children's mastery motivation, a multifaceted and psychological force that supports children's persistent interaction with and learning from their environment. DMQ 17 parent ratings of 2 to 6 year-old preschool children from English-speaking, Chinese-speaking, and Hungarian-speaking countries were used to check for measurement invariance. Confirmatory factor analyses were applied to validate the hypothesized 5-factor structure for the preschool version of the DMQ. Cross-cultural measurement invariance was found after several items with lower factor loadings and all the reversed items were deleted. A second order 5-factor structure was validated and supports the revision of the DMQ from version 17 to version 18 for this age group and these three cultures. Cultural differences were analyzed by latent mean scores. Among the three subsamples of children, there were no differences on the DMQ scales except for gross motor persistence, which was found to be lower in Chinese-speaking children than in English- and Hungarian-speaking children. These findings support the use of the DMQ 18 as a measure of young children's mastery motivation in at least these three cultures.

**Keywords:** motivation, preschool children, psychometrics, Dimensions of Mastery Questionnaire, persistence, DMQ17

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## **Introduction**

### ***Definition of Mastery Motivation***

Mastery motivation stimulates children's independent attempts to master tasks that are moderately challenging for him or her (Morgan, Harmon, & Maslin-Cole, 1990). Mastery motivation focuses on the child's persistence, the process or motivation to master the task, rather than the child's ability to solve a problem (Busch-Rossnagel & Morgan, 2013). There are three domains of the mastery motivation construct. The cognitive/object domain includes children's attempts to master toys and cognitive problems; the social domain is children's attempts to interact effectively with others, and the gross motor domain focuses on children's attempt to master physical skills (Morgan, MacTurk, & Hrncir, 1995). Within each domain, there are two indicators: instrumental and expressive. The instrumental indicator is represented by persistence and the duration of task-directed behavior, and the expressive indicator is positive or negative affect during or immediately after task-directed behavior (Barrett & Morgan, 1995).

### ***Mastery Motivation as a Predictor of Children's Achievement***

Mastery motivation is important, in part, because it is a predictor of cognitive development and school success. Some classic studies demonstrated that early indicators of mastery motivation in infancy predicted children's IQ at 3 years (e.g., Yarrow, Klein, Lomonaco, & Morgan, 1975). More recently, Mercader, Presentación, Siegenthaler, Moliner, and Miranda (2017) found that persistence in completing a challenging task in preschool significantly predicted mathematics achievement in second grade. Gilmore, Cuskelly, and Purdie's (2003) and Jennings, Yarrow, and Martin's (1984) studies found longitudinally that the instrumental aspects of mastery motivation predicted school-related skills, but only for girls. Mokrova, O'Brien, Calkins, Leerkes, and Marcovitch (2013) studied the prediction of kindergarten academic skills (language and math). They did not find gender differences, but like Gilmore and colleagues, they found that the instrumental aspect of mastery motivation (persistence) longitudinally predicted both language and math skills. Józsa and Morgan (2014) found cognitive persistence in grade 4 predicted grade point average (GPA) in grade 8.

Berhenke, Miller, Brown, Seifer, and Dickstein (2011) studied the concurrent relation between instrumental and affective or expressive aspects of mastery motivation and school readiness. They found that shame and persistence were positively correlated with social competence and with math and reading skills. Similarly, Walker and MacPhee (2011) found that instrumental mastery motivation completely mediated the concurrent prediction of preschool children's developmental level from parents' coercive control. Józsa and Molnár (2013), in a cross-sectional study of third and sixth graders, also found an association between instrumental mastery motivation and both GPA and achievement in specific school subjects. All of these findings are suggestive that both

instrumental and affective aspects of mastery motivation may be important predictors of cognitive development and school success.

### ***Measures of Mastery Motivation***

Both the Dimensions of Mastery Questionnaire (DMQ) and moderately challenging tasks (e.g., Józsa, Barrett, Józsa, Kis, & Morgan, 2017; Wang, Liao, & Morgan, 2017) are being used to measure mastery motivation. This paper uses DMQ parents' ratings of their preschool child's mastery motivation.

### ***Dimensions of Mastery Questionnaire (DMQ)***

Initially the DMQ was developed for mothers or caregivers to rate preschool children (Morgan et al., 1993). Over the years, the DMQ was expanded to include infant and school-age versions; the later had a by-self as well as a parent or teacher version. The DMQ was also expanded to include four scales of the instrumental/persistence aspects of mastery motivation and two of the expressive or affect aspects. In addition, there were items about the child's general competence or ability in comparison to same-age peers. The competence items were not considered aspects of mastery motivation and the negative reaction items in DMQ 17 had inadequate internal consistency. Thus, only the four persistence scales and mastery pleasure were used as indexes of mastery motivation in this study. Review articles by Józsa and Molnár (2013) and Morgan, Wang, Liao, and Xu (2013) provide summaries of the extensive data and studies using DMQ 17, which is the version analyzed in this paper.

To enhance the generalization of the use of the Dimensions of Mastery Questionnaire (DMQ) across cultures, English-speaking, and Chinese-speaking children have been examined using the preschool DMQ 17 (Morgan et al., 2013). Similarly, Józsa, Wang, Barrett, and Morgan (2014) used the school-age DMQ 17 to study mastery motivation in English-, Chinese- and Hungarian-speaking countries.

For parent-rated preschool version, the findings of exploratory factor analysis (EFA) showed a clear 5-factor structure for 457 English-speaking children (Morgan et al., 2013), with cross loading on only one item (item 21: Is pleased when solves a hard problem), and one reversed item (item 33: Gives up quickly when playing with adults) did not load on any factor. However, the factor structure for 299 Chinese preschool age children was less clear. The Chinese-speaking parents tended to cluster preschool children's cognitive/object persistence with gross motor persistence. Józsa et al. (2014) used the school-age DMQ 17 to study 7- to 19-year-old children in Hungary, China, and the US. They reported a clear 5-factor structure without the reversed items, competence, or negative reactions. Similar 5-factor structures were found for the whole/combined samples and for the Hungarian, Chinese, and American samples separately.

For DMQ 17 one item in each scale was negatively worded so it needed to be reversed when scoring. The reversed items were originally designed to help prevent rater

response set. However, 10-20% of the respondents seemed to misread the reversed items, which led to lower internal consistencies and presumably less valid scores for those children (Józsa & Morgan, 2017). Thus, we decided to not score the reversed items in later DMQ 17 papers (e.g., Józsa et al., 2014).

Morgan et al. (2013) compared mean DMQ 17 scale scores for English- and Chinese-speaking preschool children. The Chinese children had significantly higher scores on social persistence with adults and negative reaction to failure, but lower scores for social persistence with children compared to the English-speaking preschool children. Morgan et al. argued that these small but significant differences are consistent with what would have been predicted about child-rearing in the two cultures. In the same paper, Morgan et al. (2013) also compared parent ratings of English- and Chinese-speaking elementary school children. These English speaking adults rated their children substantially higher on all the DMQ scales, except negative reactions to failure. It may well be that by elementary school Chinese-parents have higher expectations, so they rate their children lower than American parents rate theirs.

Although the DMQ 17 data provided good evidence for reliability and validity of the scores and useful results in a number of studies, feedback received from researchers and practitioners encouraged the developers to revise the DMQ 17 to make improvements in several aspects. These revisions included increasing item clarity in different samples, dropping consistently problematic items, especially the reversed items, and ensuring linguistic equivalence of the items across cultures so that the items are age and culturally appropriate.

Numerous theoretical and empirical studies have been conducted on mastery motivation using the DMQ over the years, but only two studies used confirmatory factor analysis (CFA) and both were with school-age children. Wang, Józsa, and Morgan (2014) found a good fit for a 5-factor model with DMQ 17 self-ratings of school-age children in three countries. This multiple-group confirmatory factor analyses examined measurement invariance among American, Chinese, and Hungarian children and also among elementary, middle, and high school children from the Chinese and Hungarian samples. Measurement invariance was established in each of the analyses. A few latent mean differences in each of the five scales were found among the subsamples. Józsa and Kis (2016) analyzed students' self-ratings with CFA in a different Hungarian school-age sample. The study verified the structural validity of the DMQ 17. However, the authors pointed out that the model fit indexes and the scale reliabilities could be improved by omitting some reversed items.

Despite the fact that DMQ has been used in a variety of samples from infancy to adolescence (e.g., with typical and atypical populations and with participants from different cultures), measurement invariance across different cultures has never been examined for preschool-age children. This is necessary to justify whether the scale items and underlying mastery constructs are interpreted in a conceptually similar manner by

different groups of respondents. The study presented in this paper uses CFA techniques to test the construct structure of the DMQ, identify problematic items from DMQ 17, and examine measurement invariance of the DMQ across three countries (Hungary, Taiwan, and the US) for a preschool population rated by a parent.

The two main objectives of this study are: 1) To validate the hypothesized 5-factor structure of the DMQ 17, and examine measurement invariance across English-speaking, Chinese-speaking, and Hungarian-speaking preschool-age versions; and 2) To provide support for revisions leading to the DMQ 18.

## **Methods**

### ***Participants***

A total of 1582 children aged 24–72 months from Chinese-speaking, English-speaking, and Hungarian-speaking countries were rated by their parents with the DMQ-17 preschool version. The Chinese and American samples were mostly middle-class children; the Hungarian sample had a wide range of socio-economic status (SES). Chinese-speaking children ( $n = 389$ ) were from Taiwan (the Taipei birth panel study, 2008; Hsieh et al., 2011). English-speaking children ( $n = 353$ ) were from America and Australia. The number of Hungarian-speaking children ( $n = 840$ ) was much larger than the other two samples.

### ***Instrument***

DMQ 17 used in this study had 35 items, with each rated on a five-point Likert scale from 1 = not typical at all to 5 = very typical (Morgan, 1997). The instrumental aspects of mastery motivation are assessed on four scales: cognitive/object persistence (COP, 9 items, e.g., tries to complete things, even if it takes a long time), gross motor persistence (GMP, 8 items, e.g., tries to do well in physical activities even when they are hard), social persistence with adults (SPA, 6 items, e.g., tries hard to get adults to understand), and social persistence with children (SPC, 6 items, e.g., tries to get included when other children are playing). We also used one scale for assessing the expressive aspect of mastery motivation: mastery pleasure (MP, 6 items, e.g., smiles after finishing something). The score of each scale is the average of the items in that scale. Therefore, the score range of each scale is from 1 to 5. Except for the negative reaction scale, a higher score indicates higher mastery motivation. DMQ 17 has acceptable internal consistency ( $\alpha > .7$ ) and evidence to support validity (Józsa & Molnár, 2013; Morgan et al., 2013).

### ***Procedures***

The data from all the 1582 children were randomly separated into two subsets: sample 1 ( $n = 791$ ) and sample 2 ( $n = 791$ ). The initial confirmatory factor analysis (CFA) model was explored with sample 1 to test for the 5-factor structure, using the four

instrumental/persistence scales (COP, GMP, SPA, and SPC) and the expressive scale (MP) as used by Józsa and Molnár (2013), and Morgan et al. (2013). If any revision of the proposed 5-factor structure model was needed, sample 2 was used to cross-validate the final model (Bollen, 1989). For sample 1, the assessment of convergent and discriminative validity of the 5 latent variables was tested individually (Schumacker & Lomax, 2004). The factor loadings, Cronbach's alphas, and composite reliability scores (reliability estimation with measurement errors accounted for, see Bacon, Sauer, & Young, 1995) were used to examine the convergent validity for each factor. Item with loadings less than 0.45 were removed (Hooper, Coughlan, & Mullen, 2008). Composite reliabilities over 0.6 (Fornell & Larcker, 1981), and Cronbach's alphas greater than 0.7 (Andresen, 2000) are considered adequate. Discriminant validity was assessed using bootstrapping approaches with 1000 samples (Nevitt & Hancock, 2001) to test the standard error of correlation coefficients between the five latent variables. The 95% confidence interval was calculated for the upper and lower bounds of the correlation coefficients. If the 95% confidence interval does not contain 1.0, the pair of latent variables is considered discriminative.

To identify the best fitting model for the data of sample 1, we also conducted confirmatory factor analyses (CFAs) to compare a first order model with a second order model. The first-order CFA was estimated by allowing the five latent variables to be freely correlated. The second-order CFA was a more parsimonious model with the five latent variables loaded onto one second-order factor (See Figure 1). The target coefficient (T), which is the ratio of the chi-square of the first order model to the chi-square of the higher order (more restrictive) model, was used to evaluate whether the first or second order model is preferable for the data (Marsh & Hocevar, 1985). A value of T of 1 represents a perfect fit. There is no clear cut-point for T values, but  $> .75$  would suggest that the second order model is reasonable.

After the optimal structural model of DMQ was identified with needed revisions, samples 1 and 2 were merged. Measurement invariance was examined between samples 1 and 2, and among Chinese-, English-, and Hungarian-speaking groups. The criteria used to justify measurement invariance include  $\Delta CFI \leq 0.01$ ,  $\Delta GFI \leq 0.01$ , or  $\Delta TLI \leq 0.05$  in model comparisons (Little, 1997).

### ***Data Analysis***

This is a secondary data analysis, with children rated by their primary caregivers. The Chinese and Hungarian translation processes have been described elsewhere by Józsa et al. (2014). Considerable preschool DMQ 17 data from different cultures have been cumulated over the last decade or so (Józsa & Molnár, 2013; Morgan et al., 2013). The samples are now sufficient to conduct a rigorous validation with CFA for the preschool-version of the DMQ. CFA is a statistical technique to test the fitness between hypothesized models and empirical data; it allows estimation of measurement errors to achieve a more precise estimation of loadings, which led to the revision of DMQ 17 by

deleting items with lower loadings. In addition, CFA conducted with multiple samples simultaneously can be used to check measurement invariance, the establishment of which ensures that comparisons across groups with the same measure are meaningful (Schumacker & Lomax, 2004).

The data were analyzed using SPSS 19.0 and AMOS 20.0 (IBM, Inc., Armonk, NY, USA, 2012). CFA using the structural equation modeling (SEM) technique with maximum likelihood (ML) was applied. Fit indexes with their cutoff criteria (RMSEA < 0.08, GFI  $\geq$  0.90, NFI  $\geq$  0.90, CFI  $\geq$  0.90) (Cheung & Rensvold, 2002; Schreiber, Nora, Stage, Barlow, & King, 2006; Schumacker & Lomax, 2004) were used for assessing the model fit. Because of the strong assumption of normality in ML, the normality of each variable was judged by skewness  $\leq$  2.0 and kurtosis  $\leq$  7.0, and Mardia's coefficients of multivariate Kurtosis and its critical ratios < 5.0. However, when sample size increases or there is a violation of normality, the ML chi-square would inflate the significant  $p$  value to reject the model, then the Bollen-Stine bootstrap chi-square (Enders, 2005) was used to correct the fit indexes.

## **Results**

According to the examination of construct validity, there were 5 items with loadings lower than .45 (See Table 1) in sample 1: three COP items, one SPA item, and one MP item. Two out of the 5 items were reversely-coded items. After deleting these 5 items, we used sample 2 to confirm the model. Factor loadings, Cronbach's alphas, and composite reliabilities were all acceptable for each of the five scales: Cronbach's alphas for COP, GMP, SPA, SPC, and MP were (0.783, 0.869, 0.782, 0.812, 0.791, respectively). Composite reliabilities were (0.788, 0.897, 0.787, 0.819, 0.790). There were still three reversed items (item 3, 9, and 39) with modest loadings (0.472-0.566) in the model. Because of known problems in other samples with the reversed items (Józsa & Morgan, 2017), it had been decided not to use them in DMQ 18 and final publications with DMQ 17 (Józsa et al., 2014). Thus, these three items were omitted for the final confirmatory model with sample 2, which now had 27 items (RMSEA = 0.08, GFI = 0.96, NFI = 0.96, CFI = 0.96 with Bollen-Stine bootstrap chi-square correction). The five scales had acceptable Cronbach's alphas (0.783, 0.887, 0.768, 0.788, 0.808) and Composite reliabilities (0.804, 0.889, 0.776, 0.831, 0.851). Discriminant validity with bootstrapping suggested that the five factors are discriminative between each other. The value of coefficient (T) was 0.78. Therefore, the second order model, which modeled the 5 domain-specific mastery dimensions under a broader mastery motivation construct, fit the data as well as the first order model. Because the second order factor structure is more closely aligned with our current theoretical conceptualization of mastery motivation, we retained the second order model for the remaining analyses.



Table 1. Construct Validity for Individual DMQ 17 Scales Using Confirmatory Factor Analysis

DMQ scales/items	Standardized loading (sample 1)	Standardized loading <sup>a</sup> (Sample 2)	Standardized loading <sup>c</sup> (Sample 2)
<b>Cognitive/Object Persistence (COP)</b>			
01 Repeats a new skill until he or she can do it well.	.592	.602	.733
09 If a toy or task is hard to do, stops trying after a short time. <sup>b</sup>	.460	.473	
14 Tries to do things, even if it takes a long time.	.664	.668	.810
17 Explores all parts of an object or toy with many parts.	.316*	-	
23 Works for a long time trying to do something hard.	.795	.779	.810
24 Tries hard to do cause and effect toys such as a busy box.	.440*	-	
27 Likes to try hard things instead of easy ones.	.435*	-	
29 Will work for a long time trying to get something open.	.622	.627	.772
31 Tries to complete toys like puzzles even if they are hard.	.534	.545	.570
<b>Gross Motor Persistence (GMP)</b>			
03 Gives up if he or she cannot do physical skills well. <sup>b</sup>	.566	.566	
12 Tries to do well in physical activities even when they are hard.	.704	.704	.656
16 Likes physical activities and tries to do them well.	.754	.754	.748
26 Repeats skills related to moving around until he or she can do them. well.	.818	.818	.804
27 Tries hard to throw or roll balls to do it well.	.772	.772	.786
36 Repeats motor skills in order to do them well.	.707	.707	.660
40 Tries to do well at physical activities.	.742	.742	.777
45 Tries hard to get better at catching or retrieving things.	.696	.696	.676
<b>Social Persistence with Adults (SPA)</b>			
08 Enjoys “talking” to adults, and tries to keep them interested.	.628	.630	.599
15 Tries hard to interest adults in playing with him or her.	.742	.747	.730
19 Likes to play actively with me or other adults.	.714	.708	.671
22 Tries very hard to get adults to understand him or her.	.626	.630	.638
33 Gives up quickly when playing with adults. <sup>b</sup>	.319*	-	
37 Enjoys playing peek-a-boo with adults.	.546	.538	.553
<b>Social Persistence with Children (SPC)</b>			
25 Gets very involved looking at other children.	.468	.468	.622
28 Tries hard to touch other children when near them.	.678	.678	.664
30 Likes to “talk” to other children.	.806	.806	.780
32 Tries to get included when other children are playing.	.744	.744	.799
35 Tries to keep play going for a long time when around other kids.	.661	.661	.649
39 Avoids getting involved with other children. <sup>b</sup>	.555	.555	
<b>Mastery Pleasure (MP)</b>			
02 Smiles broadly after finishing something.	.633	.619	.730
11 Does not smile after he or she makes something happen. <sup>b</sup>	.322*	-	
18 Gets excited when he or she figures something out.	.586	.600	.639
21 Is pleased when solves a hard problem	.674	.667	.765
41 Smiles when he or she makes something happen.	.687	.681	.783
43 Shows excitement when he or she is successful.	.695	.708	.728

Note. <sup>a</sup>Items loadings < 0.45; <sup>a</sup> a standardized weight after deletion of items loading < .45; <sup>b</sup> reversed items; <sup>c</sup> a standardized weight after deletion all the reversed items

In addition, measurement invariance was established between sample 1 and 2, and among the Chinese-, English-, and Hungarian-speaking groups. Table 2 lists the goodness-of-fit statistics when models with increased constraints were compared with each other, using language spoken as the grouping variable. Each successive model included the previous model's restrictions plus additional constraints and served as the comparison standard for the subsequent model. As Table 2 shows, measurement invariance was obtained at every step when the equality constraints were set progressively on factor loadings, structural weights, and structural covariances.

Table 2. Model Fit Indices for Measurement Invariance among the Chinese-, English-, and Hungarian-speaking groups

Model	BS $\chi^2$	df	p	GFI	NFI	CFI	TLI	RMSEA	$\Delta$ BS- $\chi^2$	$\Delta$ TLI	$\Delta$ CFI
Configural invariance	1201.4	957	<.001	0.94	0.94	0.99	0.99	0.01			
Factor loading invariance	1245.4	122	<.001	0.93	0.93	0.99	0.99	0.01	43.9	<.001	<.001
Factor loading and structure weight invariance	1253.6	125	<.001	0.93	0.92	0.99	0.99	0.01	8.14	<.001	<.001
Factor loading, structure weight and structural covariance invariance	1255.7	123	<.001	0.93	0.92	0.99	0.99	0.01	2.19	<.001	<.001

Note. CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean error of approximation; BS $\chi^2$  = Bollen-Stine- $\chi^2$

Figure 1 also presents the second order confirmatory factor analysis (CFA) model with the equality constraints set on factor loadings, structure weights, and structural covariances for the three language groups. In this second order CFA model, mastery motivation was modelled as a latent variable which was not observable directly but can be inferred from the shared variance (the conceptual and empirical overlap) of the five mastery motivation dimensions, COP, SPA, SPC, GMP, and MP. Each of these five dimensions of mastery are also latent variables themselves which cannot be observed directly but can be inferred from the shared variance of a subset of the 27 items, such as inferring COP from items 1, 14, 23, 29, and 31. Besides the shared variances, each of the 27 items and the five mastery dimensions were allowed to have measurement errors (e), which were also modelled in the CFA. Such a modeling technique allows for a more accurate estimation of the latent constructs. Measurement invariance was examined by forcing the factor loadings, structure weights, and structural covariances of the same items or constructs in each language sample to be the same across each of the English, Chinese, and Hungarian language samples. In Figure 1, the corresponding loadings for each of the 27 items and for the 5 DMQ scales are shown, and are all acceptable.

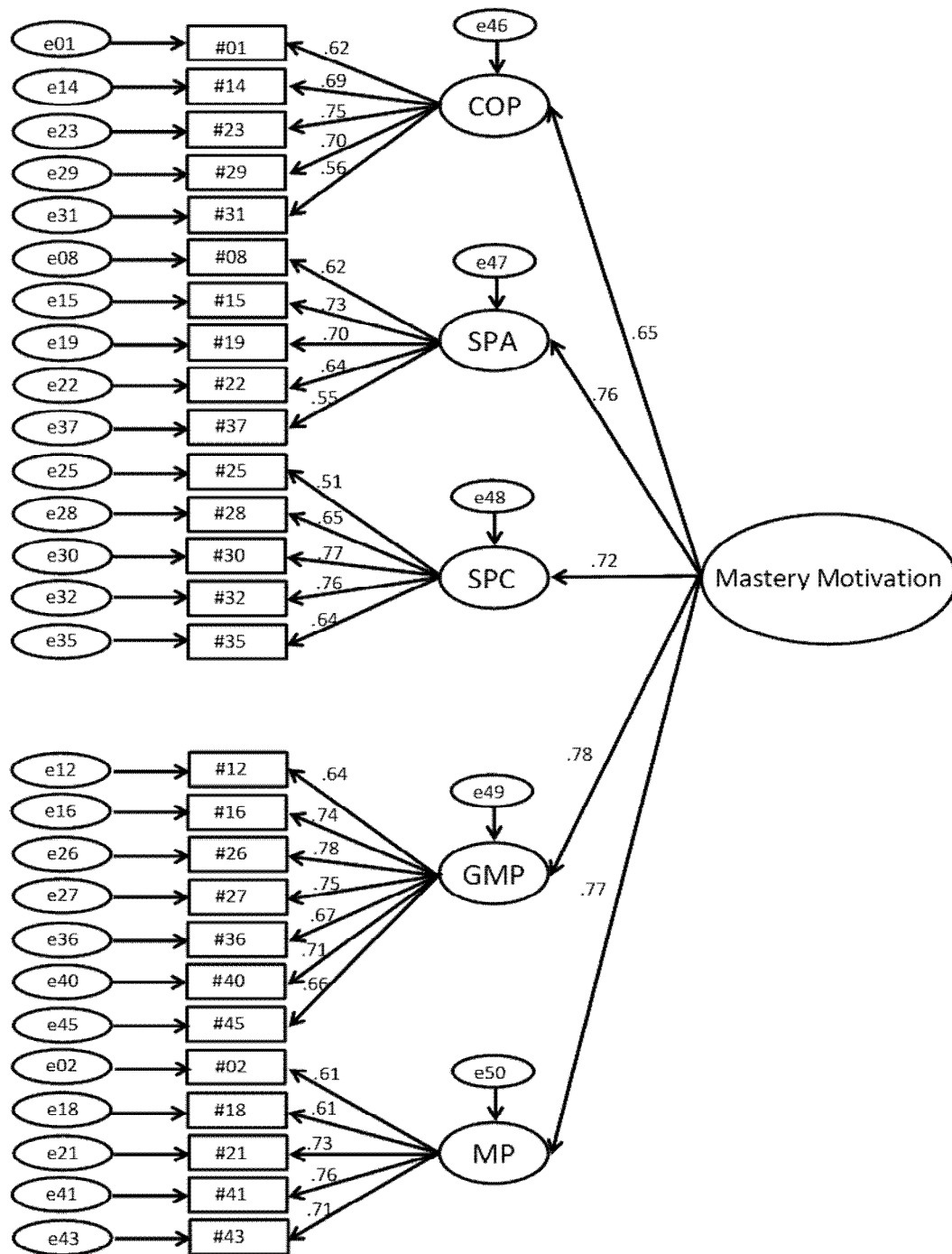


Figure 1. The Confirmatory Factor Analysis of the Second-order Factor Structure of the DMQ preschool Version. Note: COP: Cognitive/object persistence; SPA: Social persistence with adults; SPC: Social persistence with children; GMP: Gross motor persistence; MP: Mastery pleasure.

As measurement invariance across the three language groups was established, latent mean differences were examined across the three groups. Table 3 presents the differences for the estimated mean factor scores from the CFA for the three language groups. Because the sample size is large and multiple comparisons were done, we set the alpha at 0.01 for the post hoc comparisons for each of the five domains as scales of the DMQ. There were no differences between the three language groups except that the

Chinese-speaking preschool children were rated lower than the other two groups on gross motor persistence by their parents.

Table 3. Latent Mean Scores and Differences in DMQ Scales among Three Subsamples of Children

Scale	Chinese-speaking		English-speaking		Hungary-speaking		Multiple comparisons
	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	
COP	3.58	0.05	3.70	0.05	3.58	0.03	Chinese = English = Hungary
SPA	4.09	0.05	4.00	0.05	3.92	0.04	Chinese = English = Hungary
SOC	3.88	0.05	4.00	0.06	3.95	0.04	Chinese = English = Hungary
GMP	3.13	0.05	3.37	0.06	3.44	0.03	Chinese < English = Hungary
MP	4.50	0.04	4.37	0.04	4.37	0.03	Chinese = English = Hungary

Note. COP: Cognitive/object persistence; SPA: Social persistence with adults; SPC: Social persistence with children; GMP: Gross motor persistence; MP: Mastery pleasure; Post-hoc alpha <0.01 (Two-tailed).

## Discussion

### Measurement Properties

Confirmatory factor analysis (CFA) is an essential step in measurement development, through which the structure of the measure is tested against a prior theoretical conceptualization of the construct. The DMQ was developed to measure different dimensions of mastery motivation and has been used widely among different groups of participants. The current study used a preschool sample gathered from three different cultures to test a 5-factor model with items from the five DMQ scales that have been used for factor analyses in other studies (e.g., Józsa et al., 2014). The negative reaction scale items were not included because those items lack good reliability with young children. The competence scale items were not used because they are not considered aspects of mastery motivation and are relatively highly correlated with the persistence subscales, especially for teacher and parent ratings of young children. This study provides support that the DMQ appropriately represents the underlying factor structure of five dimensions of mastery motivation, cognitive/object persistence, gross motor persistence, social persistence with adults, social persistence with children, and mastery pleasure. Desirable validity and model fit indices were obtained for the preschool DMQ after filtering some problematic items. These findings provided support for the revision of the DMQ. Recently, Józsa and Morgan (2015) investigated the exploratory factor structure of the new Hungarian DMQ 18 in 211 Hungarian preschool children rated by the teacher. They found a clear 5-factor structure without any cross loadings.

The study did identify some problematic items from DMQ 17, the removal of which helped increase the psychometric qualities of the measure. Reversely coded items have been consistently identified in previous analyses to show relatively low loadings on the corresponding factors and caused problems for scale reliabilities and model fit indices. The problem of reversely coded items in DMQ has been reported in prior studies (e.g. Józsa & Morgan, 2017; Morgan et al., 2013), and reversed items were omitted from later analyses of some studies with DMQ 17 (e.g., Józsa et al., 2014) and in the revised DMQ 18 (Józsa & Morgan, 2015; Morgan et al., 2015, Morgan et al., 2017). The current study again provided evidence to support the deletion of reversed items in DMQ 18. However,

DMQ 18 included 8 revised and new negative response items. These negative response items served the same purpose as the reversed items in the DMQ 17, namely to assure that the readers are paying attention and not reading too fast. The revised DMQ 18 has the same general competence scale and six motivation scales as did DMQ 17, with a few new or revised items.

Measurement invariance is also a key quality that needs to be examined during measurement development to ensure that items and constructs are perceived in the same way and relationships between the indicators and the underlying constructs are the same across different groups. Otherwise, between-group comparison using the same measure is not meaningful. In the current study, measurement invariance for the preschool sample was achieved among three different language-speaking groups (i.e., Chinese-speaking, English-speaking, and Hungarian-speaking samples), suggesting the cross-cultural appropriateness of the DMQ. The establishment of measurement invariance gives researchers and practitioners the confidence to use the DMQ to compare mastery motivation across different samples.

### ***Group Mean Comparisons***

There were no significant latent mean differences between the three language groups on four of the five DMQ scales. However, the Chinese-speaking preschool children had significantly lower gross motor persistence than English- and Hungarian-speaking preschool children. Wang et al. (2014) also found that Chinese-speaking school children had significantly lower gross motor persistence than English- or Hungarian-speaking children. In the Wang et al. study, the data were from school age children's self-ratings rather than parent ratings of preschool children as in this study. In addition, Józsa et al. (2014) found several significant differences, but with small effect sizes when comparing large samples of Hungarian, Chinese, and American 7- to 19-year-old children's DMQ 17 self-ratings. Again, the Chinese children rated themselves lowest on gross motor persistence, but only at age 11, not age 16. Thus, we found a common trend of lower gross motor persistence among Chinese-speaking children, young and older. In the Chinese culture, gross motor related and physical fitness related skill practices are not emphasized as much as in western cultures (Singer, Singer, Agostino, & DeLong, 2009). In mainland China and Taiwan, parents' emphasis on and expectation for academically-oriented performance is high. A lot of Asian children go to preschools between 3–6 years, and structured classrooms provide more limited outdoor activities than in western countries (Singer et al., 2009). Hence Asian children would get fewer opportunities to have practice and feedback to encourage their persistence in mastering gross motor activities.

### ***Implications in cultural comparisons***

With caution about differences in age levels and respondents, applying DMQs in diverse cultures or different language-speaking countries should be meaningful in future research on DMQ 18. Culture represents the context in which children experience their learning opportunities. The mastery motivation scores of children in different learning contexts provide normative data across cultures. With this normative data, professionals can allow for cultural diversity when tracking children's mastery motivation as an important indicator for later development and provide culturally appropriate strategies to promote learning. When the context changes with time, continuously monitoring mastery motivation based on proxy or self-reports would be crucial to identify possible barriers to learning and development. As a limitation and suggestion for further study, the Hungarian subsample was much larger than the other two. Thus, it would be reasonable to select only the middle class children from Hungary to make the three subsamples more completely similar in socio-economics and compare the cultures again.

### **Conclusion**

This study provided the evidence for deletion of some items and revision of the DMQ17. The revised preschool DMQ 17 version produced here in Figure 1 was found to have good validity and measurement invariance across three cultural groups. DMQ 18, based on the revisions in this paper, includes items with sound measurement properties to collect information of children's mastery motivation across respondents in different cultures for children from 2 to 6 years. With complex constructs, such as mastery motivation, which has multiple dimensions, it is critical to develop a psychometrically sound measure so as to both capture the comprehensiveness of the construct and allow reliable, valid, and meaningful assessments across ages and groups. The development of such a measure and the accumulation of data and empirical evidence with the measure will help advance the associated theory and produce valuable scientific evidence for practice.

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## References

- Andresen, E. M. (2000). Criteria for assessing the tools of disability outcomes research. *Archives of Physical Medicine and Rehabilitation*, 81(Supplement 2), S15–S20. <https://doi.org/10.1053/apmr.2000.20619>
- Bacon, D. R., Sauer, P. L., & Young, M. (1995). Composite reliability in structural equations modeling. *Educational and Psychological Measurement*, 55(3), 394–406. <https://doi.org/10.1177/0013164495055003003>
- Barrett, K. C., & Morgan, G. A. (1995). Continuities and discontinuities in mastery motivation in infancy and toddlerhood: A conceptualization and review. In R. H. MacTurk, & G. A. Morgan (Eds.), *Mastery motivation: Origins, conceptualizations and applications* (pp. 57–93). Norwood, NJ: Ablex.
- Berhenke, A., Miller, A. L., Brown, E., Seifer, R., & Dickstein, S. (2011). Observed emotional and behavioral indicators of motivation predict school readiness in Head Start graduates. *Early Childhood Research Quarterly*, 26(4), 430–441. <https://doi.org/10.1016/j.ecresq.2011.04.001>
- Bollen, K. A. (1989). *Structural Equations with Latent Variables*. New York: Wiley. <https://doi.org/10.1002/9781118619179>
- Busch-Rossnagel, N. A., & Morgan, G. A. (2013). Introduction to the mastery motivation and self-regulation. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook on self-regulatory processes in development: New directions and international perspectives* (pp. 247–264). New York: Routledge/Taylor & Francis.
- Cheung, G. W., & Rensvold, R. B. (2002). Evaluating Goodness-of-fit Indexes for testing measurement invariance. *Structural Equation Modeling*, 9(2), 233–255. [https://doi.org/10.1207/S15328007SEM0902\\_5](https://doi.org/10.1207/S15328007SEM0902_5)
- Enders, C. K. (2005). An SAS macro for implementing the modified Bollen–Stine bootstrap for missing data: Implementing the bootstrap using existing structural equation modeling software. *Structural Equation Modeling*, 12(4), 620–641. [https://doi.org/10.1207/s15328007sem1204\\_6](https://doi.org/10.1207/s15328007sem1204_6)
- Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variable and measurement error. *Journal of Marketing Research*, 18(1), 39–50. <https://doi.org/10.2307/3151312>
- Gilmore, L., Cuskelly, M., & Purdie, N. (2003). Mastery motivation: Stability and predictive validity from ages two to eight. *Early Education and Development*, 14(4), 411–424. [https://doi.org/10.1207/s15566935eed1404\\_2](https://doi.org/10.1207/s15566935eed1404_2)
- Hooper, D., Coughlan, J., & Mullen, M. (2008). Structural equation modeling: Guidelines for determining model fit. *Electronic Journal of Business Research Methods*, 6(1), 53–60.
- Hsieh, C.-J., Hsieh, W.-S., Su, Y.-N., Liao, H.-F., Jeng, S.-H., Taso, F.-M., Hwang, Y.-H., Wu, K.-Y., Chen, C.-Y., Yueling, L. G., & Chen, P.-C. (2011). *The Taiwan Birth Panel Study: a prospective cohort study for environmentally-related child health*. BMC Research Notes, 4, 1–8. <https://doi.org/10.1186/1756-0500-4-291>
- Jennings, K. D., Yarrow, L. J., & Martin, P. P. (1984). Mastery motivation and cognitive-development: A longitudinal-study from infancy to 3 1/2 years of age. *International Journal of Behavioral Development*, 7(4), 441–461. <https://doi.org/10.1177/016502548400700404>
- Józsa, K., Barrett, K. C., Józsa, G., Kis, N., & Morgan, G. A. (2017). Development and initial evaluation of an individualized moderately challenging computer-tablet mastery motivation measure for 3-8 year-olds. *Hungarian Educational Research Journal*, 7(2), 106–126.

- Józsa, K., & Kis, N. (2016). Az Elsajátítási motiváció kérdőív szerkezeti validitásának vizsgálata megerősítő faktoranalízissel [Confirmatory factor analysis of the Hungarian version of the Dimension of Mastery Questionnaire]. In P. Tóth, & I. Holik (Eds.), *Új kutatások a neveléstudományokban 2015* (pp. 41–52). Budapest: ELTE Eötvös Kiadó. (in Hungarian)
- Józsa, K., & Molnár, É. D. (2013). The relationship between mastery motivation, self-regulated learning and school success: A Hungarian and wider European perspective. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook of self-regulatory processes in development: New directions and international perspectives* (pp. 265–304). New York, NY: Psychology Press. <https://doi.org/10.4324/9780203080719.ch13>
- Józsa, K. & Morgan, G. A. (2017). Reversed items in Likert scales: Filtering out invalid responders. *Journal of Psychological and Educational Research*, 25(1), 7–25.
- Józsa, K., & Morgan, G. A. (2015). An improved measure of mastery motivation: Reliability and validity of the Dimensions of Mastery Questionnaire (DMQ 18) for preschool children. *Hungarian Educational Research Journal*, 5(4), 87–103. <https://doi.org/10.14413/HERJ2015.04.08>
- Józsa, K., & Morgan, G. A. (2014). Developmental changes in cognitive persistence and academic achievement between grade 4 and grade 8. *European Journal of Psychology of Education*, 29(3), 521–535. <https://doi.org/10.1007/s10212-014-0211-z>
- Józsa, K., Wang, J., Barrett, K. C., & Morgan, G. A. (2014). Age and cultural differences in self-perceptions of mastery motivation and competence in American, Chinese, and Hungarian school age children. *Child Development Research*, 2014, 1–16. <https://doi.org/10.1155/2014/803061>
- Little, T. D. (1997). Mean and covariance structures (MACS) analyses of cross-cultural data: Practical and theoretical issues. *Multivariate Behavior Research*, 32(1), 53–76. [https://doi.org/10.1207/s15327906mbr3201\\_3](https://doi.org/10.1207/s15327906mbr3201_3)
- Marsh, H. W., & Hocevar, D. (1985). Application of confirmatory factor analysis to the study of self-concept: First and higher order factor models and their invariance across groups. *Psychological Bulletin*, 97(3), 562–582. <https://doi.org/10.1037/0033-2909.97.3.562>
- Mercader, J., Presentación, M.-J., Siegenthaler, R., Moliner, V., & Miranda, A. (2017). Motivation and mathematics performance: a longitudinal study in early educational stages. *Revista de Psicodidáctica*, 22(2), 1–14.
- Mokrova, I. L., O'Brien, M., Calkins, S. D., Leerkes, E. M., & Marcovitch, S. (2013). The role of persistence at preschool age in academic skills at kindergarten. *European Journal of Psychology of Education*, 28(4), 1495–1503. <https://doi.org/10.1007/s10212-013-0177-2>
- Morgan, G. A. (1997). *Dimensions of Mastery Questionnaire*. PsycTESTS. <https://doi.org/10.1037/t04950-000>
- Morgan, G. A., Harmon, R. J., & Maslin-Cole, C. A. (1990). Mastery motivation: Definition and measurement. *Early Education and Development*, 1(5), 318–342. [https://doi.org/10.1207/s15566935eed0105\\_1](https://doi.org/10.1207/s15566935eed0105_1)
- Morgan, G. A., Liao, H.-F., Nyitrai, Á., Huang, S.-Y., Wang, P.-J., Blasco, P., Ramakrishnan, J., & Józsa, K. (2017). The Revised Dimensions of Mastery Questionnaire (DMQ 18) for Infants and Preschool Children with and without Risks or Delays in Hungary, Taiwan, and the US. *Hungarian Educational Research Journal*, 7(2), 48–67.
- Morgan, G. A., MacTurk, R. H., & Hrnčir, E. J. (1995). Mastery motivation: Overview, definitions, and conceptual issues. In R. H. MacTurk, & G. A. Morgan (Eds.), *Mastery motivation: Origins, conceptualizations, and applications* (pp. 1–18). Norwood, New Jersey: Ablex.
- Morgan, G. A., Maslin-Cole, C. A., Harmon, R. J., Busch-Rossnagel, N. A., Jennings, K. D., Hauser-Cram, P., & Brockman, L. (1993). Parent and teacher perceptions of young children's mastery motivation: Assessment and review of research. In D. Messer (Ed.), *Mastery motivation in early childhood: Development, measurement and social processes* (pp. 109–131). London: Routledge.
- Morgan, G. A., Wang, J., Liao, H.-F., & Xu, Q. (2013). Using the Dimensions of Mastery Questionnaire to assess mastery motivation of English- and Chinese-speaking children: Psychometrics and implications for self-regulation. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A.



- Daunhauer (Eds.), *Handbook of self-regulatory processes in development: New directions and international perspectives* (pp. 305–335). New York, NY: Routledge/Taylor & Francis.  
<https://doi.org/10.4324/9780203080719.ch14>
- Nevitt, J., & Hancock, G. R. (2001). Performance of bootstrapping approaches to model test statistics and parameter standard error estimation in structural equation modeling. *Structural Equation Modeling*, 8(3), 353–377. [https://doi.org/10.1207/S15328007SEM0803\\_2](https://doi.org/10.1207/S15328007SEM0803_2)
- Schreiber, J. B., Nora, A., Stage, F. K., Barlow, E. A., & King, J. (2006). Reporting structural equation modeling and confirmatory factor analysis results: A review. *Journal of Educational Research*, 99(6), 323–337. <https://doi.org/10.3200/JOER.99.6.323-338>
- Schumacker, R. E., & Lomax, R. G. (2004). *A beginner's guide to structural equation modeling* (2nd ed.). Mahwah, N.J.: Erlbaum.
- Singer, D., Singer, J., Agostino, D., & DeLong, R. (2009). Children's pastimes and play in sixteen nations: Is free-play declining? *American Journal of Play*, 1(3), 283–312.
- Walker, A. K., & MacPhee, D. (2011). How home gets to school: Parental support and control strategies predict children's school readiness. *Early Childhood Research Quarterly*, 26(3), 355–364.  
<https://doi.org/10.1016/j.ecresq.2011.02.001>
- Wang, J., Józsa, K., & Morgan, G. A. (2014, May). *Measurement invariance across children in US, China, and Hungary: A revised Dimensions of Mastery Questionnaire (DMQ)*. [Summary] Program and Proceedings of the 18th Biennial Developmental Psychobiology Research Group Conference, 18, 14–15.
- Wang, P.-J., Liao, H.-F., & Morgan, G. A. (2017). The revised individualized moderately challenging mastery tasks for 15-48 month-old children. *Hungarian Educational Research Journal*, 7(2), 68–85.
- Yarrow, L. J., Klein, R. P., Lomonaco, S., & Morgan, G. A. (1975). Cognitive and motivational development in early childhood. In B. Z. Friedlander, G. M. Sterritt, & G. E. Kirk (Eds.), *Exceptional infant, assessment and intervention* (pp. 491–502). New York: Bruner/Mazel.



## The Revised Dimensions of Mastery Questionnaire (DMQ 18) for infants and preschool children with and without risks or delays in Hungary, Taiwan and the US

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### Abstract

Mastery motivation is an important concept in child development shown by persistence and affect when attempting to solve challenging problems. The Revised Dimensions of Mastery Questionnaire (DMQ 18) provides a parent or caregiver rating of a young child's responses to challenge. This paper describes and compares parent's DMQ 18 ratings of 503 children aged 6-months to 5-years in samples from Hungary, Taiwan, and the US who were developing typically, were at-risk due to prematurity, or were developmentally delayed. Good reliability and validity were found for the persistence scales. There were modest correlations between age and the positive DMQ scales in Hungary but not Taiwan. There were few gender differences, and few parent education correlations with DMQ ratings by either parents or teachers. However, parents of infants born preterm rated them lower on gross motor persistence and competence; and parents rated children with developmental delay much lower than children developing typically. Hungarian parents rated their children higher on gross motor persistence and competence but lower on shame than parents from Taiwan. Most of the results are consistent with but extend those in the literature. Implications for the use of DMQ 18 are discussed.

**Keywords:** motivation, preschool children, developmental delay, mastery motivation, Dimensions of Mastery Questionnaire, premature infants, cross cultural studies

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## Introduction

Mastery motivation stimulates a child to attempt to master a skill or solve a problem that is at least moderately challenging for him or her (Busch-Rossnagel & Morgan, 2013; Morgan, Harmon, & Maslin-Cole, 1990). Shonkoff and Phillips (2000), in a US National Academy of Sciences report, said that mastery motivation is a key developmental concept that needs to be part of a child's assessment. Mastery motivation has two aspects: *instrumental*, indexed by persistent attempts to solve problems, and *expressive*, indexed by positive and negative affective reactions when faced with challenge (Barrett & Morgan, 1995). These aspects of motivation are measured by two main techniques: individualized mastery tasks and the Dimensions of Mastery Questionnaire (DMQ), which is the focus of this paper (Busch-Rossnagel & Morgan, 2013). After briefly describing the development and current revision of the Dimensions of Mastery Questionnaire (DMQ 18), the introduction summarizes research about factors that might affect parents' ratings of their young child's mastery motivation.

### *The Development and Psychometrics of DMQ 17*

Early versions of the DMQ were designed for mothers and caretakers to rate their preschool child's persistence and pleasure when attempting challenging tasks. Later versions were expanded to include ratings of infants and school-age children. These later versions, including DMQ 17, included instrumental aspects of mastery motivation (cognitive/object, gross motor, and social persistence) as well as expressive aspects (mastery pleasure and negative reactions to challenge). More than 15,000 children from 6-months to 19-years of age were rated with DMQ 17.

These data provided considerable evidence for reliability and validity. For example, Morgan, Wang, Liao, and Xu (2013) presented evidence that the DMQ 17 instrumental and mastery pleasure scales had acceptable to good internal consistency (Cronbach alphas) for the English and Chinese versions. Józsa and Molnár (2013) reported acceptable to good test-retest reliabilities for Hungarian teachers, parents, and students on the instrumental and both expressive scales. Several DMQ 17 studies found stability in parent ratings across a time span of 6 months or more, and for even longer periods from infancy to preschool (e.g., Huang & Lay, 2017; Wang, Hwang, Liao, Chen, & Hsieh, 2011; Wang, Morgan, & Biringen, 2013).

Several studies found significant relationships between maternal perceptions of child motivation and behavioral measures of the child's mastery motivation behavior on standardized tasks, which is considered a criterion measure. (e.g., Gilmore & Cuskelly, 2009; Green & Morgan, 2017).

Evidence for convergent validity was indicated by correlations of the DMQ with other theoretically related variables (e.g., Gilmore, Cuskelly, & Purdie, 2003; Józsa & Morgan, 2014; Wang, Morgan, Hwang, Chen, & Liao, 2014). These studies provided evidence for convergent validity of the DMQ 17 in children with and without delays.

### ***Development and Psychometrics of DMQ 18***

Although DMQ 17 data provided good evidence for reliability and validity in a number of studies, we decided to make a revision for several reasons, including increasing item clarity, deleting problematic items, and ensuring linguistic equivalence across the English, Hungarian, and Chinese versions. One issue was that the negatively worded, reverse coded items clearly caused problems for 10 - 20% of the raters who did not seem to read them accurately. In part based on an analysis by Józsa and Morgan (2017), we decided to omit the negatively worded items from future analyses and publications; e.g., Józsa, Wang, Barrett, and Morgan (2014). Józsa and Kis (2016) also carried out a confirmatory factor analysis that demonstrated that the negative items did not fit well. DMQ 18 has eight negative reaction to challenge items spread throughout the questionnaire, which serve to reduce potential response set bias because the “socially desirable” response on these negative reaction items would be a low rating.

To provide statistical support for the revision, Hwang, Wang, Józsa, Wang, Liao, and Morgan (2017) reanalyzed the DMQ 17 data for samples of Chinese-, English-, and Hungarian-speaking preschool children’s parent ratings using confirmatory factor analysis and structural equation modeling to validate the hypothesized 5-factor structure of the DMQ. They also examined invariance across the three languages, which was found after several items were deleted for psychometric reasons. The remaining items were the basis of the revised (DMQ 18) preschool version of the mastery motivation questionnaire used in this paper.

We also wanted to be as certain as possible that there was not only linguistic equivalence of the revised items across cultures but that the items were age and culturally appropriate. All the new English items were translated in Chinese, Spanish, and Hungarian, examined by the authors and checked with a few parents and professionals in each country to ensure that the phrases were clear and appropriate. Their feedback led to several changes not only in the Chinese, Spanish, and Hungarian but also in the English versions (Morgan et al., 2015). Thus, the process was similar to back translation plus “decentering.”

The current paper provides data about the reliability and validity of parent ratings of the infant and preschool DMQ 18. Previously, Józsa and Morgan (2015) studied a different Hungarian sample of preschool teachers who rated their students. The four persistence scales, mastery pleasure, and competence provided strong evidence to support three measures of reliability: internal consistency, interrater, and test-retest. Interrater reliabilities for the negative reaction to challenge scales were not acceptable. Factorial evidence for the validity of the four persistence and mastery pleasure scales was excellent as shown by clean factors.

Support for the validity of DMQ 18 in children with developmental delays was indicated by significant correlation with persistence on the revised individualized moderately

challenging mastery tasks (Wang, Morgan et al., 2016). In addition, DMQ 18 measures of mastery motivation were correlated with or predicted children's developmental quotients and also participation in daily activities (Wang, Liao et al., 2016).

### **Some Factors that Might be Related to Ratings of Mastery Motivation**

*Age* differences and *cultural* comparisons on DMQ scales were discussed in several of the articles listed in the preceding sections of the paper. Four other variables that were examined in this study are discussed briefly next.

Children with and without *developmental delays* have been studied in a number of mastery motivation research projects. Parental ratings of Chinese- and English-speaking children with delay were compared to typically developing children of roughly the same mental age; parents rated children with delay significantly lower on most DMQ 17 scales (Morgan et al., 2013; Wang, Morgan, Hwang, & Liao, 2013; Wang et al., 2014).

*Parents' education* is typically used as one indicator of a family's socioeconomic status that might influence the child's development. There are many American (e.g., Duncan, Magnuson, & Votruba-Drzal, 2015) and Hungarian (e.g., Csapó, 2012) studies that parental educational attainment is correlated with behavioral measures of cognitive developmental outcomes. There have been few reports or findings in the English language literature of significant relationships between parent education and either parent ratings or behavioral measures of mastery motivation in young children (Gilmore et al., 2003; MacTurk & Morgan, 1995; Morgan et al., 2013). However, several Hungarian studies have found some relationships between parents' education and ratings of mastery motivation in school-age children (Józsa & Molnár, 2013). For example, Józsa and Kis (2016) found low, but significant correlations between parents' education and DMQ cognitive persistence rated by teachers and by early adolescent students themselves. In another Hungarian study (Fejes & Józsa, 2005), students with more educated parents rated themselves to be higher on cognitive persistence, but the effect size was small; and no significant differences were found in social persistence with adults or peers. On the other hand, Fejes and Józsa (2007) found no significant differences in DMQ ratings between Hungarian students of employed and unemployed parents, nor did they find differences between ethnic majority (Hungarian) children and those from Roma (minority) families.

In regard to *children born preterm and low birth weight*, Harmon and Murrow (1995) reported that such infants were rated lower by their mothers on persistence using an early version of the DMQ than were full-term, low-risk 12-month-old infants. In another sample reported by the same authors, infants born preterm showed less task-directed persistence and mastery pleasure but more general exploration on behavioral mastery motivation tasks than full-term infants of the same gestational age. In a recent study of children born low birth weight and preterm, Blasco and Guy (2016) found that at 6-8

months corrected age, mothers of the preterm infants rated them lower on DMQ general competence than did mothers of a matched group of full-term infants.

Józsa et al. (2014) examined *gender* differences in DMQ self-reports of school-age children and teens in Hungary, China, and the US. Males rated themselves higher than females on gross motor persistence and competence in China and Hungary but not the US. Hungarian girls also rated themselves highest on mastery pleasure and the two social persistence scales. However, all these self-reported gender-difference DMQ ratings had small effect sizes. The Morgan et al. (2013) review of 58 samples of English- and Chinese-speaking children reported few statistically significant gender differences on the DMQ scales. None of the parent ratings of mastery motivation for children developing atypically, either Chinese or English-speaking, were significantly different for boys versus girls. Likewise, there were no gender differences for teacher ratings. Thus, as found in most mastery motivation research, gender differences were small and inconsistent across samples (Józsa & Molnár, 2013; Morgan & Yang, 1995; Józsa & Morgan, 2015).

### ***Objectives for this Article***

1. Describe the infant and preschool DMQ 18 data from Taiwan, Hungary, and the US.
2. Examine the reliability and validity of the preschool and infant DMQ 18 scales for these samples, including the factor structure.
3. Examine DMQ scale scores for (a) child age differences, (b) correlations with parent education; (c) gender differences; (d) comparisons of infants born preterm and low birth weight with infants born full-term; (e) comparisons of children with and without delays; and (f) culture/country differences.

### **Method**

#### ***Participants and Samples***

Most of the data for this article are from parent ratings using DMQ 18. These ratings include samples from two studies in Taiwan, one in the US, and one in Hungary. We have information about age, gender, parent education and risk or delay for most of these children. Table 1 shows the five samples and subsamples and includes the country, child status, *N*, chronological ages, and genders for each subsample.

More information about each of the five samples is provided below:

1. Taiwan children 1 to 4½ years old with (*n* = 60) and without (*n* = 61) mental delay (Huang, Chien, & Chiang, 2016);
2. Taiwan children 2 to 3½ years old (*n* = 64) with developmental delay who were re-tested 6 months later (Wang, Morgan et al., 2016; Wang, 2016);
3. Hungarian toddlers (*n* = 172) 1 to 3 years-old from early childhood centers; 127 had parents with medium to high education levels, who had completed high school

or more; 45 had parents with low education, mostly vocational or no high school. In addition, 25 Hungarian children were in a kindergarten class of 3 and 4 year-olds. Teachers also rated most of the Hungarian children, both those in early childhood centers and in the kindergarten (Józsa & Nyitrai, 2016).

4. American infants 6 to 10 months old who were born either preterm ( $n = 56$ ) or full-term ( $n = 29$ ). At 18 20 months, 12 children who were born preterm and 10 full-term children who were re-tested (Blasco & Guy, 2016);
5. American preschool-age children 3 to 5 years old ( $n = 36$ ) living in a homeless shelter with their mothers, who answered only the 5 items of the object/cognitive persistence scale of DMQ 18; 27 were retested one week later (Ramakrishnan, 2015).

Table 1. Basic Demographics for each Subsample

Sample	Country	Child status	<i>N</i>	Age in years mean ( <i>SD</i> )	Gender % boys
1a	Taiwan	Typical	61	3.02 (.62)	64
1b	Taiwan	Mental delay	60	2.89 (.81)	85
2	Taiwan	Developmental delay	64	2.71 (.41)	76
3a	Hungary	Typical, med-high parent education	127	2.24 (.46)	54
3b	Hungary	Typical, low parent education	45	2.29 (.45)	53
3c	Hungary	Typical	25	3.50 (.47)	56
4a	US	Full-term	29	.58 (.06)	52
4b	US	Preterm	56	.66 (.05)	50
5	US	Homeless	36	3.86 (.75)	36

### **Procedure**

The mother, or in a few cases the father, completed the DMQ 18. A parent of the children in samples 1-3, 5, and the 18-20 months children in sample 4 completed the DMQ preschool version. The mother of the 6-10 months children in sample 4 completed the infant version. Both infant and preschool age versions ask about age, gender, and who (mother, father, or teacher) answered the DMQ; some samples provided additional information, such as parent education, child status, and mental age.

### **Instrument**

The 39-item revised Dimensions of Mastery Questionnaire (DMQ 18) *preschool* version was the main instrument used for this study. The seven DMQ 18 preschool scales and a common item are:

1. Cognitive/object persistence scale (5 items)  
Common item "Works for a long time trying to do something challenging."
2. Gross motor persistence scale (5 items)  
Common item "Tries to do well in physical activities even when they are challenging."
3. Social persistence/mastery motivation with adults scale (5 items)  
Common item "Tries hard to get adults to understand him or her."

4. Social persistence/mastery motivation with children/peers scale (6 items)  
Common item "Tries to do and say things that keep other children interested."
5. Mastery pleasure scale, positive affect after finishing and/or while working on a task (5 items)  
Common item "Gets excited when he or she figures something out."
6. Negative reactions to challenge in mastery situation scales (8 items with 2 subscales)  
Common item for frustration/anger subscale "Gets frustrated when not able to complete a challenging task."  
Common item for sadness/shame subscale "Looks away when tries but cannot do something."
7. General competence compared to peers scale (5 items). This scale assesses competence or the ability to solve problems in contrast to the motivation to master tasks.  
Common item "Does things that are difficult for children his or her age."

In addition to the seven main scales and two subscales, a total persistence score was computed based on the average of scales 1-4.

The 38-item *infant version* of DMQ 18 has many items in common with the preschool version and has the same scales; however, the infant DMQ 18 does not include the sadness/shame subscale.

## Results

### *Reliability*

#### *Internal Consistency*

As shown in Table 2, the internal consistency (Cronbach alphas) of the Hungarian and US DMQ scales was good to acceptable. However, in the samples from Taiwan some of the expressive scales were problematic. In sample 2, the negative reaction scales for the Taiwan children with delays were unacceptably low for both sadness/shame and for frustration/anger; as was mastery pleasure for sample 1.

#### *Stability Coefficients*

The test-retest reliability was .73 for cognitive/object persistence in sample 5, the US children who lived with their mothers in a homeless shelter. In sample 2, the Taiwan children with developmental delays were rated again by their mothers after 6 months. The stability coefficients varied from .31 for mastery pleasure to .70 for cognitive/object persistence. The 6 month stability correlations for the five persistence scales were all in the .52-.70 range, and the correlation for general competence was .63. However, the 6-month stabilities of the negative reaction scales were lower, .37 to .41. For sample 4, the approximately one-year stability from the infant DMQ to the preschool DMQ varied from



.33 for social mastery with children to .73 for cognitive/object persistence; most of the correlations across the two age versions and an approximately one year time interval were above .50.

Table 2. Internal Consistency (Cronbach Alphas) of the DMQ 18 Scales Rated by Parents

Scale	1 (TW)	2 (TW)	Sample 3 (HU)	4 (US)	5 (US)
<b>Persistence scales</b>					
Cognitive/object	.84	.84	.84	.76	.82
Gross motor	.81	.86	.88	.69	-
Social w. adults	.86	.86	.78	.82	-
Social w. children	.86	.75	.84	.84	-
Total persistence	.92	.91	.92	.92	-
<b>Expressive scales</b>					
Mastery pleasure	.58	.88	.82	.74	-
Negative reactions	.80	.65	.82	-	-
Frustration/anger	.74	.55	.86	.75	-
Sadness/shame	.68	.37	.66	-	-
General competence	.88	.76	.81	.90	-

Note. Sample 1 was 121 preschool children with and without mental delays from Taiwan (TW); sample 2 was 64 preschool children with developmental delays from Taiwan (TW); sample 3 was 197 children from early childhood centers and kindergartens in Hungary (HU); sample 4 was 85 infants born preterm or full-term from the US; sample 5 was 36 US preschool-age children who lived in a homeless shelter with their mothers.

For sample 2 six months later, the alphas were similar, but the three negative reaction scales were somewhat higher; .72, .67, and .44, respectively. For sample 4; the alphas shown are for 6-10 month infants so there were no sadness/shame or overall negative reaction scales; at 18 -20 months the sample 4 alphas were similar but a little higher, and the sadness/shame subscale was .67 and overall negative reaction was .80. For sample 5, alpha at the retest was .90.

### Validity

Parents and teachers see children in very different contexts, so one would not expect their ratings of the same child to be highly correlated. However, parent and teacher ratings should theoretically be at least somewhat related; therefore, some support for convergent construct validity is provided by the significant positive correlations between the parent and teacher ratings of the same Hungarian children. All the correlations were modest, varying from .26 to .39 for the persistence scales and .38 for competence. Parent and teacher correlations for ratings of mastery pleasure and negative reactions to challenge were even lower but still statistically significant.

Factorial validity of the preschool DMQ is supported by the relatively clean factors shown in Table 3 for 362 children from samples 1, 2, and 3 in Taiwan and Hungary. Sample 4 and sample 5 were not included in the factor analysis because sample 5 only had the cognitive object scale and sample 4 used the infant DMQ. This principal axis exploratory factor analysis with Varimax rotation was computed for the items of the four persistence scales and mastery pleasure in order to test the hypothesized 5-factor solution (see also Hwang et al., 2017). As shown, there was some overlap between the two social mastery scales, but the cognitive/object, gross motor, and mastery pleasure scales factored well. Similar results were found for separate factor analyses of the Hungarian children and the children from Taiwan.

Table 3. Factor Loadings of the Preschool DMQ 18 Items from the Four Persistence Scales and Mastery Pleasure for 362 Preschool Children from Hungary and Taiwan

Scales and items	Social mastery w. adults	Gross motor persist	Cognitive persist	Mastery pleasure	Social mastery w. peers
<b>Social mastery with adults</b>					
Tries hard to understand my feelings	.71	.40			
Tries to figure out what adults like	.66				
Tries to keep adults interested in talking	.62				
Tries hard to get adults to understand	.53				
Tries hard to interest adults in playing	.53				
Tries to understand other children	.52#	.42			
<b>Gross motor persistence</b>					
Tries hard to get better at physical skills		.70			
Repeats jumping/running skills until can do them		.66			
Tries hard to improve throwing or kicking		.61			
Tries to do well at motor activities		.58			
Tries to do well in physical activities		.58			
<b>Cognitive/object persistence</b>					
Works a long time to put something together			.71		
Works a long time trying something challenging			.71		
Tries to complete tasks, even if it takes time			.69		
Tries to complete puzzles even if it is hard			.68		
Repeats a new skill until he or she can do it			.47		
<b>Mastery pleasure</b>					
Shows excitement when successful				.73	
Smiles broadly after finishing something				.73	
Gets excited when figures something out				.60	
Is pleased when solves a challenging problem				.60	
Smiles when makes something happen				.57	
<b>Social mastery with peers</b>					
Tries to get included when children are playing					.77
Tries hard to make friends with other kids					.67
Tries to do things that keep children interested	.49				.53
Tries to keep playing with other kids					.53
Tries hard to make other children feel better					.44

Note. Principal axis factor analysis with Varimax rotation. These five factors account for 58% of the variance. Loading less than .40 have been omitted. # indicates that the item loads on incorrect factor.

We attempted a similar factor analysis for sample 4 the relatively small ( $n = 85$ ) group of American infants. Similar to previous factor analyses of a larger sample of US infants (Morgan et al., 2013), the factors of the infants were not very clean. There was considerable overlap in the two sets of social mastery (adult and peer) items, and there was also overlap of the cognitive/object and gross motor items, which is not surprising for 6-10 month-old infants when sensory motor skills are key aspects of development.

### Child Age

There were some modest but significant DMQ scale correlations with age in the several samples. The samples from Hungary ( $n = 212$ ) and Taiwan ( $n = 61$ ) of children developing typically had relatively wide age ranges, from 1 to over 4 years, so we examined correlations of parents' ratings on the DMQ with child age. In the Hungarian samples there were significant positive correlations with age for all the DMQ scales, except negative reactions and its subscales, but the  $r$ s varied from .15 to .27, so small to medium effect sizes. No significant age with DMQ correlations were found in the sample

from Taiwan, except that the older children were rated as showing more negative reactions to challenge.

### ***Parent Education***

With regard to parent education few significant relationships were found. For the Hungarian early childhood center toddlers, there were no significant relationships between parent education and the parent ratings on the DMQ scales. There were also no differences on the DMQ scales between 26 Roma (minority) children and the majority Hungarian children. This seems to indicate that even wide differences in parent education and perhaps ethnicity do not influence parent perceptions of their young child's motivation.

The finding of no relations between parent education and Hungarian parent ratings of the DMQ is strengthened by similar findings with Hungarian teachers of no significant relationships between parent education and DMQ teacher ratings. The only exception was on general competence ( $r = .16, p < .03$ ) where teachers perceive the children of less educated parents to be less competent but with a small effect size.

The general lack of strong relationships between parent education and parent DMQ ratings is similar in the preschool samples from Taiwan, except that there was a significant relationship for cognitive/object persistence ( $r = .27, p < .04$ ) for the children developing typically. There was no significant correlation between parent education and the DMQ ratings of US parents who were homeless (sample 5) on their perceptions of their 3-5 year-old child's cognitive/object persistence. We did not have parent education information about the US infants.

In summary, evidence from the several samples indicates that parent's perceptions of their child's mastery motivation is not strongly related to their educational level in Hungary, Taiwan, and perhaps in the US.

### ***Gender Differences***

There were relatively few gender differences on the DMQ scales. For example, there were no significant differences between parent ratings of boys and girls DMQ scores in the US infants in sample 4, either those born preterm or full-term. Likewise, there were no gender differences in the Taiwan toddlers with delay (sample 2), and no differences in sample 5, the US preschool children living in a homeless shelter. Furthermore, there were fewer gender differences than expected by chance for the seven scales and five samples: three from Hungary (3a, 3b, and 3c), and two from Taiwan (1a and 1b).

### ***Full-term vs. Preterm Infants***

Comparisons were made of children born low birth weight and preterm versus full-term infants (sample 4a vs. 4b). The sample of children born preterm excluded children with a known syndrome, genetic disorder, or diagnosed disability. The full-term infants were

from volunteer families in a large western-US metropolitan area. For these US infants, the mothers rated their preterm infants significantly lower on gross motor persistence and general competence even though the preterm infants were about one month older in chronological age because the groups were matched on gestational age.

### **Typical vs. Delayed Development**

Table 4 compares parent ratings of children in Taiwan developing typically with those who have delays. The children with delays were rated lower on the DMQ persistence scales, mastery pleasure, negative reactions of frustration/anger and competence. The groups were not significantly different on sadness/shame and overall negative reactions. Note that the differences between the groups were especially large ( $d > 1.0$ ) for general competence and total persistence according to Cohen (1988).

Table 4. Comparisons of the Preschool DMQ 18 Scores between Taiwanese Children with ( $n=124$ ) and without Delays ( $n=61$ )

DMQ Scales	Delayed <i>M (SD)</i>	Typical <i>M (SD)</i>	<i>t</i>	<i>p</i>	<i>d</i>
<b>Persistence scales</b>					
Cognitive/object	2.77 (.91)	3.31 (.79)	-3.93	<.001	.61
Gross motor	3.08 (.93)	3.71 (.70)	-5.24	<.001	.74
Social w. adults	2.89 (.90)	3.70 (.75)	-6.09	<.001	.96
Social w. children	2.81 (.89)	3.51 (.65)	-6.08	<.001	.86
Total persistence	2.89 (.72)	3.56 (.55)	-7.03	<.001	1.01
<b>Expressive scales</b>					
Mastery pleasure	4.05 (.82)	4.60 (.47)	-5.66	<.001	.75
Negative reactions	3.16 (.73)	3.34 (.69)	-1.55	.123	.24
Frustrations/anger	3.04 (.85)	3.43 (.82)	-2.97	.003	.46
Sadness/shame	3.29 (.81)	3.25 (.75)	.34	.731	.05
General competence	2.58 (.78)	3.61 (.66)	-8.89	<.001	1.39

### **Cross-National Comparisons**

We made comparisons of 1 to 5 year-old children from Hungary and Taiwan using parent's DMQ ratings. We also examined country differences for more narrow age groups that included US children.

#### *Comparison of Children in Taiwan and Hungary*

Table 5 shows the comparisons of 1 to 5 year-old typically developing children in Hungary (samples 3a and 3c) and in Taiwan (sample 1a). Both groups had relatively high parent education averaging more than 14 years of schooling. On the persistence and competence DMQ scales, the parents from Hungary generally rated their children somewhat higher than did the parents from Taiwan, but only the gross motor persistence and competence scales were significant at the  $p < .01$  level with effect sizes that were medium to large ( $d = .60$  and  $.63$ ). However, sadness/shame was rated significantly higher by the parents from Taiwan ( $p < .001$ ,  $d = .70$ ) again indicating a medium to large effect size (Cohen, 1988; Morgan, Leech, Gloeckner, & Barrett, 2013).

Table 5. Comparisons of Typically Developing 1 to 5 year-old Children from Hungary (n = 152) and Taiwan (n = 61)

DMQ Scales	Hungary M (SD)	Taiwan M (SD)	t	p	d
<b>Persistence scales</b>					
Cognitive/object	3.50 (.88)	3.31 (.79)	1.45	.149	.23
Gross motor	4.17 (.81)	3.71 (.70)	3.85	<.001	.60
Social w. adults	3.92 (.75)	3.70 (.75)	1.86	.065	.28
Social w. children	3.59 (.81)	3.51 (.65)	.79	.431	.11
Total persistence	3.79 (.64)	3.56 (.55)	2.51	.013	.35
<b>Expressive scales</b>					
Mastery pleasure	4.43 (.62)	4.60 (.47)	-1.94	.053	.27
Negative reactions	3.06 (.81)	3.34 (.69)	-2.35	.020	.35
Frustrations/anger	3.45 (1.07)	3.43 (.82)	.14	.886	.02
Sadness/shame	2.67 (.82)	3.25 (.75)	4.74	<.001	.70
General competence	4.07 (.61)	3.61 (.66)	-4.77	<.001	.63

### *Toddlers in the US and Hungary*

The 22 US children in samples 4a and 4b who were rated again at approximately 1 ½ years of age were compared to a subsample of 23 toddlers (from samples 3a and 3b) from Hungary who were 17-22 months of age. The only significant difference between the groups was on social persistence with adults; the Hungarian parents rated their toddlers higher on this scale than did the American parents ( $t = 2.38, p = .023$ ).

### *Children over 3 Years in Hungary, Taiwan, and the US*

Three groups of preschool-age children ( $\geq 3$  years old) were compared on the cognitive/object persistence scale. The samples were: (a) from a Hungarian kindergarten (sample 3c,  $n = 24$ ), (b) typically developing children from Taiwan (part of sample 1a,  $n = 38$ ), and (c) US children and their mothers who were experiencing homelessness (sample 5,  $n = 36$ ). The Hungarian and US children were both rated somewhat but not significantly higher by their parents than the children from Taiwan.

Children over age 3 from Hungary and Taiwan were compared on the other DMQ scales. These samples partially overlapped those of the 1 to 5 year-olds in Table 5. The Hungarian parents rated their kindergarten children significantly higher on total persistence and all the individual persistence scales, except social persistence with adults. These parents from Hungary also perceived their kindergarten children as more competent but as showing less sadness/shame than the children from Taiwan.

## **Discussion**

### ***Reliability and Validity***

This study included 503 children from 6-months to 5 years-old from Taiwan, Hungary, and the US. All of the five samples had acceptable internal consistency reliability (alphas) for the persistence scales and general competence; reliability for the expressive scales varied from good to unacceptable. Some support was found for test-retest reliability and for stability over 6 month and 1 year periods. Evidence for validity was

provided by significant, but modest, correlations between teacher and parent ratings and from a relatively clean 5-factor analysis for the preschool DMQ data.

### ***Age, Gender, and Parent Education***

Modest age differences were found, especially with infants and toddlers being rated lower on mastery motivation than kindergarten and older preschool children. Few gender differences were identified. There were also few significant relations between parent education level and parent's perceptions of their child's mastery motivation.

It is important to remember that these DMQ scores provide parent ratings based on their perceptions, not actual behavioral assessments of the child. They do provide important insight into how the child is perceived, but they are filtered by not only the personality of the rater (e.g., strict or lenient) but also by the rater's culture and other factors.

Morgan et al. (2013) made age comparisons of 1, 2, and 4 year-old English- and Chinese-speaking children rated on the DMQ by their parents. These results were only partly consistent with the current findings that Hungarian parents rated 3 to 4 year-old kindergarten children as generally more motivated for mastery than did parents of children under 2. Although these DMQ age-related results were based on parent perceptions, there is some support from the mastery task literature. For example, there were some behavioral data to suggest that 2 to 3 year-olds were more persistent than 1 to 2 year-olds at moderately challenging tasks (Barrett, Morgan, & Maslin-Cole, 1993; Morgan, Busch-Rossnagel, Maslin-Cole, & Harmon, 1992). These DMQ data in the current study were consistent with the Sparks, Hunter, Backman, Morgan, and Ross (2012) longitudinal study in which the 18-month toddlers were rated higher on mastery pleasure and competence as well as cognitive persistence than 6 month-old infants. However, Hauser-Cram (1996) did not find any age differences in mastery task score for toddlers with developmental disabilities.

Parents in our samples rated boys and girls very similarly on the DMQ scales, indicating few differences in parental perceptions between genders in young children's mastery motivation. This is generally consistent with the DMQ literature summarized by Józsa & Molnár (2013) and Morgan et al. (2013). Consistent with most behavioral mastery task studies, Hauser-Cram (1996) did not find gender differences in toddlers with developmental disabilities.

In the current study, Hungarian parents of lower and higher education levels did not rate their children's mastery motivation or competence differently. It should be noted that for Hungarian toddlers to be eligible to participate in the free early childhood centers, the mothers have to be employed. As a result, it is possible that children whose mothers were unable or unwilling to find employment would have rated their children differently than these samples of Hungarian working mothers. However, US homeless mothers, who were educationally and ethnically diverse, did not rate their preschool-age

children differently on cognitive persistence than parents rated similar-aged, typically-developing children from Hungary or Taiwan. Furthermore, in a behavioral mastery task study by Young and Hauser-Cram (2006) of 3-year-old preterm children with developmental disabilities, there was not a significant relationship between persistence at tasks and maternal education level.

Parent education does not seem to have been a main focus of the American or Chinese mastery motivation literature. However, several Hungarian mastery motivation studies have examined relationships of DMQ ratings of school-age students with parent education; the results were mixed (Józsa & Molnár, 2013). Whether parent education would be related to behavioral differences on mastery tasks or actual motivation in preschool settings is unknown. In this study, relatively low parent education does not seem to be an important risk factor for parent or teacher perceptions of their child's mastery motivation in the early years.

### ***Prematurity and Delayed Development***

In the current study, infants born preterm were rated lower on gross motor persistence and competence by their parents than were full-term infants. This result is generally consistent with Harmon and Murrow (1995), who reported that preterm infants were rated lower by their mothers than full-term infants matched on gestational age. Hauser-Cram (1996) found that the greater the degree of prematurity in toddlers with developmental disability the lower the toddlers' persistence and competence at mastery tasks. However, Young and Hauser-Cram (2006) found no relationship between gestational age in weeks and persistence at a cause-effect task in preterm 3-year-olds with developmental disabilities.

In this study as well as others (e.g., Gilmore & Cuskelly, 2011; Wang et al., 2013), mothers of children with delays perceived them to be lower on the mastery motivation than children developing typically. It is likely that when parents rate their delayed children with the DMQ, they compare them to typically developing children of a similar chronological age rather than compare them to children of the same developmental age or ability as their child (Morgan, et al., 2013). Even though the DMQ items focus on whether the child tries hard to do something challenging and not their success, it may well be that parents (and teachers) assume that a delayed child doesn't try hard or show much pleasure even when successful. However, when young children with delays have been tested with mastery motivation tasks that are individualized so that each child is given tasks that are moderately difficult for him or her, there were no differences in persistence between children with and without delays (e.g., Gilmore & Cuskelly, 2011, Hauser-Cram, 1996; Wang et al., 2013).

### ***Cross-National and Culture Differences***

The main country or cultural difference found this study was that Hungarian parents' ratings of their preschool children were higher than those of Taiwanese parents on

gross motor persistence and competence. On the other hand, parents in Taiwan rated their children higher on sadness/shame during challenges than parents in Hungary.

This finding that Hungarian children were rated by their parents as higher on competence and some aspects of persistence than were similar age peers in Taiwan seems puzzling, and not fully in agreement with Józsa et al. (2014) who compared DMQ self-ratings of 11-year-old children from Hungary and China. In that study, the Chinese children rated themselves higher, in contrast to current study, on competence, but lower on gross motor persistence, as in the current study. It seems questionable that preschool children in Hungary actually would be more competent or more persistent at behavioral tasks than similar aged children developing typically in Taiwan, although we don't know any direct behavioral evidence to suggest or refute such possibilities. However, Blinco (1992) found that young Asian children persisted longer than American counterparts in the face of difficulty. In the future, the new computer-tablet school readiness assessment by Barrett, Józsa, and Morgan (2017) could provide a way to check whether preschool children in Taiwan and Hungary really differ on mastery motivation and competence. Given the current absence of cross-cultural behavioral evidence, it seems that cultural differences in parental perceptions and personalities are most likely the reason that the Hungarian children were rated higher on persistence and competence.

A somewhat related finding reported by Morgan et al. (2013) compared English- and Chinese-speaking children with the DMQ 17; they found that typical English-speaking preschool children were rated significantly higher, on the gross motor and competence DMQ scales, than the Chinese-speaking children from Taiwan. This is similar to the current finding in that western children were rated higher than Asian. One of the possible reasons for the relatively lower ratings by parents of young children in Taiwan could be that parents have higher expectations for their children, and, thus, they rate them relatively lower than parents in Hungary or the US. Because of the competitive labor market and cultural values informed by the Confucian philosophy, most Chinese parents tend to have very high expectations for their children's educational achievement (Chen & Stevenson, 1995). For example, more than 30% of middle school students are expected to be in the top five of their class, and almost 90% are expected to earn a college or higher degree in the future (Li, Xue, Wang, & Wang, 2017).

In regard to sadness/shame, which was rated higher in Taiwanese children than in Hungarian, there have been some cross-cultural studies supporting the finding of more shame in Chinese children than in children from Western countries. Shame would be expected to be more common in persons from collectivistic cultures, such as Japan and China, than individualistic cultures, such as the US and Hungary. China with a collectivistic culture tends to foster one's relatedness or connection to others. Therefore, Chinese people will be more likely to express and experience other-focused emotions, such as shame (Markus & Kitayama, 1991). Chinese parents are also more critical of children's failure because they believe that failure indicates a need for behavior correction or more effort/motivation, and they think that criticism will lead to children's



self-improvement (Ng, Pomerantz, & Lam, 2007). Because failure signals where improvement is needed, Chinese children view failure as particularly meaningful and report experiencing more negative reaction to failure (especially shame) than English children.

### ***Future Research***

Future research with the DMQ will be strengthened by adding mastery tasks and longitudinal designs. Future DMQ research might include not only mastery motivation tasks but also measures of executive functions as outcomes (see Barrett et al., 2017). Several studies have proposed or found a relationship between mastery motivation and executive function (EF) as two partially overlapping “approaches to learning” that are important precursors of early success in school (Keilty, Blasco, & Acar, 2016; Barrett et al., 2017). Hauser-Cram, Woodman, and Heyman (2014) found that persistence on moderately challenging mastery tasks in early childhood led to EF skills in young adults with developmental disabilities so longitudinal research could well be important. Future research could also examine the effects of parental expectations on changes in child mastery motivation over time. If parental expectations influence mastery motivation, what is the mechanism for that influence?

### **Conclusion**

Data in this paper provide evidence to support the reliability and validity of the recently revised infant and preschool Dimensions of Mastery Questionnaires (DMQ 18). There were few findings of DMQ differences related to child’s age, gender, and parent education. These demographics were not highly related to parent’s DMQ ratings or perceptions of infant and preschool mastery motivation. Infant prematurity and cultural differences seem to be more important determinants of parent DMQ ratings. By far the largest differences were between children with and without delays; other studies show that such large differences disappear when children are tested with mastery tasks that provide each child with tasks of moderate difficulty for him or her.

The DMQ 18 provides a relatively quick and inexpensive method to assess adult perceptions of children’s persistence and affect in challenging mastery situations. As a result, it is a useful complement to the behavioral mastery tasks. The DMQ has proven to be a useful measure with clinical populations as indicated by ratings of children with delays in this study and many others (see especially Miller, Ziviani, & Boyd, 2014). Future research with the DMQ will be enhanced by supplementing adult perceptions with individualized mastery tasks and other behavioral measurements.

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## References

- Barrett, K. C., Józsa, K., & Morgan, G. A. (2017). New Computer-based Mastery Motivation and Executive Function Tasks for School Readiness and School Success in 3 to 8 Year-old Children. *Hungarian Educational Research Journal*, 7(2), 86–105.
- Barrett, K. C., & Morgan, G. A. (1995). Continuities and discontinuities in mastery motivation in infancy and toddlerhood: A conceptualization and review. In R. H. MacTurk, & G. A. Morgan (Eds.), *Mastery motivation: Origins, conceptualizations, and applications* (pp. 67–93). Norwood, NJ: Ablex.
- Barrett, K. C., Morgan, G. A., & Maslin-Cole, C. A. (1993). Three studies on the development of mastery motivation in infancy and toddlerhood. In D. Messer (Ed.), *Mastery motivation in early childhood: Development, measurement and social processes* (pp. 83–108). London: Routledge.
- Blasco, P. M., & Guy, S. (2016, June). *Executive function in infants and toddlers born low in birth weight (LBW) and preterm*. Presented at the International Society of Early Intervention (ISEI). Stockholm, Sweden.
- Blinco, P. M. A. (1992). A cross-cultural study of task persistence in young children in Japan and US. *Journal of Cross-Cultural Psychology*, 23(3), 407–415. <https://doi.org/10.1177/0022022192233010>
- Busch-Rossnagel, N. A., & Morgan, G. A. (2013). Introduction to the mastery motivation and self-regulation section. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook of self-regulatory processes in development: New directions and international perspectives* (pp. 247–264). New York, NY: Psychology Press/Taylor and Francis.
- Chen, C. & Stevenson, H. W. (1995). Motivation and mathematics achievement: A comparative study of Asian-American, Caucasian-American, and East Asian high school student. *Child Development*, 66(4), 1215–1234. <https://doi.org/10.2307/1131808>
- Csapó B. (Ed.). (2012). *Mérlegen a magyar iskola [Assessing Hungarian schools]*. Budapest: Nemzeti Tankönyvkiadó. (in Hungarian)
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*, 2nd ed. Hillsdale, NJ: Erlbaum.
- Duncan, G. J., Magnuson, K., & Votruba-Drzal, E. (2015). Children and socioeconomic status. In R. M. Lerner, M., Bornstein, & T. Leventhal (Eds.), *Handbook of child psychology and developmental science. Volume 4, Ecological settings and processes* (pp. 1–40). Hoboken, NJ: Wiley. <https://doi.org/10.1002/9781118963418.childpsy414>
- Fejes, J. B., & Józsa, K. (2005). A tanulási motiváció jellegzetességei hátrányos helyzetű tanulók körében [The characteristics of learning motivation among disadvantaged students]. *Magyar Pedagógia*, 105(2), 185–205. (in Hungarian)
- Fejes, J. B., & Józsa, K. (2007). Az iskolai eredményesség és a tanulási motiváció kulturális jellemzői: Roma és többségi tanulók összehasonlítása [Cultural factors in school achievement and learning motivation: A comparison of roma and majority students in Hungary]. *Iskolakultúra*, 17(6–7), 83–96. (in Hungarian)
- Gilmore, L., & Cuskelly, M. (2011). Observational assessment and maternal reports of motivation in children and adolescents with Down syndrome. *American Journal on Intellectual and Developmental Disabilities*, 116(2), 153–164. <https://doi.org/10.1352/1944-7558-116.2.153>

- Gilmore, L., Cuskelly, M., & Purdie, N. (2003). Mastery motivation: Stability and predictive validity from ages two to eight. *Early Education and Development, 14*(4), 413–424. [https://doi.org/10.1207/s15566935eed1404\\_2](https://doi.org/10.1207/s15566935eed1404_2)
- Green, S. B., & Morgan, G. A. (2017). Patterns of mastery task behavior in early school-age children in the United States. *Hungarian Educational Research Journal, 7*(2), 142–157.
- Harmon, R. J., & Murrow, N. S. (1995). The effect of prematurity and other perinatal factors on infants' mastery motivation. In R. H. MacTurk, & G. A. Morgan (Eds.), *Mastery motivation: Origins, conceptualizations, and applications* (pp. 237–256). Norwood, NJ: Ablex.
- Hauser-Cram, P. (1996). Mastery motivation in toddlers with developmental disabilities. *Child Development, 67*(1), 236–248. <https://doi.org/10.2307/1131698>
- Hauser-Cram, P., Woodman, A. C., & Heyman, M. (2014) Early mastery motivation as a predictor of executive function in young adults with developmental disabilities. *American Journal on Intellectual and Developmental Disabilities, 119*(6), 536–551. <https://doi.org/10.1352/1944-7588-119.6.536>
- Huang, S.-Y., Chien, H.-M., & Chiang, W.-C. (2016, June). *Mastery motivation in preschoolers with developmental delay: Individual differences and temperament associations*. Presented at the International Society of Early Intervention. Stockholm, Sweden.
- Huang S.-Y., & Lay, K.-L. (2017). Mastery motivation in infancy and early childhood: The consistency and variation of its stability and predictability of general competence. *Hungarian Educational Research Journal, 7*(2), 15–31.
- Hwang, A.-W., Wang, J., Józsa, K., Wang, P.-J., Liao, H.-F., & Morgan, G. A. (2017). Cross cultural invariance and comparisons of Hungarian-, Chinese-, and English-speaking preschool children leading to the revised Dimensions of Mastery Questionnaire (DMQ 18). *Hungarian Educational Research Journal, 7*(2), 32–47.
- Józsa, K., & Kis, N. (2016). Az Elsajáttási motiváció kérdőív szerkezeti validitásának vizsgálata megerősítő faktoranalízissel [Confirmatory factor analysis of the Hungarian versions of Dimension of Mastery Questionnaires]. In P. Tóth, & I. Holik (Eds.), *Új kutatások a neveléstudományokban 2015* (pp. 41–52). Budapest: ELTE Eötvös Kiadó.
- Józsa, K., & Molnár, É. D. (2013). The relationship between mastery motivation, self-regulated learning and school success: A Hungarian and European perspective. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook on self-regulatory processes in development: New directions and international perspectives* (pp. 265–304). New York, NY: Psychology Press. <https://doi.org/10.4324/9780203080719.ch13>
- Józsa, K., & Morgan, G. A. (2017). Reversed items in Likert scales: Filtering out invalid responders. *Journal of Psychological and Educational Research, 25*(1), 7–25.
- Józsa, K., & Morgan, G. A. (2015). An improved measure of mastery motivation: Reliability and validity of the Dimensions of Mastery Questionnaire (DMQ 18) for preschool children. *Hungarian Educational Research Journal, 5*(4), 87–103. <https://doi.org/10.14413/HERJ2015.04.08>
- Józsa, K., & Morgan, G. A. (2014). Developmental changes in cognitive persistence and academic achievement between grade 4 and grade 8. *European Journal of Psychology of Education, 29*(3), 521–535. <https://doi.org/10.1007/s10212-014-0211-z>
- Józsa, K., & Nyitrai, Á. (2016). *Unpublished DMQ data base of 1-4 year-old Hungarian children from early childhood centers and a kindergarten*. University of Szeged.
- Józsa, K., Wang, J., Barrett, K. C., & Morgan, G. A. (2014). Age and cultural differences in mastery motivation in American, Chinese, and Hungarian school-age children. *Child Development Research, 2014* Article ID 803061, 1–16. <https://doi.org/10.1155/2014/803061>
- Keilty, B., Blasco, P. M., & Acar, S. (2016). Re-conceptualizing developmental areas of assessment for screening, eligibility determination, and program planning in early intervention. *Journal of Intellectual Disability-Diagnosis and Treatment, 3*(4), 218–229. <https://doi.org/10.6000/2292-2598.2015.03.04.8>

- Li, M., Xue, H., Wang, W., & Wang, Y. (2017). Parental expectations and child screen and academic sedentary behavior in China. *American Journal of Preventive Medicine*, 52(5), 680–689. <https://doi.org/10.1016/j.amepre.2016.12.006>
- MacTurk, R. H., & Morgan, G. A. (Eds.). (1995). *Mastery motivation: Origins, conceptualizations and applications*. Norwood, NJ: Ablex.
- Markus, H. R., & Kitayama, S. (1991) Culture and the self: Implications for cognition, emotion, and motivation. *Psychological Review*, 98(2), 224–253. <https://doi.org/10.1037/0033-295X.98.2.224>
- Miller, L., Ziviani, J., & Boyd, R. N. (2014). A systematic review of clinometric properties of measurements of motivation for children aged 5-16 years with a physical disability or motor delay. *Physical & Occupational Therapy in Pediatrics*, 34(1), 90–114. <https://doi.org/10.3109/01942638.2013.771720>
- Morgan, G. A., Busch-Rossnagel, N. A., Maslin-Cole, C. A., & Harmon, R. J. (1992). *Mastery motivation tasks: Manual for 15- to 36-month-old children*. Bronx: Fordham University Psychology Department.
- Morgan, G. A., Harmon, R. J., & Maslin-Cole, C. A. (1990). Mastery motivation: Definition and measurement. *Early Education and Development*, 1(5), 318–339. [https://doi.org/10.1207/s15566935eed0105\\_1](https://doi.org/10.1207/s15566935eed0105_1)
- Morgan, G. A., Leech, N. L., Gloeckner, G. W., & Barrett, K. C. (2013). *IBM SPSS for introductory statistics: Use and interpretation* (5th ed.). New York, NY: Routledge/Taylor and Francis.
- Morgan, G. A., Wang, J., Barrett, K. C., Liao, H.-F., Wang, P.-J., Huang, S.-Y., & Józsa, K. (2015). *The Revised Dimensions of Mastery Questionnaire (DMQ 18)*. <https://sites.google.com/a/rams.colostate.edu/georgemorgan/mastery-motivation>
- Morgan, G. A., Wang, J., Liao, H.-F., & Xu, Q. (2013). Using the Dimensions of Mastery Questionnaire to assess mastery motivation of English- and Chinese- speaking children: Psychometrics and implications for self- regulation. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook of self-regulatory processes in development: New directions and international perspectives* (pp. 305–335). New York, NY: Psychology Press. <https://doi.org/10.4324/9780203080719.ch14>
- Morgan, G. A., & Yang, R. K. (1995). Toward a conceptualization of the organization of mastery motivation. In R. H. MacTurk, & G. A. Morgan (Eds.), *Mastery motivation: Origins, conceptualizations and applications* (pp. 317–337). Norwood, NJ: Ablex.
- Ng, F. F., Pomerantz, E. M., & Lam, S. (2007). Chinese and European American parents' responses to children's success and failure: Implications for children's responses. *Developmental Psychology*, 43(5), 1239–1255. <https://doi.org/10.1037/0012-1649.43.5.1239>
- Shonkoff, J. P., & Phillips, D. A. (2000). *From neurons to neighborhoods: The science of early childhood development*. Washington DC: National Academy Press.
- Ramakrishnan, J. (2015). *Unpublished DMQ 18 data from mothers of 3-5 year-old children living at a Minneapolis emergency homeless shelter*. Institute of Child Development, University of Minnesota.
- Sparks, T. A., Hunter, S. K., Backman, T. L., Morgan, G. A., & Ross, R. G. (2012). Maternal parenting stress and mothers' reports of their infant's mastery motivation. *Infant Behavior and Development*, 35(1), 167–173.
- Wang, J., Morgan, G. A., & Biringen, Z. (2013). Mother-infant affect exchange and mastery motivation in toddlerhood. *Infant and Child Development*, 23(2), 139–152. <https://doi.org/10.1002/icd.1825>
- Wang, P.-J. (2016). *Bidirectional relations among maternal interactive behavior, mastery motivation, and developmental ability in children with global developmental delay*. Unpublished doctoral dissertation. School and Graduate Institute of Physical Therapy, National Taiwan University.
- Wang, P.-J., Hwang, A.-W., Liao, H.-F., Chen, P.-C., & Hsieh, W.-S. (2011). The stability of mastery motivation and its relationship with home environment in infants and toddlers. *Infant Behavior and Development*, 34(3), 434–442. <https://doi.org/10.1016/j.infbeh.2011.04.005>
- Wang, P.-J., Liao, H.-F., Morgan, G. A., Hwang, A.-W., Chen, L. C., Kang, L. J., & Lu, L. (2016, June). *Relations between mastery motivation, child development and participation in children with developmental delay*. Presented at the International Society on Early Intervention, Stockholm, Sweden.

- Wang, P.-J., Morgan, G. A., Liao, H.-F., Chen, L.-C., Hwang, A.-W., & Lu, L. (2016). Reliability and validity of the revised individualized structured mastery tasks in children with developmental delay. *International Journal of Physical Medicine and Rehabilitation*, 4(6), 1–7. <https://doi.org/10.4172/2329-9096.1000374>
- Wang, P.-J., Morgan, G. A., Hwang, A.-W., Chen, L. -C., & Liao, H.-F. (2014). Do maternal interactive behaviors correlate with developmental outcomes and mastery motivation in toddlers with and without motor delay? *Physical Therapy*, 94(12), 1744–1754. <https://doi.org/10.2522/ptj.20130560>
- Wang, P.-J., Morgan, G. A., Hwang, A.-W., & Liao, H.-F. (2013). Individualized behavioral assessments and maternal ratings of mastery motivation in mental-age matched toddlers with and without motor delays. *Physical Therapy*, 93(1), 79–87. <https://doi.org/10.2522/ptj.20120068>
- Young, J. M., & Hauser-Cram, P. (2006). Mother-child interaction as a predictor of mastery motivation in children with disabilities born preterm. *Journal of Early Intervention*, 28(4), 252–263. <https://doi.org/10.1177/105381510602800402>



## The Revised Individualized Moderately Challenging Mastery Tasks for 15- to 48-month-old Children

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### Abstract

Mastery motivation is an under-assessed resiliency factor that helps all children achieve their potential. Children with developmental delay(s) (DD) have been rated lower by mothers on mastery motivation than children developing typically, but no group differences have been found when using individualized moderately challenging mastery tasks. Thus, it is important to have good individualized behavioral measures of mastery motivation. This article introduces the revised individualized moderately challenging mastery tasks for 15- to 48-month-old children; it includes the testing methods, psychometric properties, descriptive data about these mastery motivation tasks in children with DD, and clinical implications. This individualized mastery task method has shown good scoring reliability and acceptable evidence for convergent and divergent validity and is a useful tool for assessing mastery motivation for children with DD, and probably for children who are developing typically. This test may be helpful to facilitate the separation of developmental ability from motivation for each child. Suggestions for caregiver scaffolding of mastery motivation are also provided. Furthermore, caregivers and early childhood interventionists can learn how to improve a child's mastery motivation.

**Keywords:** motivation, young children, developmental delay, individualized mastery tasks, moderately challenging, persistence, task pleasure

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## **Introduction**

### ***Definition and Importance of Mastery Motivation***

Mastery motivation has been identified as one of the core aspects of child development, which should be one part of a child's evaluation. Previous studies have found that early mastery motivation predicted later cognitive ability better than early mental developmental scores did (e.g., Yarrow, Klein, Lomonao, & Morgan, 1975), and mastery motivation is a predictor of academic achievement in children with typical development (Józsa & Molnár, 2013). Furthermore, mastery motivation predicted later performance of daily activities (Hauser-Cram et al., 2001) and academic performance (Gilmore & Cuskelly, 2009) for children with developmental disabilities. Motivational procedures are the core element of the Pivotal Response Treatment, which is effective for children with autism spectrum disorders (Mohammadzaheri, Koegel, Rezaee, & Rafiee, 2014). Children with developmental delay (DD) have been rated by caregivers as having lower mastery motivation than typically developing children; however, they did not show lower mastery motivation on individualized mastery tasks that were moderately challenging for them personally (Gilmore & Cuskelly, 2011; Wang, Morgan, Hwang, & Liao, 2013). Thus, it is important for researchers and clinicians to have reliable and valid behavioral measures of mastery motivation.

Mastery motivation stimulates children's independent attempts to master tasks that are at least moderately challenging for him or her (Morgan, Harmon, & Maslin-Cole, 1990). Mastery motivation focuses on the child's goal-directed persistence, the process or motivation to master the task, rather than the child's ability to solve a problem (Busch-Rossnagel & Morgan, 2013). It leads to better executive function through keeping a goal in mind and using various problem-solving strategies (Hauser-Cram, Woodman, & Heyman, 2014; Keilty, Blasco, & Acar, 2015). The construct of mastery motivation has been assessed in two main ways: individualized behavioral tasks and adult- or self-ratings of the child's motivation with the Dimensions of Mastery Questionnaire (DMQ 18) (Morgan et al., 2017; Morgan et al., 2015).

The purpose of this article is: to describe the revised individualized moderately challenging mastery tasks, how to use these individualized tasks for assessing the mastery motivation of 15- to 48-month-old children, and to describe the psychometric properties of these tasks in young children with DD.

### ***Other Behavioral Measures of Mastery Motivation***

Several earlier behavioral methods of assessing mastery motivation in three contexts (free play, parent-child semi-structured play, and structured tasks) have been used by researchers. Free play assessment is designed to observe a child's persistence or level of play involvement when he or she is free to choose what toys to play with (e.g., Jennings, Connors, & Stegman, 1988; Maslin-Cole, Bretherton, & Morgan, 1993). Parent-child semi-structured play assessments rate a child's persistence when the parent and child



play together in their usual way with a number of toys (e.g., Smidt & Cress, 2004; Medeiros, Cress, & Lambert, 2016). In structured tasks, researchers use different types of structured tasks with a variety of materials (e.g., puzzles, shape-sorters, pictures, or fishing toys) and different scoring methods (coding specific behaviors or global rating scales) to assess mastery motivation (e.g., Blair, Greenberg, & Crnic, 2001; Jennings et al., 1988; Kelley, Brownell, & Campbell, 2000; Yarrow, Morgan, Jennings, Harmon, & Gaiter, 1982; Yarrow et al., 1983). Generally, they used tasks considered to be appropriately difficult for children of the ages being studied with structured tasks.

Since 1992, the most frequently used method has been the individualized moderately challenging task method (MacTurk, Morgan, & Jennings, 1995; Morgan, Busch-Rossnagel, Maslin-Cole, & Harmon, 1992). This method assessed children's object-oriented mastery motivation during three types of tasks (puzzles, shape-sorters, and cause-effect tasks) that were intended to be moderately challenging for that individual child. Several studies have shown that children were motivated by tasks that are moderately difficult for them; most children are less persistent at tasks that are too difficult or too easy for them (Barrett, Morgan, & Maslin-Cole, 1993; Redding, Morgan, & Harmon, 1988). This individualized task method involved identifying an appropriate moderate difficulty level for each individual child from a set of similar tasks, such as puzzles, that varied from easy to hard. A goal of this method was to find and score one moderately difficult level for each child; the examiner would start with a presumed moderately difficult level toy and continue until one actually moderately difficult level was found. Task-directed persistence was scored by counting the duration of task-directed behaviors (Morgan et al., 1992). The original individualized mastery task method had acceptable psychometric properties (Gilmore, Cuskelly, & Hayes, 2003; Hauser-Cram, 1996; Morgan et al., 1992; Wang et al., 2013).

Recently, the Individualized Moderately Challenging Mastery Tasks (IMoT) has been developed based on the original individualized mastery task method to make sure that all moderately challenging mastery task levels are measured. These tasks also were named the Revised Individualized Structured Mastery Tasks in Wang et al. (2016). Both the original and the revised individualized mastery tasks have important advantages compared to behavioral methods that did not identify moderately challenging tasks on which to assess the child's mastery motivation. The main advantage of the individualized method compared to earlier mastery task methods was that identifying a moderately difficult task facilitated the separation of the child's ability or competencies from his or her motivation. These individualized moderately challenging task methods also have important clinical implications because several previous studies using them have found no difference in mastery motivation between children with and without developmental disabilities (Gilmore & Cuskelly, 2011; Gilmore et al., 2003; Hauser-Cram, 1996; Wang et al., 2013). Other advantages of these methods are: (a) they provide objective records of the child's behavior, and thus, the scores are less influenced by social desirability than those from questionnaires; (b) the tasks used to index mastery motivation are



individually moderately challenging for that child, so they control for the confounding effects of differences in developmental abilities; (c) they can be used with children that vary in age because the tasks vary in difficulty level; and (d) they also can be used with children of the same age that vary in mental and fine motor ability.

### ***The Revised Individualized Moderately Challenging Mastery Tasks (IMoT)***

Although the studies cited above provided valuable results, we made some improvements when developing the IMoT. For example, in the original individualized tasks, finding a moderately challenging level of task was partly based on trial and error because the initially presumed moderately challenging toy might turn out to be too hard or too easy. Thus, the one identified moderately challenging task could be the first, the second, or occasionally even the third task of that type. Thus, the IMoT provides a more systematic method of finding moderately challenging tasks by starting with a presumed easy task, then moderate, and finally one hard level of task. The IMoT allowed for the possibility of identifying two or even three moderately difficult tasks for a given child. With the original method, if the child completed the moderate task before the end of the trial, the experimenter would reset the toy and ask the child to do it again, which may not be a good indicator of mastery motivation, especially for older toddlers and preschoolers. Using the revised method, we computed adjusted persistence scores for tasks that were completed after the midpoint of the trial. Thus, the IMoT procedure was based on the earlier method with theoretical and practical adjustments.

Two sets of individualized moderately challenging mastery tasks for 15- to 48-month-old children were developed to examine cognitive/object-oriented mastery motivation behaviors. The toys, procedure, and scoring for the tasks are somewhat different from the original individualized tasks developed by Morgan et al. (1992) and used Wang et al. (2013) and others. This revised method retains all of the advantages of the original individualized task method and adds the advantages described in this section.

## **Methods for Administering and Coding the Revised Mastery Tasks**

### ***Setting***

The tasks are presented in a quiet room without other toys or objects available to distract the child. Usually, these tasks have been administered in a research laboratory room, but it could be conducted in a quiet room either at home or in another setting, such as a therapy room. The main caregiver (e.g. parent, grandparent, etc.) is seated a few feet behind the child, and the examiner sits next to the child at an approximately 90° angle. When video scoring is used for research, a camera is set in front of the child and another camera is set at a 45° deviation from the horizontal line (Wang et al., 2016).

### **Warm-up**

The child is given a warm-up toy before the administration of the mastery tasks while an explanation of the procedure is being given to the main caregiver. The purpose is to give the child time to adjust to the room and to the examiner. Because children will vary in the time needed to adjust, the examiner should determine, based on clinical experience, whether the child is ready to be assessed. The warm-up toy is intended to reduce non-task behaviors, such as walking away or not touching the toy, which may be related to anxious feelings or wariness of the examiner or the testing situation.

### **Instructions to Main Caregiver**

During the presentation of the tasks, the caregiver, who faces away from the child, is asked to read magazines or work on questionnaires (such as the Dimensions of Mastery Questionnaire, DMQ). In addition, the caregiver is told that she should refrain from physically assisting the child with the task, but she can provide psychological support for her child if the child requests it.

*Table 1. Toy Sets for the Revised Individualized Moderately Challenging Mastery Tasks and the Approximate Mental and Fine Motor Age Needed to Complete the Puzzle (PZ) and Cause-Effect (CE) Tasks.*

Type of task	Toy sets of different levels of difficulty		Approximate mental and fine motor age
PZ tasks	Level 1	8-piece interchangeable circles	12-18 months
	Level 2	6 basic unconnected shapes with color cues	15-19 months
	Level 3	6 unconnected geometric shapes without color cues	20-24 months
	Level 4	6 unconnected car shapes	25-29 months
	Level 5	6-piece interlocking puzzle with cues	30-36 months
	Level 6	6-piece interlocking puzzle without cues	37-42 months
	Level 7	11-piece interlocking barn puzzle	40-45 months
	Level 8	6-piece 3D cube vehicle puzzle	46-48 months
CE tasks	Level 1	Music box with simple manipulation	12-18 months
	Level 2	Activity center with slightly harder manipulation	15-24 months
	Level 3	Pop up dinosaurs with two actions to trigger something to happen depending on initial condition	18-30 months
	Level 4	Cash register with one dual task and 6 different manipulations	24-36 months
	Level 5	Vending machine with 4 two-step sequential actions	30-42 months
	Level 6	Latches board with 6 two-step sequential and harder actions	36-48 months
	Level 7	Bead steering requiring visual-motor skill and problem solving	42-54 months

*Note. Photographs and more details about the task and their demonstration are given in Wang (2016).*

### **Test Materials**

Two types of tasks with toy sets of different levels of difficulty are used: puzzles and cause-effect tasks (Table 1). Eight puzzles and seven cause-effect toys varying in assumed difficulty level from easy for children of 15-months developmental age (DA) to difficult for children with a DA of 48-months are used.

## Testing Procedure

The assumed difficulty levels of the puzzle and cause-effect tasks were *estimated* from the average of the child's cognitive and fine motor DA based on a previous assessment with a standardized developmental test (e.g. the Bayley scales of Infant and Toddler Development-Third version or the Comprehensive Developmental Inventory for Infant and Children) (Bayley, 2006; Wang et al., 1998). Based on this assessment and Table 2, the examiner selects three specific puzzles and three cause-effect toys for each child. Tasks of three *assumed* difficulty levels are given: (a) easy, (b) moderately challenging (i.e., not too easy and not too difficult), and (c) hard. Thus, each child is given three (or sometimes four) levels of puzzle and three or four cause and effect toys for up to 3 minutes (180 seconds) during each trial, as shown on the left side of Table 2. Each level presented is called a "trial". In general, the examiner presents the assumed easy, then moderate, then hard levels as the first, second and third trials given to a child. For example, for a child with a DA of 20–24 months, puzzle levels 2, 3, and 4 usually would be presented that order.

Table 2. Assumed and Actual Difficulty Level of Easy, Moderate, and Hard Puzzle and Cause and Effect Tasks

Age group <sup>a</sup>	Assumed difficulty levels			Actual difficulty levels Mode (Range)		
	Easy	Moderate	Hard	Easy	Moderate	Hard
Puzzle tasks						
15-19 months	1	2	3 and/or 4	1 (1-2)	2 (1-3)	4 (2-5)
20-24 months	2	3	4 and/or 5	3 (1-4)	3 (2-5)	5 (4-6)
25-29 months	3	4	5 and/or 6	3.5 (1-4)	5 (4-7)	6 (5-8)
30-36 months	4	5	6 and/or 7	4 (4-6)	6 (5-7)	8 (8)
37-42 months	5	6	7 and/or 8	4.5 (4-6)	6 (5-7)	N/A
42-48 months	6	7	8	N/A	N/A	N/A
Cause and effect tasks						
15-24 months	1	3	4 and/or 5	1 (1-3)	3 (1-4)	3 (3-5)
25-36 months	2	4	5 and/or 6	3 (1-3)	4 (1-4)	5 (5)
37-42 months	3	5	6 and/or 7	3 (3)	4 (2-6)	5 (5-7)
42-48 months	4	6	7	N/A	N/A	N/A

Note. Under actual difficulty levels, the ranges of tasks found to be actually easy, moderate, and hard are reported in parentheses along with the mode/most common level of task found in 62 children with developmental delays. For example, for children of developmental age (DA) 15-19 months, puzzle task levels 1 and 2 were both found to be easy in at least 10% of the trials, and level 1 was found to be the most common easy task. N/A means that no children of that age were tested on that difficulty level. See Table 1 for identification of the levels of the specific tasks. <sup>a</sup> The age group was determined by the average of the child's cognitive and fine motor DA.

## Actual Difficulty Levels

The goal of the revised individualized moderately challenging mastery tasks is to find for each child at least one actually moderately difficult, and if possible, one actually hard level for both puzzles and cause-effect tasks. The examiner follows the procedure for presenting the assumed levels shown on the left side of Table 2. The actual difficulty of a task is based on the child's success in completing parts of that task. An *actually easy* level is one in which the child completes all predefined solutions within 90 seconds, which is the midpoint of one 3-minute trial. An *actually moderately difficult* level is one in which the child completes at least two or more predefined solutions, but not all solutions,

within 90 seconds. And an *actually hard* level is one in which the child completes less than two predefined solutions within 90 seconds (Wang et al., 2016).

### *Guidelines for Task Presentation*

In order to be sure to find at least one moderate task for puzzles and cause-effect toys, the following guidelines for task presentation are used to clarify Appendix 1 and Table 2:

- If the first trial, the assumed easy level, turns out to be actually moderate, the examiner presents the assumed moderate and hard levels as planned in Table 2. This will probably lead to one or more additional actually moderate task.
- If the first two levels presented (trial 1 and trial 2) both turn out to be actually easy, both of the presumed hard levels are presented. For example, if the child was 25-29 months DA, the assumed easy, moderate, and hard puzzle levels were 3, 4 and 5, but if level 3 and level 4 turn out to be actually easy, level 5 and level 6 puzzles would be presented.
- If after an actual easy task on trial 1, the assumed moderate level on trial 2 turns out to be actually hard, the examiner presents the previous easier or next harder level on trial 3 depending on the child's reaction to the hard task. In such rare instances, it is necessary to keep trying different levels until finding one level that turns out to be an actually moderately challenging task.
- In almost all cases, there will be one task that turns out to be actually hard. It is not necessary to find an actually easy task.
- A few children will not want to try some level of a task, usually the hard puzzle task. In these cases, the examiner shifts to the cause-effect tasks and later returns to the puzzle tasks. In rare cases, the child may be so upset (fussing or crying) that the trial needs to be stopped in order for the caregiver to calm him or her. If possible, the test would be continued later or terminated if necessary.

The actual levels of difficulty shown on the right side of Table 2 are based on one to three testing sessions of 62 children with developmental delay, ranging from 15 to 42 months in average cognitive and fine motor DA. We found that 76% and 15% of the children had an actually easy puzzle and cause-effect task, respectively. All these children had one to three actually moderate puzzles, and one to three actually moderate cause-effect tasks. About half (45%) had more than one actually moderate puzzle task, and 81% had more than one actually moderate cause-effect task. In addition, 84% had one actually hard puzzle, and 100% had one actually hard cause-effect task.

Note in Table 2, that there was a range of task levels found to be actually easy, moderate, and hard. For the 62 children with delays in the Wang et al. (2016) study, the mode of actually easy, moderately challenging, and hard levels were usually the same as the assumed level, but sometimes higher and sometimes lower.

### *Demonstrations*

A demonstration is presented before each level of task is administered. The purpose of the demonstration is to insure that the child understands what to do with each toy. Initially, the examiner uses demonstrations and verbal encouragement to elicit interest in the toy and show how to do two predefined solutions for the task. During the actual test, the examiner plays a less active role, being limited to verbally prompting and/or resetting the task as described in Appendix 1. The examiner should try not to be disruptive to the child and the flow of the trial. Wang (2016) provided photographs of the puzzle and cause-effect toys as well as listing the predefined solutions and demonstrations for the tasks.

### *Behavioral Codes to Be Recorded*

Three types of codes, assumed to be indexes of instrumental, expressive, and competence behaviors are recorded (Table 3). The examiner should be trained well to observe and record children's behaviors appropriately. If necessary, a second examiner can record the child's behaviors while the first examiner presents the tasks or the child can be video-recorded with scoring done later. However, it is always necessary for the examiner to keep track of what the child is doing in order to be able to determine the actual difficulty level, when to terminate a trial, and when the child has completed a task.

The *instrumental* codes are the most important because the main measure of mastery motivation is task-directed persistence. For *instrumental* code, it is key that the examiner focuses on making accurate judgements about whether the child's behavior during each interval, is "mostly task-directed" versus "mostly not task-directed." Task-directed behaviors are, for example, attempts by the child to put a piece in the puzzle or attempts to make the cause-effect toy work. These attempts may or may not actually produce one of the solutions. The "apparatus-related" and "non-task behaviors" help the examiner know when to give a verbal prompt and when to end a trial and go to the next one.

For *expressive* codes, the examiner observes the child's facial expressions, vocalizations, and gestures while the child is working on the task. Such expressive indicators are recorded using a "+" for task pleasure. Task pleasure is scored only if the child shows positive affect during or immediately after doing task-directed or own-task behavior. In our experience, few of the intervals had a +; the majority had neutral affect.

The *competence* code helps the examiner determine the actual difficulty of the task and when the task has been completed.

Definitions of all the behaviors related to instrumental, expressive and competence codes are shown in Table 3.

Table 3. Codes Used for Recording Behaviors during the Individualized Moderately Challenging Mastery Tasks for 15- to 48-month Old Children

Mastery behavior codes	Definition
<b>I. Instrumental codes</b>	
<b>1. Task-related behaviors</b>	
Task-directed (T)	Behavior that leads or might lead to a solution of part of the task.
Own-task (O)	Unusual, creative, task-directed uses of the toy that are not what was intended, but are clearly interpretable as task directed.
Perseverative-like (P)	Performs exactly the same sequence of behaviors that was done in the previous 15-sec. in an inflexible manner.
<b>2. Apparatus-related behaviors</b>	
Apparatus-directed (A)	Exploration, such as manipulates or handles the object, but not in a task-directed way.
Looks (L)	Looks intently at the toys/apparatus, but does not actively manipulate or touch it.
<b>3. Non-task behaviors</b>	
Experimenter-directed (E)	Tries to get attention or comfort from examiner, and does not continue to work on the task
Mother-directed (M)	Tries to get attention or comfort from mother, and does not continue to work on the task
Non-directed (N)	Does not focus on the test object task or a person
<b>II. Expressive codes</b>	
Task pleasure (+)	Positive affect during or just after task-directed behavior (T), or own-task behavior (O); i.e., during or just after a T /O interval.
Negative reaction to challenge (-)	Fussing, frowning, whining, moving away, pushing toys away or crying during or just after task-directed behavior (T), or own-task behavior (O); i.e., during or just after a T /O interval.
<b>III. Competence codes</b>	
Solution (I)	Correctly doing one pre-defined solution of the task. Only record it the first time the child does a specific pre-defined solution.
Completion (C)	Interval in which the child completes all the pre-defined solutions of the task.

### Verbal Prompts

In addition to the demonstration before each trial (i.e., level of task), there are several situations under which the examiner should give a verbal prompt to the child. These verbal prompts are shown in Appendix 1.

1. After the first 15 seconds (1<sup>st</sup> interval), there are two conditions in which a verbal prompt should be given to the child.
  - a) If the child is task directed during the interval, the examiner says “That’s good. There are some more to do.”
  - b) If the child shows non-task (E, M, and N) or apparatus-related (A, L) behavior, the examiner stops the stop watch and says “Watch carefully”. The examiner then demonstrates one predefined solution again, and says “Now, you do it”.
2. After 15 seconds and before 90 seconds (2<sup>nd</sup> – 6<sup>th</sup> interval), there are two conditions in which a verbal prompt should be given to the child.
  - a) If the child completes all predefined solutions of a given level of task, the examiner says “You completed it, let’s try another toy”.

- b) If the child does not complete all predefined solutions and shows non-task (E, M, N) or negative affect for 30 sec., the examiner stops the watch, and says "Try to do some more; keep going".
- 3. At 90 seconds (end of 6<sup>th</sup> interval), there are two conditions in which a verbal prompt should be given to the child.
  - a) If the child completes at least 2 predefined solutions, but not all by the end of 6<sup>th</sup> interval (90 sec.), the examiner says "That's fine, see if you can complete them all".
  - b) If the child completes less than 2 predefined solutions by the end of 6<sup>th</sup> interval, the examiner says "That's good. You tried to do it even though it is hard for you".

### *Termination Rules*

The termination rules for each trial also are shown in Appendix 1. The trial is terminated if:

1. the child shows non-task behavior (E, M, N) or negative affect for two consecutive 15-second intervals within the first 90 seconds, and the examiner has given the specific prompt "Try to do some more; keep going", and if the child continues to show non-task behavior or negative affect for 15 more seconds.
2. the child shows non-task behavior (E, M, N) or negative affect for two consecutive 15-second intervals after 90 seconds.
3. the child completes the task in less than 90 seconds. The task is judged to be actually easy and is terminated as soon as possible without upsetting the child.
4. the child completes two but not all predefined solutions by 90 seconds, the task is judged to be actually moderate. Then, if the child completes all the predefined solutions between 90 and 180 seconds, the examiner says, "You completed it all. Let's try another toy".

### *Time Needed to Complete the IMoT*

The testing duration for each level of trial is up to 3 minutes, and each child will be given at least three different assumed difficulty levels (easy, moderate and hard). The total duration of the IMoT requires about 20 minutes. If one has very limited time (i.e., less than 15 minutes) to assess mastery motivation, the puzzle tasks should be used because of its acceptable convergent validity with the DMQ. However, we recommend that both types of tasks should be used to understand children's mastery motivation more comprehensively.

### **Scoring the Revised Mastery Tasks**

Using Table 3, the examiner records the child's most prevalent instrumental behavior in every interval of the up to 3-minute trials for each task. For live coding, there are up to 12 15-sec. intervals, which is what we describe here and in Appendix 1. When video recording is used, there are up to 36 5-sec. intervals.

Two main types of scores for each of the three difficulty levels of the tasks are task persistence and task pleasure. In the IMoT task-directed persistence at moderate tasks (both puzzle and cause-effect toys) is calculated from the number of intervals in which the child showed mostly task-directed (T) behaviors; i.e., trying to fit a puzzle piece. For persistence at moderately challenging tasks, the child completes two but not all predefined solutions in the first 90 seconds. If the child completes all the remaining predefined solutions after 90 seconds but before 180 seconds, an adjusted persistence score at moderate tasks is calculated from the number of intervals in which the child shows mostly task-directed behavior (before completing all the predefined solutions) divided by the actual number of intervals before the child finished the task times 12 (or 36 when video-scoring is used). Table 4 shows the three difficulty levels and how to compute the persistence score for moderate and hard tasks.

Table 4. Definitions and Scoring of Task Persistence for Each Actual Difficult Level

Actual difficulty levels	Definition	Variable label	How to score
Easy	Completes all predefined solutions within 90 sec.	N/A	N/A
Moderate	Completes at least 2 predefined solutions, but not all solutions, within 90 sec.	Persistence at moderate tasks	Number of "Ts" in 180 sec.
	Completes all predefined solutions after 90 sec.	Adjusted Persistence at moderate tasks	Number of "Ts" / number of intervals before completion X 12 (or 36)
Hard	Completes less than 2 predefined solutions within 90 sec.	Persistence at hard tasks	Number of "Ts" in 180 sec. or less.

*Note. If more than one level turns out to be moderate, the appropriate persistence score will be the average of the scores for each level identified as moderate. In the unusual cases when more than one level turns out to be actually hard, the persistence score is based on the first actually hard level.*

If more than one level of puzzle or cause-effect task turns out to be actually moderate, the persistence score for that task is the average of the scores for each level identified as moderate. The total persistence score at moderate tasks is the average persistence score of the moderate puzzle and cause-effect tasks. Total persistence at moderate tasks was used as the measurable variable to represent instrumental mastery motivation in Wang (2016).

For expressive mastery motivation, the task pleasure score is based on whether or not (1 or 0) the child shows at least one interval of positive facial expressions, vocalizations or gestures during or immediately after task-directed behavior during the 3-minute (180-second) trial (see Table 5). If more than one level of puzzle or cause-effect task turns out to be actually moderate, task pleasure at moderate puzzle tasks is the average score for all the moderate puzzles; similarly task pleasure at moderate cause-effect tasks is the average of all those tasks. Total task pleasure at moderate tasks is the average score of the moderate puzzle and cause-effect tasks.



Table 5. Definition and Scoring Methods for Task Pleasure of Each of the Actual Difficult Levels Based on the Child's Behavior during the Revised Individualized Moderately Challenging Mastery Tasks

Actual difficulty levels	Definition	Variable label	How to score
Easy	Completes all predefined solutions within 90 seconds.	Task pleasure at easy tasks	Whether or not (1,0) a "+" was shown in at least one T/O interval.
Moderate	Completes at least 2 predefined solutions but not all of solutions within 90 seconds.	Task pleasure at moderate tasks	1 or 0 depending on whether or not a "+" was shown in at least one T/O interval
Hard	Completes less than 2 predefined solutions within 90 seconds	Task pleasure at hard tasks	1 or 0 depending on whether or not a + was shown in at least one T/O intervals

Note. If more than one level turns out to be easy or moderate, the task pleasure will be the average of the scores for each level identified as easy or moderate. In the unusual cases when more than one level turns out to be actually hard, task pleasure is based on the first actually hard level.

## Psychometric Information about Individualized Mastery Tasks

### Review of Research about Reliability and Validity

The original individualized mastery tasks had acceptable reliability and validity in young children with DD and for children with typical development (Gilmore et al., 2003; Hauser-Cram, 1996; Maslin-Cole et al., 1993; Morgan et al., 1992; Wang et al., 2013). The inter-rater reliabilities for task-directed persistence on puzzles, shape-sorters and cause-effect tasks in toddlers with developmental disabilities (using Cohen's kappa) were .80 to .89 (Gilmore et al., 2003; Hauser-Cram, 1996; Wang et al., 2013). Morgan et al. (1992) reported acceptable level of inter-rater reliability for task-directed persistence in toddlers with typical development,  $r = .83$  for puzzles,  $r = .81$  for cause-effect tasks, and  $r = .96$  for shape-sorters, and they reported 87% agreement for task pleasure. In the Maslin-Cole et al. (1993) study, they found interrater reliabilities of 80-100 percent agreement for persistence and pleasure during structured tasks.

Regarding validity, Gilmore and Cuskelly (2009) reported that for young children with Down syndrome, persistence on moderate tasks was positively correlated with maternal ratings of persistence ( $r = .42, p = .02$ ), and predicted later word reading competence ( $r = .48, p = .01$ ). Morgan et al. (1992) reported evidence for convergent validity from several earlier studies for task persistence in toddlers with typical development. However, for task pleasure, some previous studies found significant relationships with other theoretically related measures but other studies did not.

The reliability and validity of the IMoT in young children with DD were examined by Wang et al. (2016). Good test-retest reliability was found for persistence scores at puzzle and cause-effect tasks with moderately difficulty levels (ICC = .80 to .86;  $p < .01$ ) with no significant mean difference between the test and retest. Inter-rater reliability for the persistence scores at puzzle and cause-effect tasks was excellent (ICC = .95 to .98;  $p <$

.001), again with no mean differences between the first and second raters. Furthermore, there was good reliability for live versus video coding ( $r = .85 - .90$ ) (Wang et al., 2016).

Good convergent validity was shown by Wang et al. (2016) from significant positive correlations between the total (object) task persistence score and the DMQ object/cognitive persistence score ( $r = .34$ ;  $p < .01$ ). And, divergent validity was supported because there were no significant correlations between the task persistence scores and the other DMQ scales ( $r = -.19 - .18$ ,  $p > .05$ ).

### ***Descriptive Data for the Task Persistence and Pleasure Scores***

Table 6 shows the numbers of subjects, means, and standard deviations of the persistence scores for the actually moderate and hard difficulty levels of the IMoT.

Table 6. Task Directed Persistence Scores (Ts) at Moderate, and Hard Tasks for 62 Children with Developmental Delays

Variable	n	Number of Ts		
		Mean	SD	Range
Moderate puzzles	62	17.5	9.6	2.0 - 36.0
Moderate cause & effect	62	29.3	5.9	13.0 - 36.0
Total moderate tasks	62	23.4	6.3	11.8 - 36.0
Hard puzzles	52	11.2	9.9	0.0 - 36.0
Hard cause & effect	62	25.9	9.5	1.0 - 36.0
Total hard tasks	52	18.5	7.7	4.5 - 36.0

Note. These measures are from video recordings, so there were 36 5-second intervals. Ten children did not have a hard puzzle task.

Note that these children with DD showed mostly task-directed behavior about half the time on the moderately challenging puzzles and more than 80% of the time on the moderate cause-effect tasks. On the hard puzzle tasks, children persisted about 31% of the time, and persisted 71% of the time on hard cause-effect tasks. Thus, in general, these children with delays showed quite a bit of task-directed persistence at both types of task but somewhat more at moderate tasks than hard tasks and a lot more at cause-effect tasks than puzzles.

Barrett et al. (1993) found that 25-30 month-old children developing typically persisted approximately half the time at moderately difficult puzzle tasks and about 1/3 of the time when given hard puzzle tasks. These findings are quite similar to those reported above and in Table 6 for children with delays. It is important to note that the tasks were “moderate” and “hard” for each individual child, not for a child of a given chronological age.

With regard to task pleasure, it was relatively infrequent for puzzles; only 58% of the children with DD showed any task pleasure on the moderate puzzle tasks. For cause-effect tasks, 91% of the children showed some overt pleasure while working on or just after solving some part of the task. Thus, there was much more task pleasure shown during the cause and effect tasks than during the puzzles. For both types of task, there was the least task pleasure during the hard tasks.

These findings are consistent with earlier research about task pleasure for typically developing children (e.g., Barrett et al., 1993; Maslin-Cole et al., 1993; Morgan et al., 1992; Wang et al., 2013). In the Barrett et al. (1993) study, the amount of task pleasure for puzzles was similar for easy and moderately challenging tasks, but for cause and effect tasks there was more pleasure shown for moderate than easy tasks. There was less task pleasure for both types of hard task than for the easy or moderate tasks.

### ***Implications in the early childhood intervention/education***

The revised individualized moderately challenging mastery tasks could be used to find effective techniques to enhance the mastery motivation of children in order to facilitate their future competence and participation. The results of this test could be also used by clinicians and caregivers for differentiating between developmental ability and mastery motivation in young children with DD. Similar to the standard testing procedure of the individualized mastery task methods, teachers and clinicians could coach caregivers about how to find moderately challenging and preferred tasks for their child. Several methods could be used to help caregivers choose moderately challenging tasks or adjust task difficulty for each child. For example, caregivers could observe the child's success rate or engagement during activities. If the child's success rate is too low, such as less than 10%, then the task is probably too hard. In contrast, a success rate more than 90% may indicate that the task is too easy. A short engagement duration and negative reaction with others or with task materials indicates that adults should change the activity content, such as difficulty or complexity level of the task, or the adult needs to provide visual, oral, or physical prompts. Teachers and clinicians can adjust task difficulty through task-specific analysis and modification (McCoy & Dusing, 2012), such as modifying the amount and type of feedback, modifying practice conditions, or context (Guadagnoli & Lee, 2004). In addition, teachers and clinicians could use developmental ages based on developmental tests or knowledge of developmental sequences to estimate abilities in various developmental domains of each child, which could help them to select tasks of appropriate difficulty for each child. Then, task selection principles based on individualized mastery task methods could be used to identify moderately difficult tasks for each child.

The following strategies could also be used to enhance children's mastery motivation. First, teachers, clinicians and caregivers could use the "one-step ahead" approach, which provides only appropriate and necessary assistance to help the child attain the next level of performance (Mermelshtine, 2017). Second, teachers, clinicians, and caregivers can encourage autonomy by temporarily delaying their responses to their child, who is having trouble completing a task, in order to provide the child an opportunity to try and find solutions independently; they should also provide positive feedback when their child is in the process of trying to solve a problem, not just when he or she succeeds (Waldman-Levi & Erez, 2014). Third, teachers, clinicians, and caregivers can use motivational procedures based on the Pivotal Response Treatment approach (Koegel & Koegel, 2006; 2012). These procedures include: (a) following their children's choice of

stimulus materials in order to elicit children's interest in playing an activity; (b) interspersing the task to be learned with previously mastered tasks; (c) using natural reinforcers that are directly related to the learning task, such as an opportunity to interact or play with that activity; and (d) providing reinforcements to their children who shows goal-directed attempts.

## Conclusion

The revised individualized moderately challenging mastery tasks can be a useful tool for assessing mastery motivation of children with and without developmental delay. It provides good evidence for reliability and for acceptable convergent and divergent validity with maternal ratings of the child's mastery motivation in daily life on the DMQ 18 (Morgan et al., 2017; Morgan et al., 2015). Regarding clinical implications, the IMoT methods may be helpful to facilitate the separation of developmental ability from motivation for each child. Clinicians should use both the IMoT and the DMQ 18 to understand comprehensively children's mastery motivation, so that they can provide appropriate assistance to help children reach their maximum developmental potential in order to optimize their participation in daily life.

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## References

- Barrett, K. C., Morgan, G. A., & Maslin-Cole, C. (1993). Three studies on the development of mastery motivation in infancy and toddlerhood. In D. Messer (Ed.), *Mastery motivation in early childhood: Development, measurement and social processes* (pp. 84–108). London, United Kingdom: Routledge.
- Bayley, N. (2006). *Bayley scales of infant development* (3rd ed.). San Antonio, TX: The Psychological Corporation.
- Blair, C., Greenberg, M., & Crnic, K. (2001). Age-related increases in motivation among children with mental retardation and MA- and CA-matched controls. *American Journal of Mental Retardation*, 106(6), 511–524. [https://doi.org/10.1352/0895-8017\(2001\)106<0511:ARIIMA>2.0.CO;2](https://doi.org/10.1352/0895-8017(2001)106<0511:ARIIMA>2.0.CO;2)
- Busch-Rossnagel, N. A., & Morgan, G. A. (2013). Introduction to the mastery motivation and self-regulation section. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook on self-regulatory processes in development: New directions and international perspectives* (pp. 247–264). New York: Routledge/Taylor & Francis.

- Gilmore, L., & Cuskelly, M. (2009). A longitudinal study of motivation and competence in children with Down syndrome: Early childhood to early adolescence. *Journal of Intellectual Disability Research*, 53(5), 484–492. <https://doi.org/10.1111/j.1365-2788.2009.01166.x>
- Gilmore, L., & Cuskelly, M. (2011). Observational assessment and maternal reports of motivation in children and adolescents with Down syndrome. *American Journal on Intellectual and Developmental Disabilities*, 116(2), 153–164. <https://doi.org/10.1352/1944-7558-116.2.153>
- Gilmore, L., Cuskelly, M., & Hayes, A. (2003). A comparative study of mastery motivation in young children with Down's syndrome: Similar outcomes, different processes? *Journal of Intellectual Disability Research*, 47(3), 181–190. <https://doi.org/10.1046/j.1365-2788.2003.00460.x>
- Guadagnoli, T.D., & Lee, T. D. (2004). Challenge point: A framework for conceptualizing the effect of various practice conditions in motor learning. *Journal of Motor Behavior*, 36(2), 212–224. <https://doi.org/10.3200/JMBR.36.2.212-224>
- Hauser-Cram, P. (1996). Mastery motivation in toddlers with developmental disabilities. *Child Development*, 67(1), 236–248. <https://doi.org/10.2307/1131698>
- Hauser-Cram, P., Warfield, M. E., Shonkoff, J. P., Krauss, M. W., Sayer, A., & Upshur, C. C. (2001). Children with disabilities: A longitudinal study of child development and parent well-being. *Monographs of the Society for Research in Child Development*, 66(3), i-viii, 1-114; discussion 115–126.
- Hauser-Cram, P., Woodman, A. C., & Heyman, M. (2014). Early mastery motivation as a predictor of executive function in young adults with developmental disabilities. *American Journal on Intellectual and Developmental Disabilities*, 119(6), 536–551. <https://doi.org/10.1352/1944-7588-119.6.536>
- Jennings, K. D., Connors, R. E., & Stegman, C. E. (1988). Does a physical handicap alter the development of mastery motivation during the preschool years? *Journal of the American Academy of Child and Adolescent Psychiatry*, 27(3), 312–317. <https://doi.org/10.1097/00004583-198805000-00008>
- Józsa, K., & Molnár, É. D. (2013). The relationship between mastery motivation, self-regulated learning and school success: A Hungarian and European perspective. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook on self-regulatory processes in development: New directions and international perspectives* (pp. 265–304). New York, NY: Psychology Press. <https://doi.org/10.4324/9780203080719.ch13>
- Keilty, B., Blasco, P. M., & Acar, S. (2015). Re-conceptualizing developmental areas of assessment for screening, eligibility determination and program planning in early intervention. *Journal of Intellectual Disability - Diagnosis and Treatment*, 3(4), 218–229.
- Kelley, S. A., Brownell, C. A., & Campbell, S. B. (2000). Mastery motivation and self-evaluative affect in toddlers: longitudinal relations with maternal behavior. *Child Development*, 71(4), 1061–1071. <https://doi.org/10.1111/1467-8624.00209>
- Koegel, R. L., & Koegel, L. K. (2006). *Pivotal response treatments for autism*. Baltimore, MD: Paul H Brookes Publishing.
- Koegel, R. L., & Koegel, L. K. (2012). *The PRT pocket guide: Pivotal response treatment for autism spectrum disorders*. Baltimore, MD: Paul H Brookes Publishing.
- MacTurk, R. H., Morgan, G. A., & Jennings, K. D. (1995). The assessment of mastery motivation. In R. J. MacTurk, & G. A. Morgan (Eds.). *Mastery motivation: Origins, conceptualizations and applications* (pp. 19–56). Norwood, NJ: Ablex.
- Maslin-Cole, C. A., Bretherton, I., & Morgan, G. (1993). Toddler mastery motivation and competence: Links with attachment security, maternal scaffolding and family climate. In D. Messer (Ed.). *Mastery motivation in early childhood: Development, measurement and social processes* (pp. 205–229). London: Routledge.
- Medeiros, K. F., Cress, C. J., & Lambert, M. C. (2016). Mastery motivation in children with complex communication needs: Longitudinal data analysis. *Augmentative and Alternative Communication*, 32(3), 208–218. <https://doi.org/10.1080/07434618.2016.1179789>
- Mermelshtine, R. (2017). Parent-child learning interactions: A review of the literature on scaffolding. *Journal of Educational Psychology*, 87(2), 241–254. <https://doi.org/10.1111/bjep.12147>

- Mohammadzaheri, F., Koegel, L. K., Rezaee, M., & Rafiee, S. M. (2014). A randomized clinical trial comparison between pivotal response treatment (PRT) and structured applied behavior analysis (ABA) intervention for children with autism. *Journal of Autism and Developmental Disorders*, 44(11), 2769–2777. <https://doi.org/10.1007/s10803-014-2137-3>
- McCoy, S. W., & Dusing, S. C. (2012). Motor control: Developmental aspects of motor control in skill acquisition. In S. Campbell, R. J. Palisano, & M. N. Orlin (Eds.), *Physical therapy for children* (pp. 87–151). Philadelphia, W.B: Saunders Company.
- Morgan, G. A., Busch-Rossnagel, N. A., Maslin-Cole, C. A., & Harmon, R. J. (1992). *Mastery motivation tasks: Manual for 15- to 36-month-old children*. Bronx: Fordham University Psychology Department. (Updated 1993).
- Morgan, G. A., Harmon, R. J., & Maslin-Cole, C. A. (1990). Mastery motivation: Definition and measurement *Early Education and Development*, 1(5), 318–342. [https://doi.org/10.1207/s15566935eed0105\\_1](https://doi.org/10.1207/s15566935eed0105_1)
- Morgan, G. A., Liao, H.-F., Nyitrai, Á., Huang, S.-Y., Wang, P.-J., Blasco, P., Ramakrishnan, J., & Józsa, K. (2017). The revised Dimensions of Mastery Questionnaire (DMQ 18) for infants and preschool children with and without risks or delays in Hungary, Taiwan, and the US. *Hungarian Educational Research Journal*, 7(2), 48–67.
- Morgan, G. A., Wang, J., Barrett, K. C., Liao, H.-F., Wang, P.-J., Huang, S.-Y., & Józsa, K. (2015). *The Revised Dimensions of Mastery Questionnaire (DMQ 18)*. <https://sites.google.com/a/rams.colostate.edu/georgemorgan/mastery-motivation>
- Redding, R. E., Morgan, G. A., & Harmon, R. J. (1988). Mastery motivation in infants and toddlers- is it greatest when tasks are moderately challenging. *Infant Behavior and Development*, 11(4), 419–430. [https://doi.org/10.1016/0163-6383\(88\)90003-3](https://doi.org/10.1016/0163-6383(88)90003-3)
- Smidt, M. L., & Cress, C. J. (2004). Mastery behaviours during social and object play in toddlers with physical impairments. *Education and Training in Developmental Disabilities*, 39(2), 141–152.
- Waldman-Levi, A., & Erez, A. (2014). Will environmental interventions affect the level of mastery motivation among children with disabilities? A preliminary study. *Occupational Therapy International*, 22(1), 19–27. <https://doi.org/10.1002/oti.1380>
- Wang, P.-J. (2016). *Bidirectional Relations among Maternal Interactive Behavior, Mastery Motivation and Developmental Ability in Children With Global Developmental Delay* (Doctoral dissertation). School and Graduate Institute of Physical Therapy, National Taiwan University.
- Wang, P.-J., Morgan, G. A., Hwang, A.-W., & Liao, H.-F. (2013). Individualized behavioral assessments and maternal ratings of mastery motivation in mental age-matched toddlers with and without motor delay. *Physical Therapy*, 93(1), 79–87. <https://doi.org/10.2522/ptj.20120068>
- Wang, P.-J., Morgan, G. A., Liao, H.-F., Chen, L.-C., Hwang, A.-W., & Lu, L. (2016). Reliability and validity of the Revised Individualized Structured Mastery Tasks in children with developmental delay. *International Journal of Physical Medicine & Rehabilitation*, 4(6), 374. <https://doi.org/10.4172/2329-9096.1000374>
- Wang, T.-M., Su, C. W., Liao, H.-F., Lin, L. Y., Chou, K. S., & Lin, S. H. (1998). The standardization of the Comprehensive Developmental Inventory for Infants and Toddlers [in Chinese], *Psychological Testing*, 45, 19–46.
- Yarrow, L. J., Klein, R. P., Lomonaco, S., & Morgan, G. A. (1975). Cognitive and motivational development in early childhood. In B. Z. Friedlander, G. M. Sterritt, & G. Kirk (Eds.), *The exceptional infant: Assessment and intervention* (pp. 491–502). New York: Bruner/Mazel.
- Yarrow, L. J., Morgan, G. A., Jennings, K. D., Harmon, R. J., & Gaiter, J. L. (1982). Infants' persistence at tasks: Relationships to cognitive functioning and early experience. *Infant Behavior and Development*, 5(2-4), 131–141. [https://doi.org/10.1016/S0163-6383\(82\)80023-4](https://doi.org/10.1016/S0163-6383(82)80023-4)
- Yarrow, L. J., McQuiston, S., MacTurk, R. H., McCarthy, M. E., Klein, R. P., & Vietze, P. M. (1983). Assessment of mastery motivation during the first year of life: Contemporaneous and cross-age relationships. *Developmental Psychology*, 19(2), 265–274. <https://doi.org/10.1037/0012-1649.19.2.159>

Appendix1. Procedure for the Revised Individualized Moderately Challenging Mastery Tasks (Puzzle and Cause-Effect Tasks)

Time	Procedure	Verbal instruction
Before demonstration	Before demonstrating two predefined solutions, say "..." and show the child the toy in the " <b>completed position</b> " for 6 sec.	" <b>This is the toy you are going to play with.</b> "
Demonstration	Present the toy in the " <b>starting position</b> ", and assure that child pays attention. <b>Demonstrate two solutions</b> and say "..."	" <b>Watch how I play.</b> "
0 sec.	Reset the toy in the <b>starting position</b> without the child seeing it. Start the watch after saying "...". Record the child's predominant behavior during each 15-second interval	" <b>Now, you try to do it.</b> "
End of 15.0 sec (end of 1 <sup>st</sup> interval)	If the child shows task-directed (T) or own-task (O) behaviors in the first interval, do not stop watch, but say "..." If the child's behavior shows non-task (E, M, N) or apparatus (A, L) behavior in the first 15-sec. interval, stop the watch and, before this second demonstration, say "...". After this second demonstration, reset the toy to the starting position and say "...". Then restart the watch.	" <b>That's good. There are some more to do.</b> "  " <b>Watch carefully</b> "  " <b>Now, you do it</b> "
15.1 - 90 sec. (2 <sup>nd</sup> - 6 <sup>th</sup> interval) for <b>actually easy task</b>	If the child completes all predefined solutions of the presented toy before the end of 6 <sup>th</sup> interval, that trial is <b>actually easy</b> . Then, the examiner says "... " and moves on to the next harder level as soon as is reasonable.	" <b>You completed it, let's try another toy</b> "
15.1 - 90 sec. (2 <sup>nd</sup> - 6 <sup>th</sup> interval) for task that <b>are not actually easy</b>	If the child shows task-related behavior (T, O, P) or apparatus-related behaviors (A, L), keep recording. If the child shows non-task (E, M, N) or negative affect for 30 sec., stop the watch and say "..." If the child continues to show non-task behaviors, stop the trial and move to the next planned level/trial.	" <b>Try to do some more; keep going</b> "
At 90 sec. (6 <sup>th</sup> interval)	If the child has completed at least two predefined, but not all by the end of the 6 <sup>th</sup> interval, that level is judged to be <b>actually moderate</b> . Do not stop watch but say "...". If the child has completed less than 2 predefined solutions by the end of 6 <sup>th</sup> interval, that task is <b>actually hard</b> . Stop the watch and say "..."	" <b>That's fine, see if you can complete them all.</b> "  " <b>That's good. You tried to do it even though it is hard for you.</b> "
90.1 -180 sec. (7 <sup>th</sup> -12 <sup>th</sup> interval) for both <b>actually moderate and hard tasks</b>	If the child continues to show task-related behavior (T, O, P) or apparatus-related behaviors (A, L), keep recording until the end of 12 <sup>th</sup> interval. However, if the child shows non-task behaviors (E, M, or N) or negative affect for 30 sec., stop and say "..."	" <b>That's fine. Let's try another toy.</b> "
90.1-180 sec. for <b>actually moderate tasks</b>	If the child now completes all predefined solutions, stop the watch and say "..."	" <b>You completed it all. Let's try another toy.</b> "

Note. Each trial level lasts up to 3 minutes with 12 15-sec. intervals for with the live-coding. These procedures are very similar to these used by Wang et al. (2016), but have been simplified in little for clarify.





## New Computer-Based Mastery Motivation and Executive Function Tasks for School Readiness and School Success in 3 to 8 Year-Old Children

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### Abstract

The purpose of this paper is to give an overview of a new, computer-based assessment of school readiness skills, including mastery motivation (MM: persistent attempts to complete/solve a task that is at least moderately challenging) and executive functions (EF: planful self-control). School readiness predicts both school and life success, so measuring it effectively is extremely important. Current school readiness tests focus on pre-academic skills; however, MM and EF are also crucial. We have developed a game-like, computer-based assessment for 3 to 8 year-old children, of MM, EF, and recognition of numbers and letters. The new measures are appropriate for both Hungarian and American cultures. They were engaging for children of this age, and preliminary evidence suggests that they are reliable and valid. The new tasks can be part of assessments of school readiness, and would be useful for school practice as well as research. They enable one to ascertain the role of MM and/or EF difficulties in observed pre-academic skills. The results will contribute to the development of individualized intervention to promote school success.

**Keywords:** mastery motivation, learning motivation, executive function, school readiness, mastery learning, approaches to learning, computer-based assessment

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## **Introduction**

Recent research has documented the importance of school readiness in young children. Children who start school lacking basic skills often continue to show lower achievement throughout schooling (Burchinal, Magnuson, Powell, & Hong, 2015; Józsa, 2016; Eisenberg, Spinrad, & Eggum, 2010; Snow, 2006). Most current assessments of school readiness focus on early measures of pre-academic skills, such as emerging literacy and numeracy. Although these skills are useful in predicting school success, research suggests that approaches to learning, such as executive functions (EF) and mastery motivation (MM), may be even more important (Berhenke, Miller, Brown, Seifer, & Dickstein, 2011). Approaches to learning, an over-arching term for attributes that help children learn, such as enthusiasm, focus, persistence, flexibility, and mastery motivation, form a key dimension of school readiness according to the National Education Goals Panel (Kagan, Moore, & Bredekamp, 1995). In this article, we provide information about a new, computer based assessment of school readiness and early school skills: game-like tasks to assess mastery motivation and executive functions in children aged 3-8. For more information about psychometrics, see Józsa, Barrett, Józsa, Kis, and Morgan (2017).

## ***Mastery Motivation***

A rather unique contribution of the school readiness assessment we will discuss here is its incorporation of measures of *mastery motivation* (MM). In their classic and influential report, Shonkoff and Philips (2000) highlighted MM as a key factor in early development. Morgan, Harmon, and Maslin-Cole (1990) defined it as a multifaceted psychological force that stimulates an individual to attempt to master a skill or task that is at least moderately challenging for him or her. A key feature distinguishing this approach to motivation from others is its focus on persistence on tasks *that are at least moderately challenging for a particular individual*. Ability to persist in the face of challenge is crucial for school readiness and, even more, for school success.

In spite of the crucial importance of MM, until recently, there have been surprisingly few empirical studies on this approach to motivation. Those that have been done confirm its utility (Busch-Rossnagel & Morgan, 2013; Józsa & Molnár, 2013; Józsa & Morgan, 2014; Józsa, Wang, Barrett, & Morgan, 2014; Morgan, Józsa, & Liao, 2017). MM has an important impact on cognitive development, as well as other domains of development (Busch-Rossnagel & Morgan, 2013; Wang & Barrett, 2013).

Unfortunately, existing behavioral measurements of MM for young children are time-consuming and require training to administer. As a result, they are impractical for teachers in authentic school settings to administer. Although adult-report questionnaires have been developed that are less challenging to administer, they involve perceptions rather than behaviors, relying on adults' memory and interpretation of relevant events. Perhaps as a result, they often seem to confound motivation and

competence (e.g., Józsa & Molnár, 2013; Józsa & Morgan, 2014; Józsa et al. 2014, Morgan, Wang, Liao, & Xu, 2013).

Morgan, Busch-Rossnagel, Maslin-Cole, and Harmon (1992) developed a procedure intended to help separate motivation from the child's ability, selecting a particular task that was moderately challenging *for each individual child*, based on objective measures of children's degree of success on several, increasingly difficult tasks. They operationalized mastery motivation as children's persistence and pleasure at those moderately difficult tasks. This individualized approach has proved very useful and has been used by a number of researchers measuring mastery motivation in both typically and atypically developing young children (e.g., Gilmore & Cuskelly, 2011; Young & Hauser-Cram, 2006; Wang, Morgan, Hwang, & Liao, 2013; Wang et al., 2016). This same approach was taken in developing the new computer based assessment described in this paper. In the current version, the same tasks are given to all children of a particular age, but the tasks used to measure motivation are individualized, based on that child's performance (see Józsa et al., 2017). Eventually, the computer will be programmed to actually give children different tasks based on that child's individual performance on the initial level of the task.

### ***Executive Functions***

In the past two decades, executive functions have become a major focus of research in psychology, neuroscience, and education because these skills provide an important foundation for learning in education settings (Zelazo, Blair, & Willoughby, 2016). EF refer to cognitive processes that are required for the conscious, top-down control of action, thought, and emotions, and that are associated with neural systems involving the prefrontal cortex (Diamond, 2013; Müller & Kerns, 2015; Zelazo & Müller, 2010). There is general agreement that there are three core EF components (Blair & Diamond, 2008; Tsermentseli & Poland, 2016): inhibitory control, working memory, and cognitive flexibility. EF are essential for mental and physical health; success in school and in life; and also for cognitive, social, and psychological development (Diamond, 2013; Zelazo et al., 2016). EF are central to school readiness and early school achievement (Blair & Raver, 2015). Research has found that EF measured in childhood predict a wide range of important outcomes, including readiness for school (McClelland et al., 2007) and the successful transition to kindergarten (Blair & Razza, 2007); school performance and social competence (Mischel, Shoda, & Rodriguez, 1989). In fact, EF predicted outcomes better than IQ (Zelazo et al., 2016).

Traditionally the role of emotion and motivation in EF has largely been neglected (Peterson & Welsh, 2014). The movement away from a purely cognitive conceptualization of EF can be largely credited to the work of Zelazo, and Müller (2002) in which they proposed that EF varies according to the motivational significance of a situation. They outlined a distinction between cool and hot EF. This broader conceptualization of EF has important implications for research into child development

because EF have been found to be a strong predictor of school readiness, academic achievement and social behavior (Brock, Rimm-Kaufman, Nathanson, & Grimm, 2009; Zelazo et al., 2016). However, existing measures of EF do not take into account the role of MM in EF performance.

### ***School Readiness***

A large number of studies have highlighted the importance of the preschool-to-school transition (e.g., Burchinal et al., 2015; Eisenberg et al., 2010; Snow, 2006), and schools are increasingly being required to demonstrate their success in helping children make this transition. Researchers have paid increasing attention to identifying the conditions of a successful start in school. Creating instruments for assessing school readiness and monitoring development at the beginning of schooling is important to such initiatives. Although the majority of studies on school readiness assessment have focused on the cognitive domain, recent research identified several other factors, including motivation, executive function, and emotion regulation, which play a crucial role in the preschool to kindergarten transition (e.g., Berhenke et al., 2011; Blasco, Saxton, & Gerrie, 2014; McWayne, Cheung, Wright, & Hahs-Vaughn, 2012).

### **Research Goal**

It is clear that MM and EF are important for school success. In fact, there is evidence that MM and EF are even better predictors of later school performance than IQ (Diamond, 2016; Józsa & Molnár, 2013). Despite their importance, there are no standardized behavioral tests of the MM of children during this critical transition from pre-school to elementary school, and few computer- or tablet-based assessments of EF. Moreover, existing computer-based assessments of EF are either very long and, thus, impractical to add to other assessments, are highly influenced by less relevant skills, such as reaction time, or need to be administered individually by trained examiners.

We have developed an internet-based tablet assessment for 3 to 8 year-old children. Characteristics assessed include (a) mastery motivation (i.e., persistence in searching for letters, numbers, and pictures in an increasingly challenging array); (b) executive functions (working memory, measured by ability to remember locations of pictures; inhibitory control and mental set shifting, measured by increasingly challenging card sorting tasks), and (c) recognition of numbers and letters.

The goal of this paper is to give an overview of the new, computer-based tasks. To help the reader, the paper provides selected examples of the 103 screenshots and accompanying instructions that the computer narrator, Little Bear, gives children, so the reader can better understand the tasks from children's perspective. The paper also includes tables showing the levels of each task, including the levels for which screen shots are not included here.

## Overview and Examples of the New Computer Based Tasks

We developed seven computer-tablet, game-like tasks for this school readiness assessment. The first two tasks involve recognition of numbers and letters; they are brief assessments of pre-academic abilities. They provide some information about the child's pre-reading and mathematics readiness skills. These two brief pre-academic competency tasks may also help us distinguish the child's pre-academic knowledge from their motivation and executive functions.

Tasks 3-5 are designed to measure an important aspect of the child's MM: persistence while trying to solve a challenging problem. These letter and number search tasks vary in difficulty so that children are given tasks that are easy, moderate, and hard for most children their age. Our search tasks assess the child's persistent focus on the task in order to find all matches. By relating persistence on the MM tasks to the child's competence on the EF tasks, we can see the extent to which both types of tasks share the ability to self-regulate and inhibit potential distractions.

Tasks 6 and 7 are designed to assess aspects of EF. Our *Picture Memory* task, which assesses working memory, requires the child to remember the location of specific pictures in an array of face down picture "cards", in order to match pairs of pictures. Persistence on this task also provides another measure of MM. Our *Size-Shape-Color Game*, which is a modified version of the *Dimensional Change Card Sort* task (Zelazo, 2006) requires the child to not only remember (or, at later levels, figure out) the sorting rules but to respond to multiple rule changes on multiple sorting dimensions, and to inhibit responses consistent with previous rules. Our version has been modified to increase difficulty level at the higher levels, so that difficulty will not be defined by reaction time, as it is on other versions of the DCCS that are designed to be used across a wide age span.

Each of the seven tasks varies in difficulty from easy for 3-year-olds to difficult for 8-year-olds. We break the presentation of the seven tasks into two sessions of approximately 15-20 minutes each. Sessions may be held the same day at different times or on different days, depending on what is more convenient for the children and site involved. The first session includes the pre-academic competencies (number and letter recognition tasks, which are counter-balanced in presentation order) and also the mastery motivation (letter and number search tasks, which are again counterbalanced). Session 2 includes the picture memory and card sort tasks (again counterbalanced), both of which assess executive functions.

Tasks 3-7 could all be considered measures of "Approaches to Learning (ATL)" - non-academic attributes such as engagement, focus, and motivation that are important foundations for success in the classroom setting. One of the strengths of the present assessment is its ability to simultaneously collect data on MM, EF, and competence on the same tasks as well as on others, enabling partialling of each from the other. Tasks 3-

5 assess not only MM but some aspects of EF, especially inhibitory control, in that children with lower inhibitory control would be expected to make more mistakes of commission (touching incorrect items). And, tasks 6 and 7 could be viewed as assessing MM because persistent and focused attention is key to doing these tasks successfully.

A summary of the seven tasks and appropriate time needed for each is presented in Table 1. Note that we counterbalance the order of administration of tasks in each session as indicated below.

Table 1. Overview of the Seven Tasks

Sequence number	Task	Duration
<i>First Session: Pre-Academic Skills and Mastery Motivation</i>		
1 or 2	Number recognition	up to 1 ½ minutes
2 or 1	Alphabet recognition	up to 1 ½ minutes
3 or 4	Number search	up to about 8 minutes
4 or 3	Letter search part 1	2-8 minutes depending on the child's age
5	Letter search part 2	2-6 minutes depending on the child's age
<i>Second Session: Executive Functions Tasks</i>		
6 or 7	Picture memory	up to about 8 minutes
7 or 6	Dimensional change card sort	up to about 10 minutes

The assessment does not require children to read, but the computer narrator, Little Bear, speaks in either English or Hungarian based the examiner's selection. The tasks were developed to be appropriate for both Hungarian and American cultures, and involve pictures of everyday objects and school-related symbols, including letters, numbers, animals, vehicles (boats, cars, and airplanes), and fruits. Children of both languages were readily able to do the easy level of all of the tasks. Currently, we are working on the Hebrew version.

Preliminary data have been collected in Hungary and the U.S. (Barrett & Józsa, 2016; Józsa, Barrett, & Morgan, 2016; Józsa, Barrett, Stevenson, & Morgan, 2016). Significant correlations were found among the measures of persistence: letter search, number search, and picture memory. To assess concurrent validity, teachers rated children's persistence and mastery pleasure on the Dimension of Mastery Questionnaire (DMQ, Morgan, Busch-Rossnagel, Barrett, & Wang, 2009). Teacher-rated persistence using the DMQ was significantly correlated with persistence on the letter and number search tasks. Teacher-rated mastery pleasure on the DMQ was also significantly correlated with experimenter-rated mastery pleasure. The tasks have good reliabilities and concurrent validity (Józsa, Barrett, & Morgan, 2017; see Józsa et al., 2017 for more details).

### Session One

The session begins when the test administrator (or teacher) introduces her/himself to the children and explains that they are going to play some games on a computer/tablet. The test administrator fills in the login screen with the experimenter's user name and password, Child's ID number, and birth year and month. Note, what the computer says is in quotations and italicized.

Figure 1 appears, and touching the bear starts the narration. Little Bear moves its mouth as a pre-recorded voice says, "Hello! My name is Little Bear. I am going to play with you today."

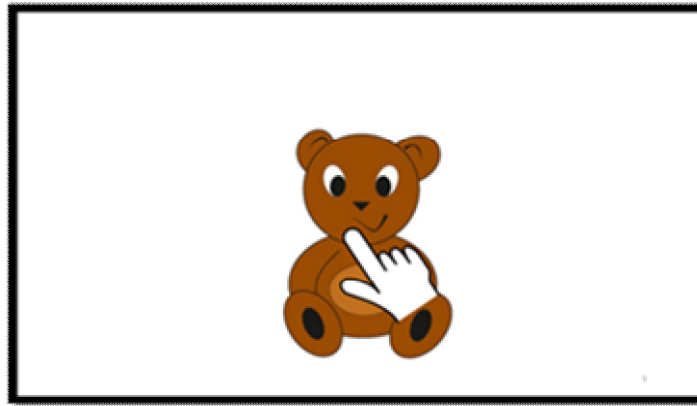


Figure 1. Touching Little Bear starts the narration

### **Pre-Academic Abilities**

#### *Training*

Before each task there are training slides; in this case with pictures of five animals (fish, bird, bunny, cat, and mouse) to help the child understand the type of task and provide help if the child does not initially know what to do.

Task 1 or 2. Number Recognition (tasks 1 and 2 are counterbalanced). The task is to see how many numbers the child can correctly identify. After training, "Little Bear" says: "Now we will play a number game. First, I will say a number. Then, you will touch that number on the screen. For example, if I say '2', you will find and touch '2' on the screen. Only touch one number. When you touch it, a new screen will appear and I will tell you a new number."

Little Bear then says a number and the child's task is to select it on the screen from an array of numbers and touch it. After the child touches a number, the array disappears, that trial ends, and a new array appears. To assess the child's number recognition, the numbers get progressively more difficult with each trial. The results of our pilot testing indicate that up to 15 trials and 90 seconds is enough to obtain a good measure of 3–8 year-old children's level of number recognition. When the child has missed two Number Recognition trials in a row, the task is stopped and the computer goes to the next task. Table 2 shows the 15 levels of the Number Recognition task.

Table 2. Difficulty Levels of the Number Recognition Task

Trial	Target number	Total cards	Array of number
1	1	5	5 3 1 2 4
2	3	5	4 5 2 3 1
3	5	5	1 2 4 5 3
4	7	5	1 7 2 3 5
5	0	5	5 6 8 0 3
6	10	7	0 1 3 5 10 11 9
7	11	7	9 11 8 10 7 1 3
8	25	7	22 15 12 2 25 55 7
9	41	7	42 14 41 44 1 21 4
10	63	7	66 68 36 63 3 9 99
11	109	7	901 190 106 991 109 903 119
12	326	7	346 726 234 246 274 326 646
13	746	7	744 746 724 247 274 472 646
14	6983	7	6839 6389 3689 9983 6983 6938 8693
15	9639	7	9369 3699 9936 9963 6939 9639 6993

*Task 2 or 1. Letter Recognition*

This task assesses how many letters the child can correctly identify. Before Trial 1, "Little Bear" says: "Now we are going to play a game with letters. For this game, I will tell you the name of a letter. On the screen, touch the letter that you hear. For example, if I say 'A', find and touch 'A'. Only touch one letter. When you touch it, a new screen will appear and I will tell you a new letter to find."

Little Bear then says a letter and the child finds it in an array of letters and touches it. As with number recognition, after the child touches one letter, all the letters in the array disappear. Then the computer says a new letter. As with numbers, the letter recognition tasks get progressively more difficult as trials progress. Pilot work indicates that at most 15 trials and 90 seconds is enough to obtain a good measure of the child's knowledge of letters. Table 3 presents these levels. The task ends when the child misses two consecutive letters.

Table 3. Difficulty Levels of the Letter Recognition Task

Trial	Target letter	Total cards	Array of letters
1	A	5	B C A D E
2	B	5	D B A E C
3	C	5	A E B C D
4	Z	5	H S T B Z
5	S	5	Z S B A R
6	G	5	Q C B A G
7	a	5	b c a d e
8	b	5	d b o p h
9	c	5	a e b c d
10	z	5	q v y n z
11	s	5	z s a b c
12	D	7	A b E D S t Z
13	j	7	a j D g C Z S
14	e	7	x E h F L l y
15	H	7	k U a h Q G r

### ***Mastery Motivation (MM) Search Tasks***

The letter and number search tasks are primarily used to obtain measures of focused persistence on moderately challenging tasks (MM), and they also yield measures of accuracy on the tasks. As Table 4 shows, each child is given one easy, two moderately difficult, and one hard level of each task based on their age, for up to two minutes each. Based on the findings of our initial studies using the assessment, we will modify the computer program so it bases the level each child receives on that child's performance on the first tasks. Note that the figures and narratives presented here show only some levels of each task. The letter search task is divided into two parts; the more difficult levels (6–8) have a different rule and directions.

Table 4. Levels of the Search Tasks Used at Different Ages

Age	Easy	Moderately challenging 1	Moderately challenging 2	Hard
Less than 4	1	2	3	5
4-5	1	3	4	6
5-6	2	4	5	7
6-7	3	5	6	8
7 or more	4	6	7	8

### ***Training***

The screen shows a target object in the upper left. The middle of the screen displays a 2x4 matrix of 8 pictures, two each of identical pictures of four familiar objects: boat, house, banana, and car. Little Bear says: “Now we are going to play a different game. Over here is a boat (it flashes). Over here there are eight pictures (they flash). Touch all the pictures of the boat.”

If children touch both of the boats, Little Bear says, “That’s right”. If children make a mistake, Little Bear corrects them, saying, “That is a \_\_\_\_, not a boat”. This serves as the training for both search tasks. It occurs before the first search task, whether it is number search or letter search. If the child touches both boats and no other objects, level 1 of the number or letter search starts; if not, another example trial is given.

### ***Task 3 or 4. Number Search***

Tasks 3 and 4 are counterbalanced. Little Bear says: “This is the Number Search game. In this game you will find the numbers. Over here, you see a number (number flashes) that is in a red box. The other numbers are in blue boxes. You will need to touch all of the blue numbers that are exactly the same as the red number. During these games we will not tell you if you have found them all.”

Little Bear appears on the screen and says: “When you think you are done with this level and want to move on to the next, just click on me! I’ll be right here!” (Figures 2 and 3)



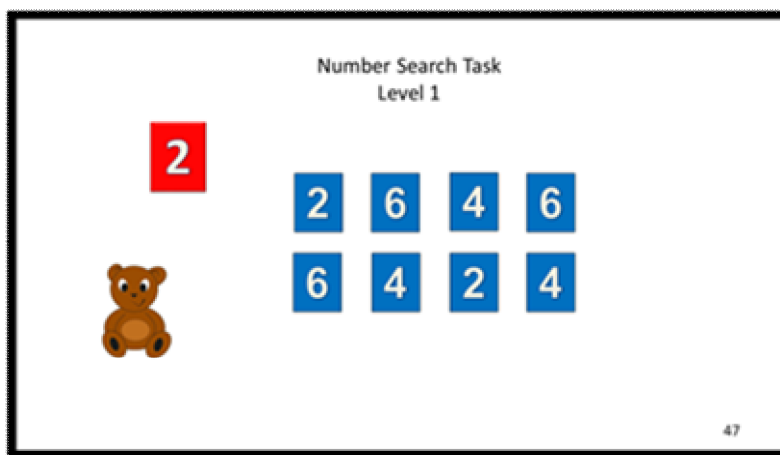


Figure 2. Level 1 of the number search, which is typically easy for 4-year-olds.

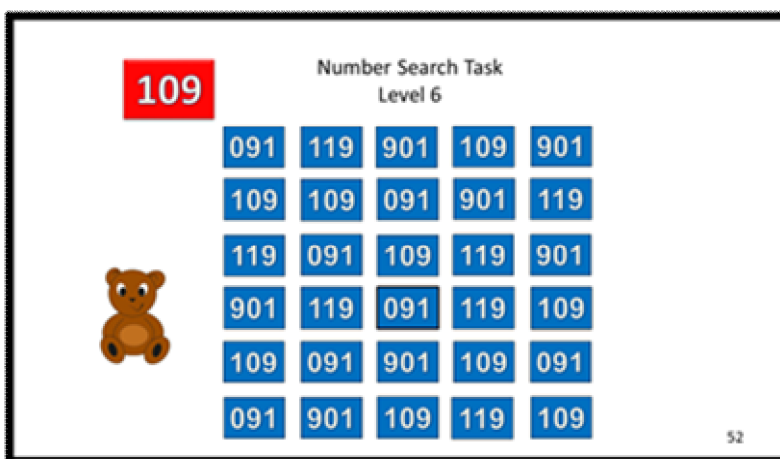


Figure 3. Level 6 of the number search task, which is a moderately challenging task for 6 and 7-year-olds, but a hard task for 4-year-olds.

Table 5. Levels of the Number Search Task

Level	N of target Digits	Numbers in blue boxes	Numbers in order?	N of matching numbers	Non-matching numbers
1	1 (2)	8 (4*2)	NA	2	6
2	1 (3)	12 (4*3)	NA	3	9
3	2 (10)	24 (6*4)	yes	6	18
4	2 (25)	30 (6*5)	yes	9	21
5	3 (746)	30 (6*5)	yes	9	21
6	3 (109)	30 (6*5)	yes	9	21
7	4 (6283)	30 (6*5)	yes	9	21
8	4 (9639)	30 (6*5)	yes	9	21

#### Task 4 or 3. Letter Search Part 1 (Levels 1–5)

Little Bear says, “Now we are going to play a game where you find letters. Over here, you will see a letter (letter flashes) that is in a red box. The other letters are in blue boxes. You will need to touch all of the blue letters that are the same as the red letter.”

“I’m still right here, so when you want to go to the next level, just touch me.”

Then the computer presents the easy level for that child’s age group (see Table 4). The computer then presents any moderate levels for that child’s age group that are no higher than level 5. It does not present levels 6–8 at this time, because additional training is needed for these highest levels. (Figure 4)

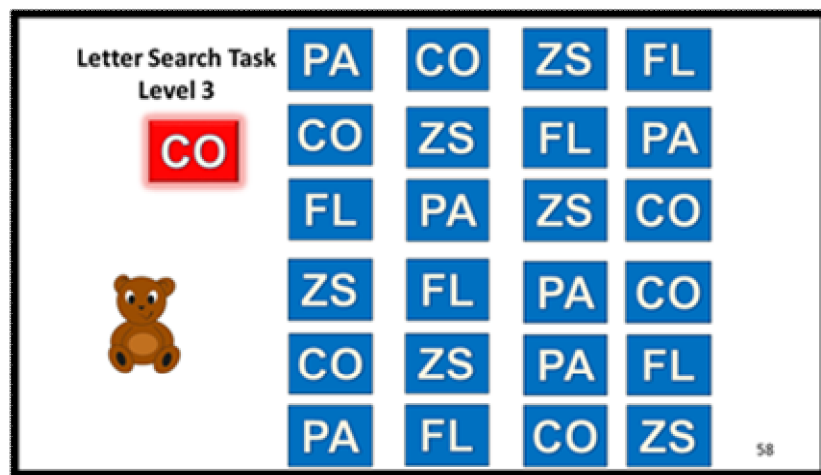


Figure 4. Level 3 of the letter search task is typically moderately challenging level for 3 to 5 year-olds

Table 6. Levels 1-5 of the Letter Search Task

Level	N of target letters	Letters in blue boxes	Letters in order?	N of matching letters	Non-matching letters
1	1 (T)	8 (4*2)	NA	2	6
2	1 (A)	12 (4*3)	NA	3	9
3	2 (CO)	24 (6*4)	yes	6	18
4	2 (GAM)	30 (6*5)	yes	9	21
5	3 (KCB)	30 (6*5)	yes	9	21

*Task 5. Letter Search Part 2 (Levels 6–8)*

Levels 6–8 require that the child find the same letters, even when they appear in a different order. Because the letters do not form words, the order is unimportant. (Because ordering numbers differently always changes the numerical value represented, the assessment does not have this same type of task for number search.) After additional training (with pictures of flowers and boats) to teach children not to consider order in finding matches, these more difficult levels of the letter search are presented by the computer. The child is given these instructions by Little Bear: “Now you get to play the new letter game, which has the same rule as the flower and boat game you just tried. In this game you will find several letters in a red box over here (box flashes). The other letters are in blue boxes. You will need to touch all of the groups of blue letters that are the same letters as the red letters. The blue letters can be in any order as long as they are the same as the red letters. Find JK and also KJ.” (Figure 5)

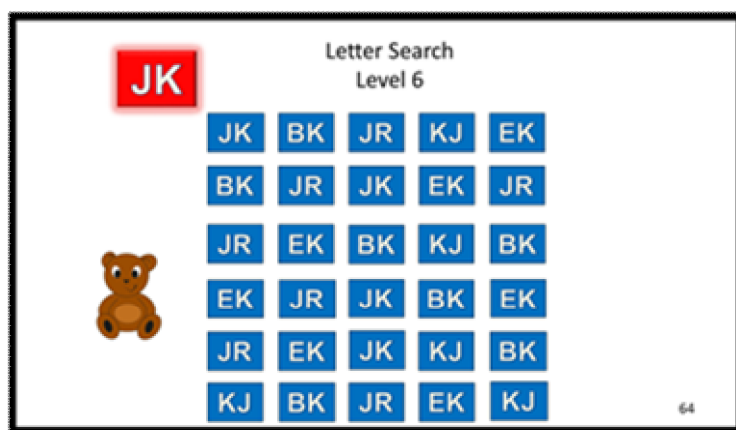


Figure 5. Level 6 of the letter search task: letters are found in either order. This is a hard task for 4-year-olds and moderately challenging task for 6 and 7-year-olds.

Table 7. Levels 6-8 of the Letter Search Task

Level	N of target letters	Letters in blue boxes	Letters in order?	N of matching letters (matches in parenthesis)	Non-matching letters
6	2 (JK)	30 (6*5)	no	4(JK), 5(KJ)	21
7	2 (VW)	30 (6*5)	no	4(VW), 5(WV)	21
8	3 (JKG)	30 (6*5)	no	3(JKG), 3(KGJ), 3(GJK)	21

When the child finishes the last level of Session 1, Little Bear says: *It was good to play with you! Let's play again soon!*

## Session Two of the Tasks

### Executive Functions Tasks

Each child will receive one task that is typically easy at the child's age, one moderate task, and one hard task as shown on Table 8.

Table 8. Task Levels Used at Different Ages for Both EF Tasks

Age	Easy	Moderately challenging	Hard
Less than 4	1	2	4
4-5	1	3	5
5-6	2	4	6
6-7	3	5	7
7 or more	4	6	8

### Task 6 or 7. Picture Memory

Tasks 6 and 7 are counterbalanced. In this task the child sees a rectangular array of blank cards, which have pictures on the other side. When the child touches the blank card, the computer turns it over so that the picture is visible. Little Bear explains it as follows: *"This is the picture memory game. In this game, you will find pictures that are the same. Touch a card to see what picture it is and then touch another card to try to find the same picture. For example, if you touch a card that is a fish, touch another card to see if it is the other fish. If the other card is also a fish you have found what you are looking for. If you find a picture that isn't the same, then keep playing."*

If the child doesn't find the match they are expected to keep trying by touching one card at a time until they find the match. For levels 1-5, when the child touches a matching card, both cards disappear, but when a non-matching card is touched, it flips back. However, in the more difficult levels 6-8, the computer turns over the cards and leaves them in the same place on the screen. "Let's start. Find all the cards that are the same as each other" (Figure 6).

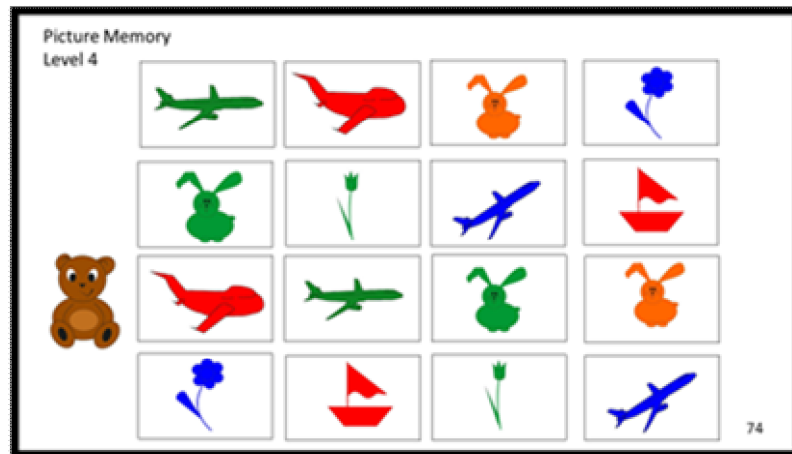


Figure 6. Level 4 of the picture memory task, which is typically a hard task for 3-year-olds, a moderately challenging task for 5-year-olds, and an easy task for 7-year-olds

Children aged 5 years and older will receive at least one task from levels 6–8. The computer will give them instructions about the "new," harder game where the cards don't disappear when they are matched (Figure 7).

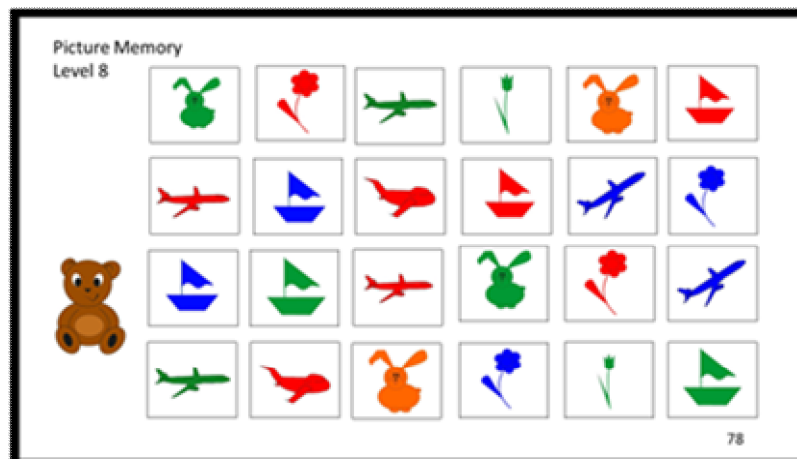


Figure 7. Level 8 of the picture memory task, which is considered hard for the 7-year-olds because there are many pairs to match and they don't disappear when matched

Table 9 shows all eight levels of the picture memory task, including details about: (a) the number of pairs of pictures, (b) the total number of pictures on the screen, and (c) whether both cards disappear when they are matched or the cards turn back over when matched rather than disappearing.

Table 9. Levels of the Picture Memory Task

Level	N of pairs	N on screen	Matched cards disappear
1	3	6	yes
2	4	8	yes
3	6	12	yes
4	8	16	yes
5	12	24	yes
6	6	12	no
7	8	16	no
8	12	24	no

Task 6 or 7

This is the Modified Dimensional Change Card Sort Task (the Size-Shape-Color game). Figure 8 shows the general design on the screen for these tasks. Note that there is a red sailboat on the bottom of the screen which the child can drag into one of two baskets depending on the sorting dimension specified (the game being played). Instructions vary with the specific task (Figure 8).

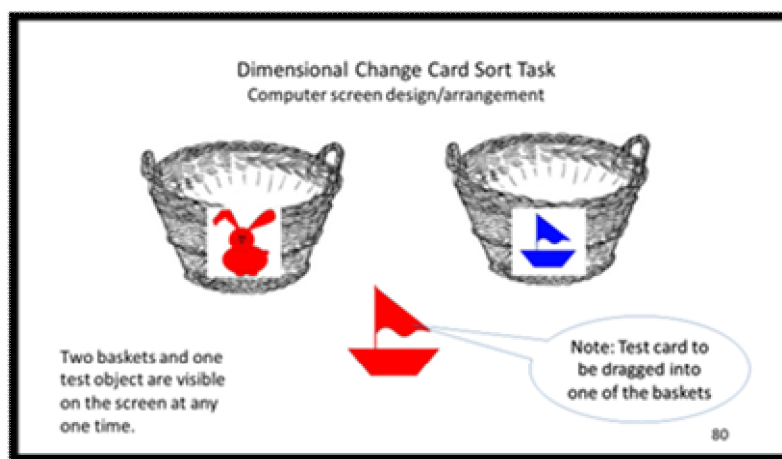


Figure 8. The general design of the screen for the dimensional change card sort tasks. For levels 1–6, there are two baskets and one test object or card on the screen at any one time

Sometimes, the child “plays the shape game”, where the child is told to drag the test card into the basket with the same shape, ignoring color. For example, in the shape game, all of the rabbits go in the basket with the rabbit on it, and all of the boats go in the basket with the boat on it even though the colors don’t match. In the “color game,” all the red boats go in the basket with the red bunny, and all of the blue bunnies go in the basket with blue boat. In the size game, all the big things go in the basket with the big picture on it and all the little things go in the basket with the little picture on it. The child is told whether it is correct on training trials but not on the test trials. Note that the cards to be sorted never exactly match the pictures on the baskets. After training, Little Bear starts the task by saying, “We’re going to play a game with colors and shapes. You will sort ‘pictures’ into two baskets. During each game, we will tell you the rule you will use to sort pictures.”

*Level 1. Pre-Switch*

“Now we are going to play the color game. In the color game, you put all of the red ones in this basket (it flashes) and all of the blue ones in this basket (it flashes). Each time you see a new card, put it in the red basket if it is red and the blue basket if it is blue.”

*Level 1. Post Switch*

“Now we are going to play the shape game. Put the flower cards in the flower basket and the airplane in the airplanes basket.”

Level 4 has nine cards to be sorted with two shades of green and two shades of blue. The left basket has a small daisy with one shade of blue on it and the right hand basket has a large airplane with a shade of green. Level 4 is intended to be hard for 3-year-olds, moderately challenging for 5-year-olds, and easy for 7-year-olds. Note that only one picture at a time actually shows at the bottom of the screen.

*Level 4. Pre-Switch*

“This time we will play the color game. All of the blue cards go in the blue basket, and all of the green cards go in the green basket.” (Figure 9)

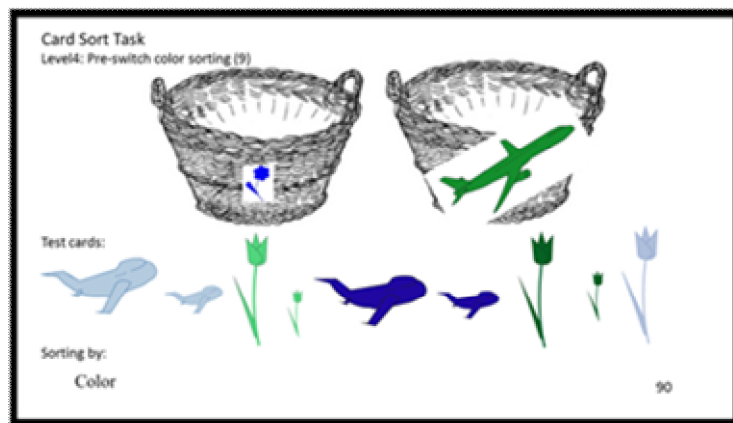


Figure 9. Pre-Switch for Level 4 of the card sorting task, requires cards to be sorted by color, either a shade of blue or a shade of green

Level 4 Post Switch: Using the same two blue and green baskets and nine test cards. “Now, we are playing the opposite color game. In the opposite color game, you put the cards in the basket with the OTHER color. So, the blue cards go in the green basket and the green cards go in the blue basket.”

Level 4 Second Post Switch: Using the same two baskets and nine test cards. “Now, we are going to sometimes play the color game and sometimes the opposite color game. When I say color game, keep playing that game until I say we will play the opposite color game. Keep playing that game until I say we will now play the color game.”

For levels 7 and 8, there are four baskets on the screen and children are instructed to sort the test cards into first one and then the other appropriate basket, based on one of three dimensions: size, color, or number. The computer demonstrates the sorting, but does not verbalize how it is sorting. For example, in level 7a and 8a, the child is shown but not told to sort based on size so a large orange rabbit would go into the basket with the large orange boat and then into the basket with the two large green bunnies. The second test card, which is a small green boat would go into the baskets with the small objects on them (See Table 10). When the child finishes the last executive functions task, Little Bear says “Goodbye”.

Table 10. Levels for the Modified Dimensional Change Card Sort Task

Level	N of baskets	N of cards	Pictures sorted	Pictures on baskets	Pre-switch dimension	Post-Switch dimension	2nd post-switch dimension
1	2	6	Red airplane Blue flower	Red flower; Blue airplane;	Color	Shape	NA
5	2	9	Orange big bunny Green little boat Orange little bunny Green big boat	Green little bunny; Orange big boat	Size	Opposite size	Mixed, with 6 opposite size and 3 size
8	4	9	Orange big bunny Dark green little boat Light orange little bunnies Light green big boats Light orange big bunny Light green little boats Dark green big bunnies Dark green big boat Orange little boats	1 Little dark green bunny 1 Big dark orange boat 2 Little light orange boats 2 Big light green bunnies	8a Size	8b Number	

## Conclusion

The need for tests of children’s motivation and executive functions during this transition to school period is very great. Currently, there are many tests of IQ and basic achievement skills, and there are questionnaire assessments of concepts such as intrinsic motivation, mastery motivation, and executive functions. However, to our knowledge there are no standardized behavioral tests including both children’s mastery motivation and executive functions, and no computer-based assessments of both of these skills. Thus, such a test will fill a void in a very large Hungarian, US, and international market. The preliminary data show good reliabilities and construct validity of the tested tasks.

We are currently creating an android version of the tasks. The android app will enable us to do the tasks even when internet access is inconsistent or unavailable. Because the computer tablet essentially administers age-appropriate tasks and collects the data needed for the analyses, individualized adaptive test administration and data collection will not require much teacher time or training.

Our long-term plan is to make the assessment available to school systems as well as researchers. We believe that the tasks will be useful in schools and for school success research as a crucial part of an assessment of school readiness. Our tasks should also aid in the development of individualized assessment plans for intervention or remediation. Ultimately, the assessment will be standardized and available to schools in Hungary, the US, and other countries and languages.

Much research has documented that high quality early childhood education has an extraordinarily high return on investment, given its association with increased school performance and with decreases in later school drop-out, delinquent and other risky behaviors. Both in Hungary and the US, early childhood education and school readiness are important, especially with regard to access to it by low income families. Both countries value individualized assessments of school readiness and individualized curriculum to remediate any deficiencies. A tablet-based assessment can determine each individual child's level of development on each task, allowing for individualized remediation and enrichment efforts.

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### **References**

- Barrett, K. C., & Józsa, K. (2016, July). *Computer Tablet Assessment of Executive Functions and their Relations to School Readiness and Socioemotional Health in Hungarian and American Children*. 24th Biennial Meeting of the International Society for the Study of Behavioural Development, ISSBD, July 10-14, 2016, Vilnius, Lithuania.
- Berhenke, A., Miller, A. L., Brown E., Seifer, R., & Dickstein, S. (2011). Observed emotional and behavioral indicators of motivation predict school readiness in Head Start graduates. *Early Childhood Research Quarterly*, 26(4), 430–441. <https://doi.org/10.1016/j.ecresq.2011.04.001>
- Blair, C., & Diamond, A. (2008). Biological processes in prevention and intervention: Promotion of self-regulation and the prevention of early school failure. *Development and Psychopathology*, 20(3), 899–911. <https://doi.org/10.1017/S0954579408000436>
- Blair, C., & Raver, C. C. (2015). School Readiness and self-regulation: A developmental psychobiological approach. *Annual Review of Psychology*, 66, 711–731. <https://doi.org/10.1146/annurev-psych-010814-015221>



- Blair, C., & Razza, R. P. (2007). Relating effortful control, executive function, and false belief understanding to emerging math and literacy ability in kindergarten. *Child Development, 78*(2), 647–663. <https://doi.org/10.1111/j.1467-8624.2007.01019.x>
- Blasco, P. M., Saxton, S., & Gerrie, M. (2014). The little brain that could: Understanding executive function in early childhood. *Young Experimental Children, 17*(3), 3–18. <https://doi.org/10.1177/1096250613493296>
- Brock, L. L., Rimm-Kaufman, S. E., Nathanson, L., & Grimm, K. J. (2009). The contributions of "hot" and "cool" executive function to children's academic achievement, learning-related behaviors, and engagement in kindergarten. *Early Childhood Research Quarterly, 24*(3), 337–349. <https://doi.org/10.1016/j.ecresq.2009.06.001>
- Burchinal, M., Magnuson, K., Powell, D., & Hong, S. S. (2015). Early childcare and education. In R. Lerner, M. Bornstein, & T. Leventhal (Eds.), *Handbook of child psychology and developmental science*. Volume 4. Ecological settings and processes, Chapter 6 (pp. 1–45). Hoboken, NJ: Wiley. <https://doi.org/10.1002/9781118963418.childpsy406>
- Busch-Rossnagel, N. A., & Morgan, G. A. (2013). Introduction to section three: Overview and analysis. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook on self-regulatory processes in development: New directions and international perspectives* (pp. 247–264). New York, NY: Psychology Press. <https://doi.org/10.4324/9780203080719.ch12>
- Diamond, A. (2013). Executive function. *Annual Review of Psychology, 64*, 135–168. <https://doi.org/10.1146/annurev-psych-113011-143750>
- Diamond, A. (2016). Why improving and assessing executive functions early in life is critical. In J. A. Griffin, P. McCardle, & L. S. Freund (Eds.), *Executive Function in Preschool-Age Children: Integrating Measurement, Neurodevelopment, and Translational Research* (pp. 11–43). Washington, DC: American Psychological Association.
- Eisenberg, N., Spinrad, T. L., & Eggum, N. D. (2010). Self-regulation and school readiness. *Early Education and Development, 21*(5), 691–698. <https://doi.org/10.1080/10409289.2010.497451>
- Gilmore, L., & Cuskelly, M. (2011). Observational assessment and maternal reports of motivation in children and adolescents with Down syndrome. *American Association on Intellectual and Developmental Disabilities, 116*(2), 153–164. <https://doi.org/10.1352/1944-7558-116.2.153>
- Józsa, K. (2016). Kihívások és lehetőségek az óvodai fejlesztésben [Challenges and possibilities in preschool education]. *Iskolakultúra, 26*(4), 59–74. (in Hungarian) <https://doi.org/10.17543/ISKKULT.2016.4.59>
- Józsa, K., & Molnár, É. D. (2013). The relationship between mastery motivation, self-regulated learning and school success: A Hungarian and wider European perspective. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook of self-regulatory processes in development: New directions and international perspectives* (pp. 265–304). New York, NY: Psychology Press. <https://doi.org/10.4324/9780203080719.ch13>
- Józsa, K., & Morgan, G. A. (2014). Developmental changes in cognitive persistence and academic achievement between grade 4 and grade 8. *European Journal of Psychology of Education, 29*(3), 521–535. <https://doi.org/10.1007/s10212-014-0211-z>
- Józsa, K., Barrett, K. C., Stevenson, C. A., & Morgan, G. A. (2016, June). *A new computer-tablet assessment of mastery motivation for preschool children*. Presented at a symposium on Valid New Measures of Mastery Motivation for Young Children at the International Society of Early Intervention, ISEI, June 8–10, 2016, Stockholm, Sweden.
- Józsa, K., Barrett, K. C., & Morgan, G. A. (2017, April). *A computer based assessment of mastery motivation for young children: Reliability and validity of a new measure*. Presented at a symposium on Measuring mastery motivation in early childhood: Methodological advances and challenges at the Society for Research on Child Development: 2017 SRCD Biennial Meeting - April 6-8, 2017, Austin, Texas.
- Józsa, K., Barrett, K. C., & Morgan, G. A. (2016, July). *New computer based assessment of mastery motivation for young children*. Presented at a symposium on Young Hungarian, Israeli, and Chinese children's motivation to engage in culturally sanctioned tasks. Presented at the 24th Biennial Meeting of the

- International Society for the Study of Behavioural Development, ISSBD, July 10–14, 2016, Vilnius, Lithuania.
- Józsa, K., Barrett, K. C., Józsa, G., Kis, N., & Morgan, G. A. (2017). Development and initial evaluation of individualized moderately challenging computer-tablet mastery motivation tasks for 3-8 year-olds. *Hungarian Educational Research Journal*, 7(2), 106–126.
- Józsa, K., Wang, J., Barrett, K. C., & Morgan, G. A. (2014). Age and cultural differences in self-perceptions of mastery motivation and competence in American, Chinese, and Hungarian school-age children. *Child Development Research*, 2014, Article ID 803061, <https://doi.org/10.1155/2014/803061>
- Kagan, S. L., Moore, E., & Bredekamp, S. (1995). *Reconsidering children's early development and learning: Toward common views and vocabulary*. Washington, DC: National Education Goals Panel Goal 1 Technical Planning Group.
- McCall, R. B. (1995). On definitions and measures of mastery motivation. In R. B. MacTurk, & G. A. Morgan (Eds.), *Mastery motivation: Origins, conceptualizations, and applications* (pp. 273–292). Norwood, NJ: Ablex.
- McClelland, M. M., Cameron, C. E., Connor, C. M., Farris, C. L., Jewkes, A. M., & Morrison, F. J. (2007). Links between behavioral regulation and preschoolers' literacy, vocabulary, and math skills. *Developmental Psychology*, 43(4), 947–959. <https://doi.org/10.1037/0012-1649.43.4.947>
- McWayne, C., Cheung, K., Wright, L., & Hahs-Vaughn, D. (2012). Patterns of school readiness among Head Start children: Meaningful within-group variability during the transition to kindergarten. *Journal of Educational Psychology*, 104(3), 862–878. <https://doi.org/10.1037/a0028884>
- Mischel, W., Shoda, Y., & Rodriguez, M. L. (1989). Delay of gratification in children. *Science*, 244(4907), 933–938. <https://doi.org/10.1126/science.2658056>
- Morgan, G. A., Busch-Rossnagel, N. A., Barrett, K. C., & Wang, J. (2009). *The Dimensions of Mastery Questionnaire (DMQ): A manual about its development, psychometrics and use*. Colorado State University, Fort Collins. Retrieve from <http://mycahs.colostate.edu/George.Morgan/MasteryMotivation.htm>
- Morgan, G. A., Busch-Rossnagel, N. A., Maslin-Cole, C. A., & Harmon, R. J. (1992). *Individualized assessment of mastery motivation: manual for 15 to 36 month old children*. Colorado State University, Fort Collins. Retrieve from <https://sites.google.com/a/rams.colostate.edu/georgemorgan/mastery-motivation>
- Morgan, G. A., Harmon, R. J., & Maslin-Cole, C. A. (1990). Mastery motivation: Definition and measurement. *Early Education and Development*, 1(5), 318–339. [https://doi.org/10.1207/s15566935eed0105\\_1](https://doi.org/10.1207/s15566935eed0105_1)
- Morgan, G. A., Wang, J., Liao, H-F., & Xu, Q. (2013). Using the Dimensions of Mastery Questionnaire (DMQ) to assess mastery motivation of English and Chinese speaking children: Psychometrics and implications for self-regulation. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook on self-regulatory processes in development: New directions and international perspectives* (pp. 305–335). New York, NY: Psychology Press. <https://doi.org/10.4324/9780203080719.ch14>
- Müller, U., & Kerns K. (2015). The development of executive function. In Lerner, R. M. (Ed.), *Handbook of child psychology and developmental science* (pp. 571–623). New York: John Wiley & Sons. <https://doi.org/10.1002/9781118963418.childpsy214>
- Peterson, E., & Welsh, M. C. (2014). The development of hot and cool executive functions in childhood and adolescence: Are we getting warmer? In S. Goldstein, & J. A. Naglieri (Eds.), *Handbook of Executive Functioning* (pp. 45–65). London: Springer. [https://doi.org/10.1007/978-1-4614-8106-5\\_4](https://doi.org/10.1007/978-1-4614-8106-5_4)
- Shonkoff, J. P., & Phillips, D. A. (2000). *From neurons to neighborhoods: The science of early childhood development*. Washington DC: National Academy Press.
- Snow, K. L. (2006). Measuring school readiness: Conceptual and practical considerations. *Early Education and Development*, 17(1), 7–41. [https://doi.org/10.1207/s15566935eed1701\\_2](https://doi.org/10.1207/s15566935eed1701_2)
- Tsermentseli, S., & Poland, S. (2016). Cool versus hot executive function: A new approach to executive function. *Encephalos*, 53(1), 11–14.

- Wang, J., & Barrett, K. C. (2013). Mastery motivation and self-regulation during early childhood. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook on self-regulatory processes in development: New directions and international perspectives* (pp. 337–380). New York, NY: Psychology Press. <https://doi.org/10.4324/9780203080719.ch15>
- Wang, P. J., Morgan, G. A., Hwang, A. W., & Liao, H. F. (2013). Individualized behavioral assessments and maternal ratings of mastery motivation in mental age-matched toddlers with and without motor delay. *Physical Therapy, 93*(1), 79–87. <https://doi.org/10.2522/ptj.20120068>
- Wang, P.-J., Morgan, G. A., Liao, H.-F., Chen, L.-C., Hwang, A.-W., & Lu, L. (2016). Reliability and validity of the revised individualized structured mastery tasks in children with developmental delay. *International Journal of Physical Medicine and Rehabilitation, 4*(6), 374. <https://doi.org/10.4172/2329-9096.1000374>
- Young, J. M., & Hauser-Cram, P. (2006). Mother-child interaction as a predictor of mastery motivation in children with disabilities born preterm. *Journal of Early Intervention, 28*(4), 252–263. <https://doi.org/10.1177/105381510602800402>
- Zelazo, P. D. (2006). The Dimensional Change Card Sort (DCCS): A method of assessing executive function in children. *Nature Protocols, 1*, 297–301. <https://doi.org/10.1038/nprot.2006.46>
- Zelazo, P. D., & Müller, U. (2002). Executive function in typical and atypical development. In U. Goswami (Ed.), *Blackwell handbook of childhood cognitive development* (pp. 445–469). Oxford: Blackwell. <https://doi.org/10.1002/9780470996652.ch20>
- Zelazo, P. D., & Müller, U. (2010). Executive function in typical and atypical children. In U. Goswami (Ed.), *The Blackwell-Wiley handbook of childhood cognitive development* (2nd rev. ed., pp. 574–603). Oxford, England: Blackwell. <https://doi.org/10.1002/9781444325485.ch22>
- Zelazo, P. D., Blair, C. B., & Willoughby, M. T. (2016). *Executive function: Implications for education (NCER 2017–2000)*. Washington, DC: National Center for Education Research, Institute of Education Sciences, U.S. Department of Education.



## Development and Initial Evaluation of an Individualized Moderately Challenging Computer-tablet Mastery Motivation Measure for 3–8 year-olds

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### Abstract

This paper describes information about the development of a new computer-based, individualized mastery motivation assessment and reports results from a study using the assessment with a sample of 274 children aged 3-8 years in Hungarian kindergartens and elementary schools. Mastery motivation as an important characteristic in early childhood, in part because it is a predictor of later cognitive and school performance. In the present study, each child was given four number search and four letter search tasks that varied in assumed difficulty for their age from easy to hard. Results suggest that the children enjoyed the tasks and varied meaningfully in persistence in matching target numbers or letters from an array. As the tasks increased in assumed difficulty, children spent more time searching, but were less successful and made more errors in matching the letters or numbers. Mastery motivation scores were calculated based on each child's computer-calculated persistence on the tasks that were actually moderately challenging for that child. This individualized persistence score was significantly correlated with teachers' and experimenters' ratings of persistence, providing support for the measure's criterion/construct validity. These results support the promise of the tasks as part of a school readiness assessment to predict children's school performance.

**Keywords:** motivation, child development, computer-assisted testing, mastery motivation, individualized tasks, moderately challenging, mastery tasks

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## **Introduction**

### ***Mastery Motivation***

Morgan, Harmon, and Maslin-Cole (1990) proposed that mastery motivation is a multifaceted, initially intrinsic psychological force that stimulates an individual to attempt to master a skill or task that is at least moderately challenging for him or her. Morgan, MacTurk, and Hrnčir (1995) identified three main instrumental aspects of mastery motivation: (1) cognitive persistence, a child's motivation to persist at and master cognitive and school-related tasks, (2) gross motor persistence, the motivation to master physical skills, and (3) social persistence, the motivation to master interpersonal relations with adults and with peers. In addition to these instrumental dimensions, Barrett and Morgan (1995) emphasized the importance of the affective or expressive aspects of mastery motivation; they highlighted the role of mastery pleasure in enhancing mastery motivation and the rate of frustration, sadness, or shame after failure in potentially undermining it. Mastery motivation inclines children to practice and acquire a new skill or ability even when it is challenging, and thus should fundamentally impact development (MacTurk & Morgan, 1995; Messer, 1993; Wang & Barrett, 2013).

The literature highlights the importance of research on and assessment of mastery motivation (Busch-Rossnagel & Morgan, 2013; Shonkoff & Philips, 2000; Wang & Barrett, 2013). Research has indicated that mastery motivation may be a better predictor of cognitive development than intelligence, hence playing a crucial role in school achievement (Gilmore, Cuskelly, & Purdie, 2003, Józsa & Molnár, 2013; Mercader, Presentación, Siegenthaler, Moliner, & Miranda, 2017). However, extant behavioral measurements of mastery motivation for 3 to 8 year-olds are time-consuming and require training to administer, making them impractical for teachers to administer in authentic school settings. Previous large-scale studies used adult-report questionnaire measures (i.e., the Dimensions of Mastery Questionnaire), which, although less challenging to administer, are subject to potential rater biases, such as confounding motivation and competence (e.g., Józsa & Molnár, 2013; Józsa & Morgan, 2014; Józsa, Wang, Barrett, & Morgan, 2014; Morgan, Wang, Liao, & Xu, 2013).

We distinguish the motive to master moderately challenging skills and problems from the somewhat related concept of intrinsic motivation. The two concepts are different in terms of focus and measurement. Although mastery motivation has usually been assumed to be initially intrinsic in infants, the focus of mastery motivation research has been on a child's persistent attempts to master challenging tasks, whether the reward comes from within or whether extrinsic rewards are offered (Józsa & Morgan, 2014; Józsa et al., 2014). In contrast, the intrinsic motivation literature places little emphasis on mastery, focusing instead on the source (internal or external) of the motivation.

### ***Individualized Mastery Tasks***

The approach taken in our computerized assessment is based on earlier work by Morgan, Busch-Rossnagel, Maslin-Cole, and Harmon (1992) to individualize the difficulty level of mastery tasks. Theoretically, mastery motivation involves persistence on tasks that are at least moderately challenging, but level of challenge of any particular task varies with the ability of the person working on the task. Morgan and his colleagues strove to separate motivation from ability by selecting tasks that are moderately challenging for each individual child. This strategy involved the use of sets of similar tasks/toys, such as puzzles, which had several levels of difficulty. The child's motivation was assessed with the level of each set of tasks that was found to be moderately difficult for that individual child. Specifically, a task was selected so that the child would successfully complete at least part of it, but would not finish all parts of the task too quickly. Thus, the level chosen for a given child was moderately challenging but not so hard that partial completion was not achieved. The child's persistence and pleasure at those moderately difficult tasks were used to measure mastery motivation.

McCall (1995) called this individualized approach, with its identification and use of moderately difficult tasks "one of the most important measurement advances" (p. 288), in part because it facilitates the separation of ability or competence from motivation. This individualized method has been used by a number of researchers and led to an increasing understanding of mastery motivation in young children developing typically and, especially, atypically (e.g., Gilmore & Cuskelly, 2011; Young & Hauser-Cram, 2006; Wang, Morgan, Hwang, & Liao, 2013; Wang et al., 2016). We used the Morgan et al. (1992) methods as the starting point for developing our new computer-based assessment described in this paper.

### ***Purposes of this paper***

The goals of this paper are to present findings from two studies used to develop and test the computer-based mastery motivation tasks and a new individualized, moderately challenging persistence measure. First, we summarize the method and results of the face-to-face pilot study used to develop and refine the new mastery motivation tasks. Then we describe the method and results of the initial study of the computer-based mastery motivation tasks. We present data about descriptive statistics, the development of the individualized persistence measure, and validity of this new measure.

### **Face-to-Face Pilot Study**

#### ***Method***

##### *Participants*

Kindergarten in Hungary includes three or more years from age 3 to 6–8. The first year of kindergarten (preschool) is the first stage of public education. Hungarian Law

guarantees free kindergarten for all children. There were 12 Hungarian kindergarten children aged 4 to 7 in the face-to-face pilot study. Half of them were boys. They were middle class children in a preschool in a middle size city in the central part of Hungary.

### *Measures*

Test items were developed based on the Morgan et al. (1992) moderately challenging task procedure for young children. We used a letter search and a number search game. Both of them included 8 difficulty levels; all children were given the same 8 tasks. The tasks were in color printed on white A4 (ca. 8.3x11.7 inches) paper. Each difficulty level was printed on a separate sheet. The layout of the papers were designed to simulate future computer monitor/tablet screens; that is, children saw a monitor screen-like layout on the table in front of them. They were given paper discs to put on the letters and numbers they were instructed to find.

### *Procedure*

The aim of the individual face-to-face pilot study was to see if children understood and liked these tasks, and to check if difficulty levels were defined appropriately. Data collection took place at a kindergarten in a room suitable for testing. The pilot study was carried out by the first and the third authors of this paper. The kindergarten teacher was present during the testing, to help children feel comfortable in the presence of the unknown testers.

At the start of the examination, a training task was given to the children. Our goal with this was to make sure participants understood the instructions. In the training task children had to find, among three numbers or letters, the one that was highlighted at the top of the page. Understanding was aided by verbal instructions. Only one child needed more detailed explanation during the training task. After the completion of the training task, all children understood the instructions.

One of the researchers interacted with the child, while the other was responsible for recording the time with a stop watch and for filling in the data recording form. Children were allowed 2 minutes on each of the eight levels or until they had finished (or in a few cases, at the hardest levels, until they gave up). Time spent on the tasks in seconds, number of "errors", and "missing" cards were recorded on this form. "Errors" occurred when discs were placed on pictures that did not match the target picture. An answer was "missing" when no disc was put on a picture that was identical with the target picture. Emotional reactions, signs of giving up, as well as off-task behaviors were also recorded. Every child was given each of the eight difficulty levels of the number search task and the eight levels of the letter search. Data collection started with the letter search task for half of the children and with the number search for the other half. A child's letter and number search tasks were administered on different days.

## Results

The first two difficulty levels proved to be easy for every child; they found all the letters and numbers at these levels. Time spent on tasks increased as the level increased from level 1 to 8 (see Table 1). Although the sample in the pilot study was small, Table 1 also shows that the time needed to complete the game-like task was similar for the letter and the number search tasks on the corresponding levels. On the higher levels, more errors occurred and more correct pictures were “missing” (not found). A few children’s persistence (time spent) was seemingly lower on the higher levels, in part because off-task behavior also was observed in some children. Two children did not even start the last two levels of the letter search, so their times were not included in Table 1.

Table 1. Average Time Spent in Seconds on the Different Difficulty Levels (L1-L8) of the Pilot study

Search Tasks	L1	L2	L3	L4	L5	L6	L7	L8
Letter	13	13	30	44	77	79	73	94
Number	10	13	25	20	39	65	66	97

Note. N = 12 for each task, except for 2 children who did not start levels 7 and 8 of the letter search.

## Discussion: Changes Based on the Face-to-Face Pilot Test

The results supported the ordering of the tasks in difficulty level, and also suggested that the lowest levels may be appropriate for even younger age groups. Based on our desire to train children on how to do the task rather than to familiarize them with the numbers and letters that would be included in the task, numbers and letters were replaced by pictograms (banana, boat, house, ship) for the training level on the computer-based tasks. Using the pictograms also enabled children to learn how to do the search through more familiar symbols. In the computer-based version, a built-in function prevents children from moving on from the training level until they demonstrate an understanding of the task instructions. For this reason, more than one training level is given if it is needed. If a child does not seem to understand the instructions, the test will not start.

After the pilot study, some changes were made to the combinations of the letters. This seemed necessary to increase the difficulty of the higher levels. In the face-to-face pilot study, all eight levels of the letter and number tasks were included as part of the computer-based test. However, given time constants, we decided to give each child only four different levels for the computer assessment: one that was assumed to be easy for their age, two moderate, and one difficult. Thus, in the computer-based version children were given a total of four age-appropriate levels each of the number and letter search tasks instead of the original eight levels.

In this face-to-face study, we originally planned to have children report on their emotional state before, during, and after the tasks. Children were presented with four stylized drawings of faces depicting four different emotions (happy, neutral, sad, and angry) and were asked to point to the face that showed how they felt during that task.



However, children’s answers did not seem to reliably reflect their task-related emotions. Most children chose the happy face, often saying they liked it the most. Some children spoke about emotions resulting from some other situation, such as playing in the courtyard that morning, rather than the task. This method did not seem to validly measure the young children’s emotional responses to challenge, mastery, and/or failure; therefore, it was not included in the computer-based test. Instead, the examiner was asked to rate the child’s emotions as they did the tasks.

Children in the pilot sample showed pleasure in participating in the study. They regarded it as a game and enjoyed finding the letters and numbers. After the pilot study and the modifications made, we found the tasks to be appropriate to start the development of the computer-based test.

## Initial Testing of the Computer-Based Mastery Tasks

### Method

#### Participants

Participants in the initial testing of the computer tasks were kindergarten and elementary school children in Hungary. Using a cross-sectional design, we collected data from children from 3 to 7 or more years old (Table 2). The total sample size was 274; 49.3% of the children were boys. The data collection was done in a mid-size city in Southern Hungary. The children were recruited from 8 kindergartens and 3 elementary schools. We made an effort to sample schools that would include children from all categories of parental educational levels. The average number of years of parental education was approximately 10.5 years for fathers ( $SD = 1.78$ ) and 10.9 for mothers ( $SD = 2.03$ ). Approximately 16% of the fathers and 15% of the mothers had a BA degree or higher; 32% of the fathers and 22% of the mothers had less than a high school degree.

Table 2. Distribution of the Sample by Age

Sample	3-4 yrs.	4-5 yrs.	5-6 yrs.	6-7 yrs.	7 or more yrs.
N	62	79	76	23	34
Age [in months]	40(6)	54(4)	65(3)	75(3)	94(15)

Note. Age shows the mean age in months;  $SD$  is in parentheses.

#### Computer-based Mastery Motivation Tasks

Based on both our theoretical approach (Morgan et al., 1992) and our experiences from the face-to-face pilot study, computer-based, game-like tasks were developed to measure (a) mastery motivation, (b) pre-academic skills, and (c) executive functions. Barrett, Józsa, and Morgan (2017) provide a more detailed description of all the tasks. Based on the literature we assumed that these three components together should be a good measure of school readiness (Józsa & Barrett, 2017; Zelazo, Blair, & Willoughby, 2016). The present paper focuses just on the mastery motivation tasks.

These computer tasks were designed to measure an important aspect of the child’s mastery motivation: persistence while trying to solve a moderately challenging task. The tasks assess the child’s persistent attempts to find all matching numbers and letters from an array. Both letter and number searching tasks varied in difficulty from those assumed to be easy for 3-year-olds to ones assumed to be difficult for 8-year-olds, based on findings of the face-to-face pilot.

The assessment does not require children to read; the examiner selects a language, either English or Hungarian, and the computer narrator, Little Bear, guides children through the tasks in that language. The tasks were developed to be appropriate for both Hungarian and American cultures. Children were readily able to do the easy level of both of the tasks, regardless of language spoken.

In the *number search* tasks, the computer introduces the task by saying “This is the Number Search game. In this game, you will find the numbers. Over here, you will see a number (number flashes) that is in a red box. The other numbers are in blue boxes. You will need to touch all of the blue numbers that are exactly the same as the red number. During these games we will not tell you if you have found them all.” As the level of difficulty increased, the number of blue boxes to be matched increased. The *letter search* tasks were similar except that at the more difficult levels (6 to 8), the child was told to “ignore the order of the letters and find them in any order” (Barrett et al., 2017). The blue “boxes” that had letters or numbers in them are called “cards” in the rest of the paper.

The letter and number search tasks were designed primarily to obtain measures of time spent on moderately challenging tasks (i.e., mastery motivation). The computers also yielded measures of accuracy on the tasks (matching cards found and non-matching cards touched; i.e., errors). Based on those variables, a competence score was computed. A computer-based, individualized persistence score on moderately challenging tasks was computed based on the child’s competence score and time spent on the task. These and other computer-based scores are described in more detail in the next section.

As Table 3 shows, each child was given one level assumed to be easy, two assumed to be moderately difficult, and one assumed to be hard, based on their age, for up to two minutes each. A level was terminated when the child touched the “Little Bear” signaling that he or she was done with the level.

Table 3. Assumed Difficulty Levels of the Search Tasks Used at Different Ages

Age group in years	Easy	Moderately challenging 1	Moderately challenging 2	Hard
3-4	1	2	3	5
4-5	1	3	4	6
5-6	2	4	5	7
6-7	3	5	6	8
7 or more	4	6	7	8

### *Computer-based Scores*

The computer saved all of the children's computer responses into a database. From that database, several types of scores were produced for each child in each of the four assumed difficulty levels of the number search tasks and the four letter search tasks. Remember that the easy, two moderate, and hard levels of the task were difficulty levels assumed to be that level of difficulty for the average child of that age. The computer-based scores were:

1. Computer-calculated time spent persisting (TSP) in trying to match target cards. This was the time, in seconds, during each of the four levels x 2 types of tasks given to each child. Time spent is a rough measure of the child's persistence trying to match the target card (i.e., mastery motivation) because it included both accurate matches and errors, i.e., touching non-matching cards. However, time spent could, but usually did not, include off-task behaviors such as looking around the room because the computer program was not able to detect such behaviors. The examiner ratings, described below, provided an estimate of actual time on tasks. A summary TSP score, based on the four tasks that were assumed to be moderately challenging, was used to assess reliability in Table 8.
2. Percentage of matching cards found (PMC). For each child in each task, a percentage score was computed consisting of the correct cards that the child touched (i.e., the cards that matched the target card) out of correct cards possible. A PMC on the four tasks assumed to be moderate was used in Table 8 for reliability.
3. Percentage of non-matching cards touched (PNM). Similarly, a score was computed of the percentage of the incorrect or non-matching cards the child touched or "found." The PNM on the four tasks assumed to be moderate was used in Table 8 for reliability.
4. Percentage of completely successful trials. A child's performance on a specific level (e.g., assumed easy) was completely successful if he/she touched or "found" all (100%) of the matching cards and none (0%) of the non-matching cards.
5. Computer search competence score (CST). For each of the four difficulty levels of both types of search task. We computed the mean of two variables for each child: the percentage of matching cards found and 100% minus the percentage of non-matching cards touched (i.e., the errors). Some examples of competence scale values are:
  - 100 if the child touched all (100%) of the matching cards and none (0%) of the non-matching cards,
  - 90 if, for example, the child touched 90% of the matching cards and 10% of the non-matching cards. That is,  $(90 + 100 - 10) / 2$ ,
  - 50 if, for example, 50% of the correct cards are found and 50% of the wrong cards were touched,
  - 0 if the child touched none of the matching cards and all of the non-matching cards.

The CST on the four tasks assumed to be moderate was used to calculate reliability in Table 8.

### *Empirically-based Actual Levels of Difficulty*

As indicated previously, the computer presented task levels that were assumed to be easy, moderately challenging, and hard based on children's age. However, it was evident from descriptive statistics using the above scores that some of the tasks *assumed* to be moderately challenging were very easy for many of the children. Similar to criteria used by Morgan et al. (1992) and Wang, Liao, and Morgan (2017), we empirically defined levels for each child that were considered to be *actually* easy, actually moderate and actually hard. We used the following criteria to define a moderately challenging level for an individual child: (a) the child's search competence score was between 50% and 90%, or (b) the competence score was higher than 90% and the time spent on the task was longer than the mean time plus one standard deviation for a child of his/her age on that level of the task. A task was defined as hard if the competence score was less than 50. An easy task was one in which the child had a competence score of more than 90 and took less time to complete the task than was required for it to be considered moderate.

### *Examiner Ratings*

In addition to the computer produced data and scores, the children were rated on persistence and emotion by the examiner at the end each of level of the computer tasks. Thus, these were ratings of what the child was doing while working on the computer tasks. A rating sheet, developed for this purpose, included the following dimensions for each task level presented to the child:

1. The most intense emotion: positive, neutral or negative during each task level.
2. The intensity of emotions at each task level.
  - a) If the most intense emotion was neutral, the intensity of emotion was noted as 0.
  - b) Positive emotion: 1 = low positive (e.g. closed mouth smile), 2 = moderate positive (e.g. open mouthed smile), 3 = high positive (e.g. smile and positive vocalization or clapping, excited body);
  - c) Negative emotion: 1 = low negative (e.g. slight frown), 2 = moderately negative (e.g. clearly angry or sad face), 3 = high negative (e.g. angry or sad face and negative vocalization or crying).
3. Persistence was rated as the percentage of the time the child was focused on trying to do the task. 1 = 0–19%, 2 = 20–39%, 3 = 40–59%, 4 = 60–79%, 5 = 80–100%.

### *Dimensions of Mastery Questionnaire (DMQ 17)*

The Hungarian version of Dimensions of Mastery Questionnaire (Józsa & Molnár, 2013) was used to measure mastery motivation. This instrument was developed by Morgan, Busch-Rossnagel, Barrett, and Wang (2009); see also Morgan et al. (2013). The questionnaire consists of 5-point Likert items. The instrument has seven scales: cognitive persistence, gross motor persistence, social persistence with adults, social persistence with children, mastery pleasure, negative reaction to failure, and competence. The questionnaires were completed by each child's teacher. The cognitive persistence, mastery pleasure, and negative reaction scales were used in the present

study. The reliabilities of the Hungarian questionnaires were high (Hwang et al., 2017; Józsa & Molnár, 2013; Józsa et al., 2014).

### Procedure

The computer-based tasks were administered in preschool and school settings. Trained education graduate students were the examiners. They tested the children individually in quiet rooms. After a warm-up period, the examiners introduced the computer-tablet assessment to the child. All of the children used touch screen tablets in this study. The testing situation, including training on each task, lasted 10–20 minutes. The examiners rated the children's persistence and emotion reactions during the computer tasks on the rating sheet described above. The teacher filled out the DMQs before the computer based assessment.

## Results

### Computer-produced Time Spent Trying to Match the Target Card

The computer recorded the time each child spent on each task. Table 4 shows the time in seconds that children spent working on search tasks by age group. With increased difficulty level of the tasks, the time also increased. The children spent a similar amount of time on the letter and the number search tasks. Repeated-measures ANOVA for the total sample showed a significant linear (straight line) increasing trend in time both on the number search ( $F = 223.40$   $p < .001$ , partial  $\eta^2 = .464$ ), and letter search ( $F = 234.71$   $p < .001$ , partial  $\eta^2 = .499$ ).

Table 4. Average Time in Seconds Spent on the Different Assumed Difficulty Levels

Age	Number search				Letter search			
	E	M1	M2	H	E	M1	M2	H
Less than 4	20 (13)	32 (21)	42 (22)	52 (28)	18 (14)	26 (11)	36 (19)	59 (35)
4–5	19 (12)	39 (19)	56 (29)	55 (33)	16 (16)	41 (20)	55 (31)	42 (29)
5–6	23 (13)	54 (24)	50 (23)	61 (37)	14 (11)	49 (24)	62 (35)	47 (27)
6–7	32 (13)	41 (17)	50 (23)	57 (25)	25 (12)	53 (20)	42 (16)	62 (31)
7 or more	35 (18)	37 (18)	46 (22)	49 (21)	20 (07)	29 (10)	39 (16)	46 (26)
Total	23 (15)	42 (22)	50 (25)	56 (31)	17 (14)	40 (21)	50 (30)	49 (30)

Note. Assumed difficulty levels. E = Easy, M1 = Moderately challenging 1, M2 = Moderately challenging 2, H = Hard; SDs are in parentheses.

### Percentage of Matching Cards Found

The computer recorded whether or not a child touched every card that was the same as the target card. From that, we computed the percentage of matching cards found score. Children found about 95% of the matching cards on the assumed easy number and letter search tasks. On average, they found significantly fewer matching cards at the 1st moderately challenging levels (number search 76%, letter search 79%), and less still at the 2nd moderately challenging levels (number search 66%, letter search 68%). On the assumed hard tasks, they found 53% of the matching numbers, and 56% of the matching letters; thus, on the hard task children found about half of the cards whereas on the easy

task they found almost all of them. Repeated-measures ANOVA shows a significant decreasing linear trend in the numbers of matching cards found, both in the number search ( $F = 298.41 p < .001$ , partial  $\eta^2 = .532$ ), and the letter search ( $F = 384.38 p < .001$ , partial  $\eta^2 = .618$ ). These large eta squares indicate steep linear declines for both tasks in the number of matching cards found as the assumed difficulty increased.

*Percentage of Non-matching Cards Touched*

The computer also recorded when the children touched cards that did not match the target. When children touched non-matching cards, we considered that an error. Note that mastery motivation includes both successful attempts to solve a problem and those that are not successful; i.e., non-matching touches or errors. The percentage of non-matching cards touched on the assumed easy task, 1st and 2nd moderately challenging tasks, and the hard number search tasks were: 4%, 5%, 11%, and 16%, respectively; and for the letter search were: 4%, 4%, 9%, and 13%. Repeated-measures ANOVA shows a significant linear increase in the non-matching cards touched both in the number search ( $F = 55.61 p < .001$ , partial  $\eta^2 = .175$ ), and the letter search ( $F = 32.69 p < .001$ , partial  $\eta^2 = .121$ ). These eta squares for errors are smaller than the ones for cards found correctly, which indicates that expected difficulty level is less strongly predictive of the change in error rate than is the change in successful matching.

*Percentage of Completely Successful Trials*

As described in the Method section, children who were 100% successful not only correctly touched all matching cards, but also refrained from touching any (0%) of the non-matching cards. Table 5 displays the percentage of children with scores of “yes” on the dichotomous variable “completely successful”.

Table 5. Percentage of Children Who Touched All of the Matching Cards and None of the Non-Matching Cards

Age group	Number search tasks				Letter search tasks			
	E	M1	M2	H	E	M1	M2	H
Less than 4	76(43)	59(50)	15(36)	3(18)	73(45)	88(33)	27(45)	0
4-5	88(32)	44(50)	4(19)	1(11)	88(33)	63(49)	14(35)	3(17)
5-6	97(16)	30(47)	27(45)	7(25)	89(31)	43(50)	4(20)	8(27)
6-7	80(41)	40(50)	35(49)	30(47)	86(36)	19(40)	32(48)	12(33)
7 or more	74(45)	44(50)	38(49)	21(41)	82(39)	56(50)	35(49)	18(39)
Total	85(35)	43(49)	19(40)	8(27)	85(36)	52(50)	18(38)	6(24)

Note. E = Easy, M1 = Moderately challenging 1, M2 = Moderately challenging 2, H = Hard; SDs are in parentheses.

A non-parametric Friedman test of differences among levels was conducted for the number and also for the letter search tasks. There were significant differences among the levels in both cases (number search  $\chi^2(3) = 386.86, p < .001$ ; letter search  $\chi^2(3) = 352.11, p < .001$ ). The mean ranks for the number search task were 3.39, 2.71, 2.08, 1.82, and were for the letter search task 3.43, 2.58, 2.11, 1.88, respectively. All of the possible pair differences were significant at  $p < .001$  for in both tasks (Wilcoxon test z scores for number search task were 7.86, 8.26, 4.73, letter search task 9.82, 6.33, 4.73, respectively.).

Computer Search Competence Scores

As described in the Method section, we derived a search competence score from the computer produced data for each child in each assumed difficulty level for both types of tasks. Table 6 shows the means and standard deviations for the search competence score by child’s age and task difficulty level.

Table 6. Means of the Search Competence at the Search Tasks

Age	Number search				Letter search			
	E	M1	M2	H	E	M1	M2	H
Less than 4	92 (19)	86 (21)	74 (20)	64 (17)	89 (19)	86 (20)	80 (20)	60 (12)
4–5	96 (13)	86 (18)	72 (16)	66 (17)	95 (15)	89 (18)	76 (19)	71 (16)
5–6	99 (06)	84 (18)	80 (19)	66 (17)	97 (08)	87 (18)	69 (17)	72 (16)
6–7	98 (06)	85 (19)	89 (13)	77 (22)	97 (11)	84 (17)	88 (15)	72 (20)
7 or more	97 (09)	89 (17)	85 (18)	85 (19)	98 (06)	93 (12)	83 (20)	76 (22)
Total	96 (13)	86 (18)	78 (19)	69 (19)	95 (13)	88 (18)	77 (19)	70 (17)

Note. E = Easy, M1 = Moderately challenging 1, M2 = Moderately challenging 2, H = Hard; SDs are in parentheses.

Repeated-measures ANOVA for the total sample showed a steep, significant decreasing linear trend; the within-subjects statistics for the total sample for the number search task were:  $F(1, 262) = 497.92, p < .001$ , partial  $\eta^2 = .655$ , and for the letter search were:  $F(1, 238) = 481.83, p < .001$ , partial  $\eta^2 = .669$ . This means that for both tasks the competence scores were lower as the tasks increased in assumed difficulty.

Computer-based Persistence Score at Tasks That Were Actually Moderately Challenging

Table 7 presents the empirically defined levels of actual difficulty for each child, as described in the Method section. The table shows that, based on our definitions, most of the children found the assumed easy and moderate 1 levels to be actually easy. Most of the children found the assumed moderate 2 and the hard tasks to be actually moderately challenging. Few children found any of the tasks to be actually hard, according to the above definition.

Table 7. The Percentage of Tasks of the Four Levels of Assumed Difficulty that Turned Out to be Actually Easy, Moderate, or Hard

Actual difficulty	Number search tasks				Letter search tasks			
	E	M1	M2	H	E	M1	M2	H
Easy	80	55	30	16	77	55	28	15
Moderate	18	43	67	74	23	45	66	79
Hard	2	2	3	10	0	0	6	6

Note. Assumed difficulty levels: E = Easy, M1 = Moderately challenging 1, M2 = Moderately challenging 2, H = Hard.

A child could have 0 to 8 empirically defined actually moderately challenging levels. The percentages of children who had 0 to 8 actually moderately challenging levels were the following: 7%, 8%, 12%, 18%, 18%, 17%, 19%, 7%, and 1%, respectively. Thus, 7% had no moderate tasks, and only 1% of the children found all 8 to be moderate; 72% had between 3 and 6 moderate tasks.

*Examiner Ratings of Persistence and Emotion*

As described in the Method section, the examiner rated the children's task-directed persistence on a 1–5 scale at each level while the child was working on the computer (Figure 1). Based on these ratings, children's persistence was very similar for the letter and the number search tasks; there were no significant differences between them at any of the levels. However, there were steep significant decreases in persistence as the levels got harder. Repeated-measures ANOVA shows significant decreasing linear trends; the within-subjects statistics for the number search task were:  $F(1, 100) = 73.71, p < .001$ , partial  $\eta^2 = .424$ , and in case of the letter search task:  $F(1, 100) = 64.48, p < .001$ , partial  $\eta^2 = .404$ , which indicates that as the tasks get harder, children were rated by the experimenter as spending a lower percentage of their time focused on trying to match the cards correctly. The cubic (two bend) trend was also significant for the number search task ( $F(1, 100) = 5.66, p = .019$ , partial  $\eta^2 = .054$ ). Both the quadratic (one bend) trend ( $F(1, 100) = 13.37, p < .001$ , partial  $\eta^2 = .123$ ), and the cubic trend ( $F(1, 100) = 5.07, p = .027$ , partial  $\eta^2 = .050$ ) were significant for the letter search task ( $F(1, 100) = 5.66, p = .019$ , partial  $\eta^2 = .054$ ). The non-linear trends have much smaller effect sizes ( $\eta^2$ ) than the linear trend.

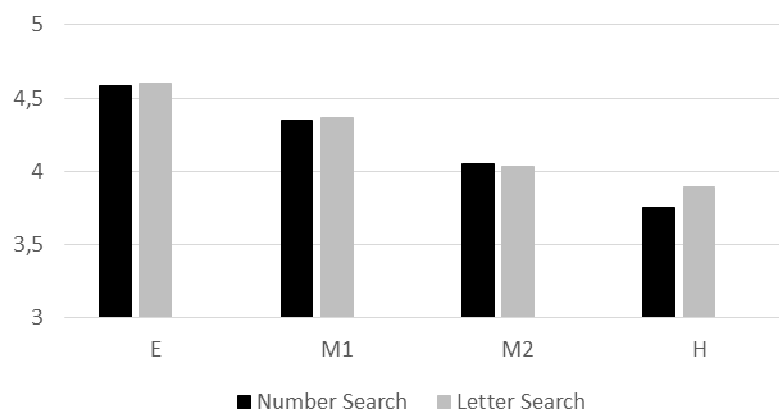


Figure 1. Mean examiner ratings for a 1 to 5 Likert-type scale of persistence at the search tasks assumed to be easy, moderate, and hard. E = assumed easy, M = assumed moderate, H = assumed hard

The examiners also rated the intensity of children's positive and negative emotions on 1–3 scales during each of the four levels (Figure 2). The children did not show very intense emotions. Typically, they showed moderate positive emotions (mastery pleasure), and few children showed any negative emotions.



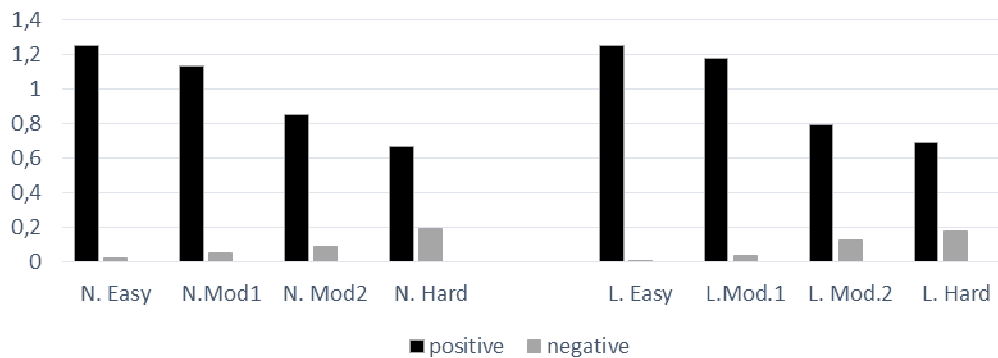


Figure 2. Mean examiner ratings of positive and negative emotion from 1 to 3 on the search tasks assumed to be easy, moderately challenging, and hard. N = number search task, L = letter search task, Mod 1 = 1<sup>st</sup> task assumed to be moderately challenging, Mod 2 = 2<sup>nd</sup>, somewhat hard task assumed to be moderately challenging

Repeated-measures ANOVA showed a significant decreasing linear trend in positive emotions. The within-subjects statistics for the number search were:  $F(1, 100) = 55.64, p < .001$ , partial  $\eta^2 = .260$ , and for the letter search were:  $F(1, 100) = 69.03, p < .001$ , partial  $\eta^2 = .311$ , which indicates that as the assumed level of the task got harder, the children were rated as showing less pleasure while working on it. Repeated-measures ANOVA also showed a significant increasing linear trend in negative emotions. The within-subjects statistics for the number search were:  $F(1, 100) = 12.89, p < .001$ , partial  $\eta^2 = .075$ , and for the letter search were:  $F(1, 100) = 14.88, p < .001$ , partial  $\eta^2 = .089$ , which indicated that children showed somewhat more negative reactions as the task got more difficult.

### Reliability

Cronbach's alpha reliabilities were computed for the three types of measures used in the study: computer-based scores, examiner ratings of the child's behavior as they worked on the computer tasks, and teacher ratings of the child's mastery behavior in the everyday school environment using the DMQ. These reliabilities, shown in Table 8, were calculated using the four task levels assumed to be moderately challenging at each age. All of the values are at least marginally acceptable (above .6, see Gliner, Morgan, & Leech, 2017). Reliabilities of the examiner ratings of persistence and positive emotion and of computer measures of percentage of matching cards and competence on the search tasks were good to excellent; those for negative emotional reaction rated by the examiner and those for computer-based persistence and non-matching cards touched were lower but adequate. Cronbach's alphas for the DMQ scales were generally high (all over .7).

Table 8. Internal Consistency and Correlations between Number and Letter Search Tasks Assumed to be Moderately Challenging

Reliability	Computer measure				Examiner ratings			DMQ		
	TSP	PMC	PNC	CST	EP	EPE	ENE	TCP	TMP	TNR
Cronbach's $\alpha$	.689	.870	.634	.737	.892	.893	.613	.880	.872	.741
NL correlation	.478	.496	.353	.540	.800	.807	.742	-	-	-

Note.  $N = 255$ ; NL correlations of the two assumed number search with the two letter search tasks, TSP = Time spent, persistence on the four tasks assumed to be moderately challenging, PMC = Percentage of matching cards found, PNC = Percentage of non-matching cards touched, CST = Competence on the search tasks, EP = Examiner rating of persistence, EPE = Examiner ratings of positive emotion, ENE = Examiner ratings of negative emotion, TCP = DMQ teachers' ratings of cognitive persistence, TMP = DMQ teachers' ratings of mastery pleasure, TNR = DMQ teachers' ratings of negative reaction to failure.

The number and letter search each included two tasks assumed to be moderately challenging. We computed an average number search and an average letter search score for the computer measures and for the examiner ratings. Thus, we had seven number search and seven letter search variables. Table 8 shows correlations between the number and letter search variables. The correlations were higher for experimenters' ratings (.74 – .81) than for the computer-based data (.35 – .54), but in all cases were significant and at least moderate in size (Cohen, 1988; Leech, Barrett, & Morgan, 2015). These correlations confirm that there was moderate consistency in individual differences in persistence and competence across the letter and number search tasks.

### Validity

Next, we standardized the time spent on each task ( $M = 0$ ,  $SD = 1$ ) separately for each level and each age. The computer persistence score displayed in Table 9 was the mean of the standardized times spent on all empirically-defined, actually moderately challenging levels for that individual child. This individualized moderately challenging computer (IMCC) persistence score was used to examine the validity of the computer-based mastery tasks.

In this study, mastery motivation was measured with three different measures. First, the computer tablets recorded time spent on all of each child's *actually* moderately challenging number and letter search tasks. As described earlier, these times were standardized and used to compute the individualized, moderately challenging, computer (IMCC) persistence score. Second, the examiners rated on-task persistence and emotional reactions during the four tasks assumed to be moderately challenging. Third, before the child did the computer-based assessment, teachers rated the child's mastery motivation using the DMQ. Correlations among these variables are given in Table 9.

Table 9. Correlations among the Different Measures of Task Persistence and Mastery Emotions

Variables	1	2	3	4	5	6
1 IMCC persistence						
2 DMQ persistence	.25**					
3 Ex. rating persistence	.33**	.35**				
4 DMQ mastery pleasure	.19	.53**	.21*			
5 Ex. rating pos. emotion	.40**	.29*	.30**	.29**		
6 DMQ negative reaction	-.13	-.28**	-.07	-.11	.18	
7 Ex. rating neg. emotion	-.47**	-.18	-.42**	-.38**	-.35**	.23*

Note. IMCC persistence = the average time spent on all the computer tasks found to be individually moderately challenging for each child. DMQ = Dimensions of Mastery Questionnaire, Ex. = Examiner. Examiner ratings are based on the four tasks assumed to be moderately challenging; \*  $p < .05$ , \*\*  $p < .01$ .

Persistence on the individualized moderately challenging computer-based tasks was correlated significantly with examiners' persistence ratings and teachers' ratings of DMQ cognitive persistence,  $r = .33$  and  $.25$ , respectively. These correlations provide evidence for the validity of the newly developed computer-based measure. The computer persistence score also was positively correlated (.40) with the child's positive emotions during the tasks rated by the experimenter, and was negatively correlated with the negative emotions rating (-.47). This suggests that children who show more positive and fewer negative emotions on moderately challenging tasks also persist more on moderately challenging tasks, again providing convergent validity for the computer-based measure of mastery motivation.

Teachers' DMQ cognitive persistence ratings were significantly correlated with examiners' rating of persistence on the tasks (.35), supporting the validity of both DMQ and examiner ratings. The significant correlations shown in Table 9 have small to medium effect sizes (Cohen, 1988; Leech et al., 2015).

## Discussion

### Summary of the Results

The results of a face-to-face pilot study of 12 children 4-7 years old and a large study using the computer-tablet tasks with 274 Hungarian children from 3 to 8 years-old support the reliability and validity of our new computer-based measure of mastery motivation (persistence on tasks that are moderately challenging for the individual child), as well as the examiner ratings of children's behavior during the tasks. In the pilot study, the children were assessed for the time spent (persistence) trying to match a target number or letter to an array on a printed page. As the tasks increased in difficulty, the children's time spent trying increased and success rate decreased. These pilot tests indicated that children understood, liked, and persisted at trying to match the letters or numbers, but children also made some errors and younger children were more likely to give up on or not want to try the harder tasks. The pilot study also led to changes and improvements in the method as the computer-based tasks were developed.

The computer-based mastery task study produced interesting results related to the computer's measures of the child's search for matching cards and the experimenter's

ratings of the child's persistence at the tasks and positive and negative emotions during the tasks. Each child was given eight tasks, four number search and four letter search. For each type, the child was presented with one task assumed to be easy, two assumed to be moderately challenging, and one assumed to be hard for a child that age. As the task difficulty increased, the time children spent trying to find all the matching letters or numbers increased in a significant linear way. Similarly, there was a decreasing linear trend in the percentage of cards found for both types of tasks as the assumed level of difficulty increased, and there was an increasing linear trend in errors (i.e., touching a wrong card). Likewise, a measure of the child's competence had a decreasing linear trend for both types of tasks as the difficulty increased.

However, it became evident that for many children, tasks assumed to be moderately difficult were actually easy, and few tasks were actually hard for any of the children. Based on the child's competence score and the time spent trying to find matches, we made an empirical/behavioral definition of tasks we considered to be actually moderately challenging. Then each child was given a persistence score for moderately challenging tasks based on all the letter and number tasks that were found to be actually moderately challenging for that child personally. This was the individualized moderately challenging computer-based persistence score used to assess the validity of the tasks.

It is interesting to note that there was no evidence that older children spent more time searching for matches than did younger children on tasks that were assumed to be hard for each age (see Table 4). However, a higher percentage of older than younger children touched all the matching and none of the non-matching cards (Table 5), suggesting older children may have had more systematic and effective search strategies and/or better inhibitory control. We also collected data on Executive Functions (EF) for the same children; it will be interesting to see if EF is higher for older children and whether age predicts fewer errors and omissions. Similarly, the older children had somewhat higher competence scores (Table 6).

### ***Evidence for Validity of Individualized Moderately Challenging Mastery Measure***

In the current study, there was evidence to support the validity of the individualized computer measure of persistence based on significant correlations with experimenter ratings of persistence of the tasks and ratings of cognitive persistence on the DMQ by teachers. Ratings of positive affect by experimenters were also significantly related to the computer-based persistence measure.

Several other studies have used a somewhat similar individualized approach to measuring mastery motivation using mastery-oriented toys such as puzzles rather than computer tasks. Wang et al. (2016, 2017) also provided support for the validity of individualized moderately challenging tasks based on significant correlations with parent DMQ ratings of object/cognitive persistence and correlations with cognitive and fine motor ability in young children with developmental delays. Wang (2016) also found

that the individualized task persistence scores predicted cognitive and fine motor ability 6 months later, and they mediated the relation between the quality of maternal teaching and later ability.

Gilmore and Cuskelly (2009, 2017) followed 25 4 to 7 year-old children with Down syndrome into adolescence and then young adulthood. At the youngest age (T1), they were assessed with the Morgan et al. (1992) individualized mastery tasks and the DMQ. Evidence for validity was provided by strong contemporaneous correlations of persistence on the tasks with DMQ persistence. More importantly, the T1 individualized mastery tasks predicted T2 reading performance as well as persistence on tasks and DMQ persistence. The 2017 paper reported evidence for the long-term predictive validity of adult adaptive behavior and self-determination from the T1 individualized mastery tasks.

Another study that provided evidence of long-term predictive validity for the individualized moderately challenging mastery tasks is Hauser-Cram, Woodman, and Heyman (2014). They used the Morgan et al. (1992) tasks to assess mastery motivation in 3-year-old children with developmental disabilities. They found that the 3-year-olds who had higher persistence on the individualized mastery motivation tasks performed better on an executive function task as young adults.

Because the current study was cross-sectional, the results did not provide evidence about how these mastery task measures would relate to later school performance. However, other studies using similar individualized, moderately challenging tasks have predicted later behavioral outcomes. This suggests that our computerized tests may predict school performance, which is an ultimate goal for these mastery motivational tasks.

### ***Evidence for Reliability of Scores on Tasks Assumed to be Moderately Challenging***

In the current study, adequate internal consistency reliability was found for the computer measures and for the experimenter ratings of children's behaviors on the tasks. None of the other studies using individualized moderately challenging tasks reported Cronbach alphas, no doubt because they had only 1 or a few such tasks. They did usually report that the different types of task (e.g., puzzles and shape sorters) were significantly correlated, as is true for the current computer-produced data. In the current study, there were four tasks assumed to be moderately challenging so we computed alphas, but four tasks is minimal for computing alphas, which are highly influenced by the number of items. Furthermore, many of those four tasks turned out to actually be easy. Other studies (e.g., Morgan et al. 1992; Wang et al. 2016) have found evidence of good test-retest and interrater reliability from their individualized tasks.

## **Limitations**

A problem with our computer-based persistence scores is that we do not have a direct, computer-based assessment of the time spent actually focusing on and trying to do the task. We do know how much time the child spent before finding all the matching letters and numbers or giving up, which ended the trial. However, it is possible that some time was spent looking around the room or other non-task behaviors. The examiner ratings of on-task behavior somewhat compensated for this problem. We also had only examiner ratings for task-related emotions. In future versions of the computerized assessment, we hope to video-record gaze and facial expressions to better address these issues.

## **Conclusion**

This study used computer tablet number and letter search tasks to assess 3–8 year-old Hungarian children's mastery motivation. A measure of each child's persistence at tasks that were moderately challenging for them, personally, was demonstrated to have construct validity. Future plans include doing longitudinal studies to examine the potential as a school readiness assessment of the whole battery of these tablet tasks, which include measures executive functions and of number and letter recognition.

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## **References**

- Barrett, K. C., Józsa, K., & Morgan, G. A. (2017). New computer-based mastery motivation and executive function tasks for school readiness and school success in 3 to 8 year-old children. *Hungarian Educational Research Journal*, 7(2), 86–105.
- Barrett, K. C., & Morgan, G. A. (1995). Continuities and discontinuities in mastery motivation in infancy and toddlerhood: A conceptualization and review. In R. H. MacTurk, & G. A. Morgan (Eds.), *Mastery motivation: Origins, conceptualizations, and applications* (pp. 67–93). Norwood, NJ: Ablex.
- Busch-Rossnagel, N. A., & Morgan, G. A. (2013). Introduction to section three: Overview and analysis. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook on self-regulatory processes in development: New directions and international perspectives* (pp. 247–264). New York, NY: Psychology Press. <https://doi.org/10.4324/9780203080719.ch12>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*, 2nd ed. Hillsdale, NJ: Erlbaum.
- Gilmore L, & Cuskelly M, (2009). A longitudinal study of motivation and competence in children with Down syndrome: early childhood to early adolescence. *Journal of Intellectual Disability Research*, 53(5), pp. 484–492. <https://doi.org/10.1111/j.1365-2788.2009.01166.x>

- Gilmore, L., & Cuskelly, M. (2011). Observational assessment and maternal reports of motivation in children and adolescents with Down syndrome. *American Association on Intellectual and Developmental Disabilities*, 116(2), 153–164. <https://doi.org/10.1352/1944-7558-116.2.153>
- Gilmore, L., & Cuskelly, M. (2017). Association of child and adolescent mastery motivation and self-regulation with adult outcomes: A longitudinal study of individuals with Down syndrome. *American Journal of Intellectual and Developmental Disability*, 122(3), 235–246. <https://doi.org/10.1352/1944-7558-122.3.235>
- Gilmore, L., Cuskelly, M., & Purdie, N. (2003). Mastery motivation: Stability and predictive validity from ages two to eight. *Early Education and Development*, 14(4), 413–424. [https://doi.org/10.1207/s15566935eed1404\\_2](https://doi.org/10.1207/s15566935eed1404_2)
- Gliner, J. A., Morgan, G. A., & Leech, N. L. (2017). *Research Methods in Applied Settings: An integrated approach to design and analysis* (3rd ed.). New York, NY: Routledge/Taylor & Francis.
- Hauser-Cram, P., Woodman, A. C., & Heyman, M. (2014). Early mastery motivation as a predictor of executive function in young adults with developmental disabilities. *Journal of the American Association on Intellectual and Developmental Disabilities*, 119(6), 536–551. <https://doi.org/10.1352/1944-7588-119.6.536>
- Hwang, A.-W., Wang, J., Józsa, K., Wang, P.-J., Liao, H.-F., & Morgan, G. A. (2017). Cross cultural invariance and comparisons of Hungarian-, Chinese-, and English-speaking preschool children leading to the revised Dimensions of Mastery Questionnaire (DMQ 18). *Hungarian Educational Research Journal*, 7(2), 32–47.
- Józsa, K., & Barrett, K. C. (2017). *Affective and Social Mastery Motivation in Preschool as Predictors of Early School Success: A Longitudinal Study*. (submitted).
- Józsa, K., & Molnár, É. D. (2013). The relationship between mastery motivation, self-regulated learning and school success: A Hungarian and wider European perspective. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook of self-regulatory processes in development: New directions and international perspectives* (pp. 265–304). New York, NY: Psychology Press. <https://doi.org/10.4324/9780203080719.ch13>
- Józsa, K., & Morgan, G. A. (2014). Developmental changes in cognitive persistence and academic achievement between grade 4 and grade 8. *European Journal of Psychology of Education*, 29(3), 521–535. <https://doi.org/10.1007/s10212-014-0211-z>
- Józsa, K., Wang, J., Barrett, K. C., & Morgan, G. A. (2014). Age and cultural differences in self-perceptions of mastery motivation and competence in American, Chinese, and Hungarian school-age children. *Child Development Research*, 2014, Article ID 803061. <https://doi.org/10.1155/2014/803061>
- Leech, N. L., Barrett, K. C., & Morgan, G. A. (2015). *IBM SPSS for intermediate statistics: Use and interpretation* (5th ed.). New York, NY: Routledge/Taylor & Francis.
- MacTurk, R. H., & Morgan, G. A. (Eds.). (1995). *Mastery motivation: Origins, conceptualizations and applications*. Norwood, NJ: Ablex.
- McCall, R. B. (1995). On definitions and measures of mastery motivation. In R. B. MacTurk, & G. A. Morgan (Eds.), *Mastery motivation: Origins, conceptualizations, and applications* (pp. 273–292). Norwood, NJ: Ablex.
- Mercader, J., Presentación, M.-J., Siegenthaler, R., Moliner, V., & Miranda, A. (2017). Motivation and mathematics performance: a longitudinal study in early educational stages. *Revista de Psicodidáctica*, 22(2), 1–14.
- Messer, D. J. (1993). (Ed.). *Mastery motivation in early childhood: Development, measurement and social processes*. NY: Routledge.
- Morgan, G. A., Busch-Rossnagel, N. A., Barrett, K. C., & Wang, J. (2009). *The Dimensions of Mastery Questionnaire (DMQ): A manual about its development, psychometrics and use*. Colorado State University, Fort Collins. Retrieve from <http://mycahs.colostate.edu/George.Morgan/MasteryMotivation.htm>
- Morgan, G. A., Busch-Rossnagel, N. A., Maslin-Cole, C. A., & Harmon, R. J. (1992). *Individualized assessment of mastery motivation: manual for 15 to 36 month old children*. Colorado State University, Fort

- Collins. Retrieve from <https://sites.google.com/a/rams.colostate.edu/georgemorgan/mastery-motivation>
- Morgan, G. A., Harmon, R. J., & Maslin-Cole, C. A. (1990). Mastery motivation: Definition and measurement. *Early Education and Development*, 1(5), 318–339. [https://doi.org/10.1207/s15566935eed0105\\_1](https://doi.org/10.1207/s15566935eed0105_1)
- Morgan, G. A., MacTurk, R. H., & Hrnrcir, E. J. (1995). Mastery motivation: Overview, definitions and conceptual issues. In R. H. MacTurk, & G. A. Morgan (Eds.), *Mastery motivation: origins, conceptualizations and applications* (pp. 1–18). Norwood, NJ: Ablex.
- Morgan, G. A., Wang, J., Liao, H-F., & Xu, Q. (2013). Using the Dimensions of Mastery Questionnaire (DMQ) to assess mastery motivation of English and Chinese speaking children: Psychometrics and implications for self-regulation. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook on self-regulatory processes in development: New directions and international perspectives* (pp. 305–335). New York, NY: Psychology Press. <https://doi.org/10.4324/9780203080719.ch14>
- Shonkoff, J. P., & Phillips, D. A. (2000). *From neurons to neighborhoods: The science of early childhood development*. Washington DC: National Academy Press.
- Wang, J., & Barrett, K. C. (2013). Mastery motivation and self-regulation during early childhood. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook on self-regulatory processes in development: New directions and international perspectives* (pp. 337–380). New York, NY: Psychology Press. <https://doi.org/10.4324/9780203080719.ch15>
- Wang, P.-J. (2016). *Bidirectional Relations among Maternal Interactive Behavior, Mastery Motivation and Developmental Ability in Children with Global Developmental Delay* (Doctoral dissertation).
- Wang, P.-J., Morgan, G. A., Hwang, A.-W., & Liao, H.-F. (2013). Individualized behavioral assessments and maternal ratings of mastery motivation in mental-age matched toddlers with and without motor delays. *Physical Therapy*, 93(1), 79–87. <https://doi.org/10.2522/ptj.20120068>
- Wang, P.-J., Morgan, G. A., Liao, H.-F., Chen, L.-C., Hwang, A.-W., & Lu, L. (2016). Reliability and validity of the revised individualized structured mastery tasks in children with developmental delay. *International Journal of Physical Medicine and Rehabilitation*, 4(6), 374. <https://doi.org/10.4172/2329-9096.1000374>
- Young, J. M., & Hauser-Cram, P. (2006). Mother-child interaction as a predictor of mastery motivation in children with disabilities born preterm. *Journal of Early Intervention*, 28(4), 252–263. <https://doi.org/10.1177/105381510602800402>
- Zelazo, P. D., Blair, C. B., & Willoughby, M. T. (2016). *Executive Function: Implications for Education (NCER 2017-2000)*. Washington, DC: National Center for Education Research, Institute of Education Sciences, U.S. Department of Education.





## Enhancing Persistence on Mastery Tasks Among Young Preschool Children by Implementing the “I Can” Mastery Motivation Classroom Program

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### Abstract

Task persistence plays important role in school readiness and helps to enhance young children’s cognitive development and academic skills; thus, designing and implementing programs to enhance it is vital. The objective of the present research was to assess the effectiveness of the “I Can” mastery motivation classroom program in enhancing young children’s persistence on mastery tasks. Altogether, forty-four (n = 44) children between the ages of two to three years selected from three kindergartens in Malaysia participated in the research, which was conducted by using a randomized pretest and posttest experimental-control group design. Persistence on three mastery tasks and mastery pleasure were assessed by using the Individualized Assessment of Mastery Motivation manual. The experimental group (n = 25) was exposed to the “I Can” mastery motivation classroom program, while the control group (n = 19) attended regular classroom lessons. There was a significant gain score difference between the experimental and control groups on task persistence for puzzles but not for shape sorters, cause and effect toys, and mastery pleasure. Thus, the program was effective in enhancing persistence on some mastery tasks. The content and findings of the intervention should help policy makers understand this important aspect of early childhood education.

**Keywords:** persistence, preschool children, motivation, mastery tasks, structured class room activities, puzzles, shape sorters, cause & effect toys

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## **Introduction**

Looking at the history of scientific discoveries and exploring the personality characteristics of world renowned scientists and inventors, it is revealed that most of them showed one subtle characteristic; i.e., their persistence in solving problems and remaining with it until they achieved their desired solutions. Persistence is also considered as one of the important developmental milestones for young children as they learn to control their impulses to quit working on a task when facing difficulty or initial failure and remain focused until they achieve their goals. Such persistence helps them to enhance their self-efficacy as well. Children who are persistent acquire developmental skills better than those who give up while facing failures. White (1959), while describing the concept of “effectance motivation” suggested that infants’ persistence during play activities showed their desire to affect their environment. He also suggested that infants’ persistence remained stable and thus would predict later competence in various domains of child development. White’s theory about the role of persistence in child development motivated several developmental psychologists to proceed in this direction and explore developmental progressions of infants’ persistent behavior as well as its relationship with child development.

Mokrova, O’Brien, Calkins, Leerkes, and Marcovitch (2013) while studying the relationship between task persistence and academic skill acquisition among kindergarten children, suggested that preschoolers’ persistence on tasks was related to their academic skills two years later over and above early cognitive-linguistic skills as well as demographic factors. They suggested that young children’s task persistence while facing a challenging task could be considered an important aspect of their development in terms of school readiness.

Belsky, Friedman, and Hsieh (2001), while predicting the role of attentional persistence towards children’s school readiness, also found that low attentional persistence (displayed by children with shorter attention span during an unstructured play session) along with high negative emotionality at the age of three, were found to be related to more behavior problems. These children showed less social competence, and perhaps less school readiness as well. Belsky et al. (2001), while discussing the research findings, further suggested that the results might have been different if attentional persistence was high in infancy. Sigman, Cohen, Beckwith, and Topinka (1987) also found that higher levels of task persistence at age two, shown by children spending more time trying to open a box which contained a toy was related to many developmental aspects. These children had higher levels of cognitive skills at the age of five years and also seem to have fewer behavior problems, even when controlling for children’s initial cognitive abilities.

Józsa and Molnár (2013) found an association between persistence and both GPA and test achievement in different school subjects in grade 3 and 6. A longitudinal study by

Józsa and Morgan (2014) also found a significant relation between cognitive persistence in grade 4 and GPA later in grade 8.

Persistence and mastery pleasure have been considered as important components of mastery motivation. Barrett and Morgan (1995), while explaining the concept of mastery motivation, suggested that it has two aspects; the instrumental aspect of mastery motivation is defined as measurable behavior such as remaining persistent when working on a given task, while positive affect such as display of pleasure and pride are affective aspects of mastery motivation. Lewis, Alessandri, and Sullivan, (1992) also stated that children show pride and shame in response to their success or failure while accomplishing a task. Historically, persistence while working on different types of moderately challenging tasks using toys was considered a measure of mastery motivation among young children (MacTurk, Morgan, & Jennings, 1995; Morgan, Busch-Rossnagel, Maslin-Cole, & Harmon, 1992; Dichter-Blancher, Busch-Rossnagel, & Knauf, 1997). Persistence also has been considered an important aspect of emotional regulation and executive functions among young children. According to Eisenberg, Gershoff, Fabes, Shepard, Cumberland, and Losoya (2001), young children's persistence while facing challenges and controlling their frustrations, as well as their compliance with care givers, are part of acquiring emotional self-regulation. Therefore, keeping in mind the importance of persistent behavior for child development outcomes, it is of great importance to develop and implement early childhood programs that can enhance young children task persistence.

### **Early Childhood Programs to Enhance Young Children's Task Persistence**

Task persistence is considered as an important aspect of motivation. Wigfield, Eccles, Schiefele, Roeser, and Davis-Kean (2006) suggested that child's level of persistence and engagement in particular activities can affect a child's performance in these activities. Longer and deeper involvement in a task tends to provide the opportunity to practice existing skills and to acquire new ones; thus, according to them, motivation in early childhood is an important aspect of child development. Based on the work of Wigfield et al., it appears that task persistence contributes directly and indirectly to children's early academic skills and overall development in many domains; therefore, measures should be taken to support and encourage task persistence among young children. Any structured classroom programs or activities to enhance young children's ability to remain persistent on tasks can positively affect their cognitive, motor, and language development. Hauser-Cram (1998) also suggests that teachers can help to encourage mastery motivation among young children by providing moderate choice of activities, encouraging them to learn rather than be correct or incorrect, supporting them, and discussing with parents their children's interests.

On the basis of findings from evidence-based practice, when implementing programs and curriculum with young children, it can be assumed that early childhood programs can help in strengthening and maintaining children's enthusiasm, persistence, and

engagement in learning. Powell, Burchinal, File, and Kontos (2008) found that early childhood programs that use the small groups approach encourage children to engage more actively in the learning process. On the other hand it was also found that children seem to be least engaged during whole group activities. Wigfield, Guthrie, Tonks, and Perencevich (2004) suggested that early childhood programs that integrate across academic or subject matter domains appear to promote children's interest, motivation, and persistence. Hyson (2008) also found that learning programs that foster choice, independence, and appropriate levels of challenge can help to enhance children's motivation, which in turn can improve their persistence. Thus findings from these earlier researchers were integrated into the "I Can" mastery motivation classroom program evaluated in this article.

Looking at most of existing programs that are designed to provide services to children, we can see that the focus of these programs is usually on children who are at risk for of facing various biological or demographic challenges such as poverty, low socio-economic status, health-related issues, or combinations of these problems. There is less focus on the children who do not have these problems; however, children without these types of social problems also need services to enhance their basic learning-related skills, such as persistence, attention, and focus, which are needed for school readiness. Therefore, the present research is aimed at determining the efficacy of the "I Can" mastery motivation classroom program developed by Hashmi, Seok, & Halik (2014) used to enhance persistence on mastery tasks among preschool children with the objective that every child should have access to quality care and programs. The purpose of the "I Can" mastery motivation classroom program was to promote the importance of task persistence among young children. It has five modules based on the Dimensions of Mastery Questionnaire developed by Morgan, Busch-Rossnagel, Barrett, and Wang (2009). These modules are (1) object oriented (cognitive) persistence, (2) gross motor persistence, (3) social persistence with adults, (4) social persistence with peers/children, and (5) mastery pleasure. During the present research, each module was implemented for three weeks in the form of structured lesson plans using 10 age appropriate classroom activities. It was assumed that involvement in the "I Can" mastery motivation classroom program would enhance young children's persistence while working on moderately challenging puzzles, shape sorters, and cause and effect toys.

## **Method**

### ***Research Design***

The present research was conducted as a randomized pre and post experimental-control group design. After conducting assessments of task persistence and mastery pleasure during the pre experimental stage, the intervention based on the "I Can" mastery motivation classroom program was administered. The program was implemented for fifteen (15) weeks. Post experimental assessments of task persistence and mastery

pleasure were carried out after program implementation by a tester who was “blind” to whether the participating child was in the experimental or control group.

### **Participants and Procedures**

All the participants of the present research, which consisted of 44 children between ages of two to three years, were selected from three kindergartens around the urban areas of Kota Kinabalu, Sabah State in Malaysia. The kindergartens were similar in terms of services and facilities as well as the curriculum they used. The child-teacher ratio was also similar. After considering geographic factors such as proximity and parents socio-economic status, the three kindergartens were identified as suitable to conduct the present research. Once kindergarten personnel agreed to cooperate, they were given a briefing about the flow of the research. Children were screened to determine whether they met criteria for inclusion in the research, which were: the child was developing typically and was between ages 2 and 3. Brief information about the research in the form of pamphlets were distributed to parents. Mothers along with their children were seen for a first meeting of approximately 30 minutes to explain the objectives, methodology, duration and materials of the research. Mothers were informed that all testing procedures as well as other materials used during research were safe and consisted of age-appropriate educational toys. Mothers were also asked to sign informed consent forms and were assured that all the information about their child obtained during research was to be only used for academic purposes and would not be released to anyone. Based on the required age range, 47 children were selected to take part in the present research. After getting informed consent, each participating child at the three different locations was randomly assigned to either the experimental ( $n=26$ ) or the control group ( $n=21$ ), with deliberate over-assignment to the experimental group (Figure 1).

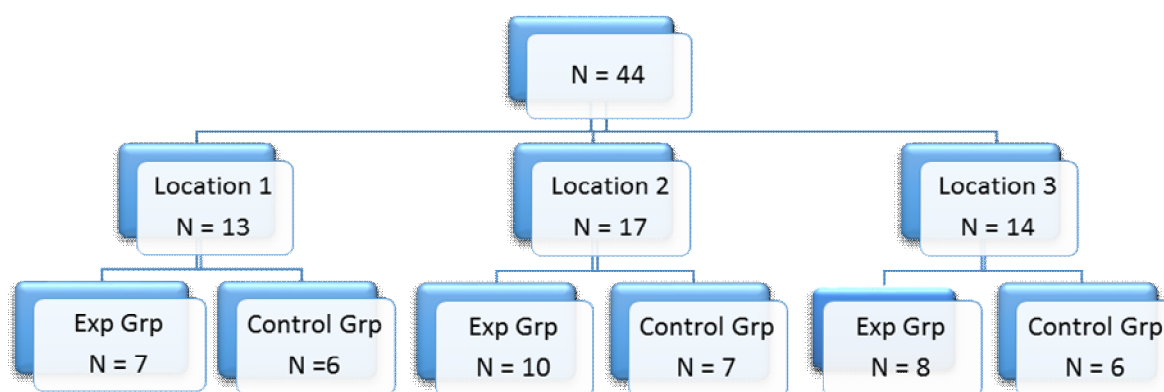


Figure 1. Number of participants randomly allocated to the experimental and control group at each location.

It took 5 months to complete data collection (including pre experimental assessment, intervention phase, post experimental assessment); 3 cases were dropouts (1 family moved to other state, 1 mother went on maternity leave so the child missed many days of kindergarten, and 1 family moved to another neighborhood so they changed kindergartens). Therefore, the remaining number of participating children was 44; the

experimental group having 25 and the control group having 19 participants. The children were individually assigned to the experimental group or control group from all three locations regardless of scores attained for task persistence during the pre experimental condition.

### ***Measurement of Task Persistence and Mastery Pleasure***

The Individualized Assessment of Mastery motivation Manual for 15-36 months old children developed by Morgan et al. (1992) was used to assess children's level of task persistence and mastery pleasure during the pre experimental and post experimental stages. Structured play activities in a test-like situation were used with the objectives that (a) the tasks presented were moderately challenging to the individual child, (b) the child was able to engage in the task directed behavior without interference for an extended period of time, and (c) the total amount of time the child was involved in task directed behavior was recorded (Morgan et al., 1992). The assessment used three types of toys; i.e. puzzles, shape sorters, and cause and effect toys. The toys included four wooden puzzle boards, arranged from 1-4 according to the level of difficulty, four sets of shape sorters, also arranged from 1-4 according to the level of difficulty, and four cause and effect toys. However, after the pilot study, the level 1 wooden puzzles which included interchangeable circles was removed as it was found to be very easy for children. Persistence at tasks was rated in every 15 second time block during the four minutes period on each toy assumed to be at appropriately challenging levels of task difficulty. The possible score range of task persistence was 1- 16 for each toy. To determine the appropriate level of task difficulty, criteria suggested by Morgan et al. (1992) for moderately challenging tasks were adopted. Moderately challenging tasks were operationally defined as tasks for which the child solved at least one part within 120 seconds, but did not complete all components within that same time. The coding procedure suggested in the Individualized Assessment of Mastery Motivation Manual was used. Live coding was done on target behaviors as is suggested by the manual (Morgan et al., 1992).

Mastery pleasure and positive affect displayed while achieving a solution to moderately challenging tasks were also measured. Behaviors displayed by children such as showing excitement, laughing, smiling and "high-five" were recorded only when successfully completing the mastery task so the range was 0-1 for mastery pleasure. The administration and scoring in the Individualized Assessment of Mastery Motivation Manual to assess task persistence and mastery pleasure involved categorical measurement of child behavior on a given task; thus, the inter-rater reliability was determined by using Cohen's Kappa Value (Cohen, 1960). Reliabilities were calculated from independent scoring by a second observer during a pilot study, pre experimental assessment, and post experimental evaluation. According to Fleiss (1981), Kappa values > .60 are considered acceptable. Table 1 presents the Cohen's Kappa values for task persistence and mastery pleasure.

Table 1. Cohen's K inter rater reliability values for task persistence

Scales	Pilot study Cohen's K	Actual study Cohen's K
Task persistence	0.70	0.72
Puzzles	0.71	0.77
Shape sorters	0.70	0.73
Cause and effect toys	0.69	0.68
Mastery Pleasure	0.82	0.75

### Description of the "I Can" Mastery Motivation Classroom Program

The experimental group was taught using the lesson plans designed by the researcher based on the "I Can" mastery motivation classroom program resource manual for fifteen (15) weeks, while the control group had typical lesson plans designed by the kindergartens. As shown in Table 2, the intervention module included fifteen 2-hour structured lessons, three times a week, divided into five modules. Each module was repeated three times, so it took fifteen (15) weeks to complete the intervention phase.

Table 2. "I Can" mastery motivation class room program module specifications and implementation

Program Modules	Module	Lesson	Week
Object oriented persistence	1	1,2,3	1, 6, 11
Gross motor persistence	2	4,5,6	2, 7, 12
Social persistence with adults	3	7,8,9	3, 8, 13
Social persistence with children	4	10,11,12	4, 9, 14
Mastery pleasure	5	13,14,15	5, 10, 15

The "I Can" mastery motivation classroom program was implemented by one research assistant who was trained to implement the intervention module along with the kindergarten teachers. The intervention phase was conducted in different rooms for the experimental and control groups.

Programs such as the Incredible Years, Dina Dinosaur child training program developed by Webster-Stratton (2002), Social Skills in Pictures, Stories, and Songs developed by Serna, Nielson and Forness (2007), and Al's Pals developed by Wingspan (1999) were used as guidelines to design the overall lesson plans, the activities, and the length of each lesson as well as the duration of the whole "I Can" mastery motivation classroom program. Guidelines suggested in "Developmentally appropriate practice in early childhood programs serving children from birth through age 8," a position statement of the National Association for the Education of Young Children (2009), was also used to plan the activities and lesson plans of the "I Can" mastery motivation class room program.

The "I Can" mastery motivation classroom program has five modules based on the Dimensions of Mastery Questionnaire developed by Morgan et al. (2009). An activity from each module is described next; during each activity, teachers and the research assistants provided verbal prompts, praise, and small rewards for the children's efforts to complete the task and to remain persistent. The object-oriented persistence module used an activity such as sorting and matching where children were provided with plastic

buttons, straws, plastic shapes, and 3 small buckets into which they sorted and matched objects based on shape, color and size. The gross motor persistence module used an activity such as animal walk (slither like snake, hop like a bunny rabbit and spring like a kangaroo) on a 20 feet long zigzag trail made with tape on the floor. The social persistence with adults' module used an activity such as circle time with hand puppets, where children engaged in conversation with the teachers for a longer-than-usual time period about their puppet. The social persistence with children module used an activity such as hand games (hot cross bun, pat a cake); hula hoops were used to create a space for each pair of children, so that each pair can sit inside their individual space and play with that friend. The mastery pleasure module used an activity such as treasure hunt where the children were asked to hunt for the hidden toys in places in the room which were easily accessible to children. Each lesson plan also included other types of activities such as completing the puzzles, singing, table tasks, story time, and getting active time. Some activities in the "I Can" mastery motivation classroom program were carried out in small groups of 3-4 children in a group, and in some other activities children worked individually. Table 3 is a brief summary of the focus and goals of the "I Can" mastery motivation classroom program.

Table 3. "I Can" mastery motivation classroom program modules

Program Modules	Focus	Goals
Object oriented persistence	Attempt to master the task, work for a longer time, keep repeating new skills, and task completion	Children will learn how to remain focused and persistent on a task
Gross motor persistence	Encouraging and involving children in gross motor activities and repeating motor skills	Children will learn how to remain focused and persistent while working on gross motor activities.
Social persistence with adults	Encouraging and involving children to develop social persistence while interacting with adults.	Children will learn how to remain focused and persistent while interacting with adults.
Social persistence with children	Encouraging and involving children to develop social persistence while interacting with children.	Children will learn how to cooperate with each other to work as a team and remain focused and persistent while interacting with children.
Mastery pleasure	Encouraging positive affect such as smiling and clapping hands after completing a task or when he or she makes something happen.	Children will learn to relate positive affect with mastery and task completion

### Content validity of the "I Can" Mastery Motivation Classroom Program

The program manual was sent to two experts in field of child psychology to review and evaluate the content validity of the program. They were asked to assess whether the "I Can" mastery motivation classroom program to enhance task persistence among young children provides appropriate and adequate lessons, modules and materials. Both external evaluators reported that the program manual was well structured, the contents were appropriate, instructions were easy to follow, and the goals set were achievable.



## Data Analysis

Data collected were analyzed using SPSS. Inferential statistics (i.e., independent t tests) were used to determine gain scores differences in task persistence and mastery pleasure between the experimental and control groups.

## Results

### Demographic Information

The participants of the present study were 44 children who were physically healthy and were considered to be achieving normal developmental milestones. Gender, age and ethnic distribution of the participants are given below (See Table 4).

As expected, because children were randomly assign to the groups, there was no significant difference between the experimental and control groups on task persistence for puzzles ( $t = .98, p = .33$ ), shape sorters ( $t = 1.93, p = .06$ ), cause and effect toys ( $t = .31, p = .76$ ) and mastery pleasure ( $t = -.58, p = .56$ ).

Table 4. Demographic Information about Children in the Experimental ( $n = 25$ ) and Control Groups ( $n = 19$ )

Variables	Experimental group		Control group	
	Frequency	Percentage	Frequency	Percentage
<b>Gender</b>				
Male	11	44	9	47.4
Female	14	56	10	52.6
<b>Age</b>				
24-30 months	14	56	12	63.2
31- 36 months	11	44	7	36.8
<b>Ethnic</b>				
Malay	7	28	4	21.1
Chinese	2	8	1	5.3
Others	13	52	13	68.4
Indians	3	12	1	5.3

The effect of participation in the “I Can” mastery motivation classroom program on children’s task persistence and mastery pleasure was determined by calculating the gain scores (posttest minus pretest), which were analyzed using the  $t$  test to compare the gains of intervention vs. control. Table 5 shows that the increase in task persistence on puzzles was greater for participants in the intervention condition, with a large  $d$  effect size. Although the gain score differences for shape sorters and cause and effect tasks were not significant, the  $d$  effect sizes were between medium and small (Cohen, 1988). There was no difference for mastery pleasure and the effect size was essentially zero, so it was very small (Table 5).

Table 5. Mean, Standard Deviations, and Gain Score Differences for the Experimental Group ( $n = 25$ ) and the Control Group ( $n = 19$ ) During Pre Experimental and Post Experimental Conditions

Variable	Groups	Pretest	Post test	Gain Score	$t$	$p$	$d$
		Mean (SD)	Mean (SD)	Mean (SD)			
Puzzles	Experimental	11.72(1.81)	13.56(1.83)	1.84 (1.46)	3.38	.002	1.05
	Control	11.21(1.54)	11.68(1.63)	0.47(1.12)			
Shape sorters	Experimental	12.08(1.84)	12.64(1.47)	0.56(2.21)	1.00	.323	0.31
	Control	11.11(1.37)	11.10(1.14)	0.01(1.15)			
Cause and effect toys	Experimental	11.68(1.77)	13.36(1.72)	1.68(2.05)	1.11	.273	0.34
	Control	11.53(1.38)	12.57(1.53)	1.04(1.54)			
Mastery Pleasure	Experimental	2.48(0.87)	2.60(0.86)	0.12(1.01)	.044	.965	0.01
	Control	2.63(0.83)	2.84(0.95)	0.21(1.19)			

## Discussion

The present research attempted to determine the effectiveness of “I Can” mastery motivation classroom program. The major features of the program were a structured classroom environment, pre-planned age-appropriate lessons and activities, support of caring adults, appropriate feedback and use of reward when children displayed task persistent behaviors, as well as opportunities to work independently some times and cooperatively at other times. “I Can” mastery motivation classroom program has five modules which address different dimensions of mastery motivation and persistence including object-oriented persistence, gross motor persistence, social persistence with adults, social persistence with children, and mastery pleasure. However, due to lack of reliable behavioral measures to assess gross motor persistence, social persistence with adults and social persistence with children, only persistence at object-oriented tasks and mastery pleasure were measured during the pre and post experimental condition.

During the present research, only individualized mastery tasks were used to measure children mastery motivation and mastery pleasure; however, as suggested by Morgan, Józsa and Liao (2017), if possible, researchers interested in assessing mastery motivation among children should use both behavioral measures and the Dimensions of Mastery Questionnaire (Józsa & Morgan, 2015; Morgan et al., 2015; Morgan, Liao, Nyitrai et al., 2017) for better research outcomes.

It was hypothesized that the “I Can” mastery motivation classroom program would help children achieve the goals set for the target population. Based on the results of the current study, children in the experimental group who attended the “I Can” mastery motivation classroom program showed better gain score task persistence on puzzles compared with the control group. No significant gain score difference was found between the two groups on shape sorters, cause and effect toys, or on mastery pleasure. However, the  $d$  effect sizes for shape sorters and cause and effect tasks were medium to

small, so with larger samples it is possible that there also would be significant improvement on these tasks as well as on puzzles.

Puzzles pose more challenging problems than the cause and effect toys, which may be why intervention was more effective with them. The battery operated cause and effect toys were less challenging and were popular with most children from both the experimental and control groups who showed similar amounts of interest, task persistence and mastery pleasure while working on them. During program implementation, it was observed that children were able to grasp the concept of persistence and motivation. They were able to understand the concept that if they keep on trying to solve some problem, such as a puzzle, they might end up solving it correctly. Some of the children who early in the program had difficulty controlling the urge to quit while working on a challenging task seem to have somewhat overcome their tendency to quit towards the end of the program. Therefore, it seems that the "I Can" mastery motivation classroom program was effective in enhancing task persistence among young children at least on some tasks. As for mastery pleasure, it was found that the "I Can" mastery motivation classroom program was not effective in improving it. Children in both the experimental and control group displayed similar mastery pleasure related behaviors in post experimental condition. Observations also revealed that more excitement, and positive affect was displayed by children during both pre and post experimental conditions while working on cause and effect toys compared to puzzles and shape sorters.

The findings of the present research also suggest that systematic efforts to enhance children's task persistence can be successful. Young children can be encouraged to be more persistent if we provide an appropriate environment and activities. These findings are supported by various earlier researchers such as Malakoff et al. (1998), who studied the influence of inner city environment and an early Head Start program on persistence on challenging tasks and the intrinsic motivation of 78 preschoolers. They found the program to be effective with an effect size of 0.38. Note that this effect size is similar to that found for the shape sorters and cause and effect toys in the "I Can" mastery motivation classroom program intervention, but the early Head Start program results were significant because of the larger sample. The Head Start children showed greater curiosity, were more likely to select challenging tasks, worked more independently and persistently on tasks, and were more interested in the type of symbolic rewards typically used in school than children who were waitlisted and had not attended the head start program.

In another study, Bryant et al. (2002), while exploring the effects of Smart Start child care on kindergarten entry skills including motivation to learn, found that the program was effective with an effect size of 0.34. Although this motivation study found promising results for a classroom intervention for kindergarten children, few researchers have focused on the influence of this type of intervention program on the psychological and behavioral responses of the young children below the age of 3 years.

Wang et al. (2013) explored mastery motivation in toddlers with and without motor delays and found out that when given moderately challenging tasks, toddlers with motor delay did not show lower persistence and mastery pleasure when compared to toddlers without motor delays. Their finding about mastery motivation and persistence can help clinicians and therapists to design suitable intervention plans for young children with motor delays.

The first five years of life are considered most critical to a child's lifelong development by many prominent researchers. Shonkoff and Phillips (2000) suggested that during the first few years of life, children rapidly develop the social, emotional, behavioral and cognitive capacities that provide the foundation for their future development. It is during this crucial period that young children acquire the skills that are necessary for healthy growth and development, setting the stage for later success in school and life. Kagan, Moore, and Bredekamp (1995), while suggesting five dimensions of school readiness, also emphasized on one of the dimensions; which they described as approaches towards learning. It referred to behaviors that facilitate learning process such as creativity, cooperativeness, independence, and persistence. Learning process start early before any formal education; therefore, efforts to enhance and facilitate learning-related behaviors such as motivation and task persistence can have long lasting positive effects on child development and their school readiness. While observing the process of human development, we can see that children are different in their approaches towards the learning process and overall learning-related behaviors, even in the early stages of development. These differences in overall learning related behaviors can have an influence on children's school readiness as well as their overall success in school. According to National Center for Education Statistics (2001), motivated children who start school with positive attitude such as eagerness and willingness to learn, tend to perform better in academics, and also seem to have better reading and mathematics skills compared to their less motivated peers.

The work of earlier researchers supports the findings of the present research that the early childhood programs designed to achieve positive developmental goals can be effective provided that the programs have achievable objectives. The "I Can" mastery motivation classroom program was designed with the objectives of providing children with the opportunity to maintain focus and persistence on the tasks, and having teachers' provide quick feedback about children's involvement in the activities.

The constructivist framework can be used to understand the demonstrated increase in task persistence levels on puzzles for children who attended the "I Can" mastery motivation classroom program. This framework holds that children should be actively involved in the learning process during early years. Applying this narrative, we can say that young children must engage actively in the learning process to ensure that effective learning takes place. Persistence is considered an important aspect of motivation, therefore, programs targeted to enhance motivation can improve young children's persistence.

In addition to the structured lesson plans used to implement the “I Can” mastery motivation classroom program, another important aspect of the program was the role of teachers. As suggested in the “I Can” mastery motivation classroom program resource manual, teachers and early childhood educators can be trained in five-day workshops to understand the concept of mastery motivation and its implications for child development outcomes. Educators also can learn other aspects of the program, such as promoting mastery motivation among young children and implementing the modules suggested in the resource manual of the program in order to enhance mastery motivation among young children. The findings of the present research suggest that the “I Can” mastery motivation classroom program was only partially effective in enhancing task persistence and mastery motivation among young children. However, the small number of participants and limited age range of participating children are the issues that need to be dealt with when considering improvements in the efficacy of the program and future evaluations of it.

## **Conclusion**

Based on the findings of present research, we can infer that structured classroom activities can be used to promote learning-related skills such as persistence and motivation among children. The structured environment provided during the implementation of the “I Can” mastery motivation classroom program helped in achieving the goals planned for the program. Moreover, early childhood programs and interventions of high quality have been shown to have lasting effects on the learning and motivation of the young children. Quality care and early childhood programs can help children to develop many learning-related skills that can facilitate their learning processes later on. Therefore, steps should be taken to provide children with the appropriate programs to enhance their motivation and learning related behavior at young age. The findings of the present research can help policy makers consider important aspects of early childhood education and use these findings to form guidelines for developmentally appropriate practice.

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## **References**

- Barrett, K. C., & Morgan, G. A. (1995). Continuities and discontinuities in mastery motivation during infancy and toddlerhood: A conceptualization and review. In R. H. MacTurk, & G. A. Morgan (Eds.), *Mastery motivation: Origins, conceptualizations, and applications* (pp. 57–94). Norwood, NJ: Ablex Publishing Corporation.

- Belsky, J., Friedman, S. L., & Hsieh, K. H. (2001). Testing a core emotion-regulation prediction: Does early attentional persistence moderate the effect of infant negative emotionality on later development? *Child Development*, 72(1), 123–133. <https://doi.org/10.1111/1467-8624.00269>
- Bryant, D., Bernier, K., Peisner-Feinberg, E., & Maxwell, K. (2002). *Smart Start and Child Care in North Carolina: Effects on quality and changes over time*. Chapel Hill, NC: Frank Porter Graham Child Development Institute.
- Cohen, J. (1960). A coefficient of agreement for nominal scales. *Educational and Psychological Measurement*, 20(1), 37–46. <https://doi.org/10.1177/001316446002000104>
- Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences*, 2nd Edition. Hillsdale: Lawrence Erlbaum.
- Dichter-Blancher, T. B., Busch-Rossnagel, N. A., & Knauf-Jensen, D. E. (1997). Mastery motivation: Appropriate tasks for toddlers. *Infant Behavior and Development*, 20(4), 545–548. [https://doi.org/10.1016/S0163-6383\(97\)90043-6](https://doi.org/10.1016/S0163-6383(97)90043-6)
- Eisenberg, N., Gershoff, E. T., Fabes, R. A., Shepard, S. A., Cumberland, A. J., & Losoya, S. H. (2001). Mothers' emotional expressivity and children's behavior problems and social competence: Mediation through children's self-regulation. *Developmental Psychology*, 37(4), 475–490. <https://doi.org/10.1037/0012-1649.37.4.475>
- Fleiss, J. L. (1981). *Statistical methods for rates and proportions*. 2nd ed. New York: John Wiley.
- Hashmi, S. I., Seok, C. B., & Halik, M. (2014). "I Can", "I Will Try Again And Again Because I Know I Can Do It". Resource Manual. <https://www.mediafire.com/?xjuab4a58uu086g>
- Hauser-Cram, P. (1998). I think I can, I think I can: Understanding and encouraging mastery motivation in young children. *Young Children*, 53(4), 67–71.
- Hyson, M. (2008). *Enthusiastic and engaged learners: Approaches to learning in the early childhood classroom*. New York: Teachers College Press and Washington, DC: NAEYC.
- Józsa, K., & Molnár, É. D. (2013). The relationship between mastery motivation, self-regulated learning and school success: A Hungarian and European perspective. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook on self-regulatory processes in development: New directions and international perspectives* (pp. 265–304). New York, NY: Psychology Press. <https://doi.org/10.4324/9780203080719.ch13>
- Józsa, K., & Morgan, G. A. (2015). An improved measure of mastery motivation: Reliability and validity of the Dimensions of Mastery Questionnaire (DMQ 18) for preschool children. *Hungarian Educational Research Journal*, 5(4), 87–103. <https://doi.org/10.14413/HERJ2015.04.08>
- Józsa, K., & Morgan, G. A. (2014). Developmental changes in cognitive persistence and academic achievement between grade 4 and grade 8. *European Journal of Psychology of Education*, 29(3), 521–535. <https://doi.org/10.1007/s10212-014-0211-z>
- Kagan, S. L., Moore, E., & Bredekamp, S. (Eds.) (1995). *Reconsidering children's early learning and development: Toward shared beliefs and vocabulary*. Washington, DC: National Education Goals Panel.
- Lewis, M., Alessandri, S., & Sullivan, M. W. (1992). Differences in shame and pride as a function of children's gender and task difficulty. *Child Development*, 63(3), 630–638. <https://doi.org/10.2307/1131351>
- MacTurk, R. B., Morgan, G. A., & Jennings, K. D. (1995). Assessment of mastery motivation in infants and young children. In R. B. MacTurk, & G. A. Morgan (Eds.), *Mastery motivation: Origins, conceptualizations, and applications* (pp. 19–56). Norwood, NJ: Ablex.
- Malakoff, M. E., Underhill, M., & Zigler, E. (1998). Influence of inner-city environment and Head Start experience on effectance motivation. *American Journal of Orthopsychiatry*, 68(4), 630–638. <https://doi.org/10.1037/h0080371>
- Mokrova, I., O'Brien, M., Calkins, S. D., Leerkes, E. M., & Marcovitch, S. (2013). The role of persistence at preschool age in academic skills at kindergarten. *European Journal of Psychology of Education*, 28(4), 1495–1503. <https://doi.org/10.1007/s10212-013-0177-2>

- Morgan, G. A., Józsa, K., & Liao, H.-F. (2017). Introduction to the HERJ special issue on mastery motivation: Measures and results across cultures and ages. *Hungarian Educational Research Journal*, 7(2), 5–14.
- Morgan, G. A., Busch-Rossnagel, N. A., Barrett, K. C., & Wang, J. (2009). *The Dimensions of Mastery Questionnaire (DMQ): A manual about its development, psychometrics and use*. Retrieved from <http://www.mycchs.colostate.edu/george.morgan/MasteryMotivation.html>.
- Morgan, G. A., Busch-Rossnagel, N. A., Maslin-Cole, C. A., & Harmon, R. J. (1992). *Mastery motivation tasks: Manual for 15- to 36- month-old children*. Bronx, NJ: Fordham University, Psychology Department.
- Morgan, G. A., Liao, H.-F., Nyitrai, Á., Huang, S.-Y., Wang, P.-J., Blasco, P., Ramakrishnan, J., & Józsa, K. (2017). The Revised Dimensions of Mastery Questionnaire (DMQ 18) for infants and preschool children with and without risks or delays in Hungary, Taiwan, and the US. *Hungarian Educational Research Journal*, 7(2), 48–67.
- Morgan, G. A., Wang, J., Barrett, K. C., Liao, H.-F., Wang, P.-J., Huang, S.-Y., & Józsa, K. (2015). *The Revised Dimensions of Mastery Questionnaire (DMQ 18)*. <https://sites.google.com/a/rams.colostate.edu/georgemorgan/mastery-motivation>
- National Association for the Education of Young Children (2009). *Developmentally Appropriate Practice in Early Childhood Programs Serving Children from Birth through Age 8. Position statement*. Retrieved from <http://www.naeyc.org/files/naeyc/file/positions/PSDAP.pdf>
- National Center for Education Statistics (2001). *Children's reading and mathematics achievement in kindergarten and first grade*. Washington, DC: Author. Online: <https://nces.ed.gov/pubs2002/kindergarten/24.asp>
- Powell, D. R., Burchinal, M., File, N., & Kontos, S. (2008). An eco-behavioral analysis of children's engagement in urban public school pre-school classrooms. *Early Childhood Research Quarterly*, 23(1), 108–123. <https://doi.org/10.1016/j.ecresq.2007.04.001>
- Serna, L., Nielsen, M., & Forness, S. (2007). *Social skills in pictures, stories, and songs. A multisensory program for preschool and early elementary students*. Champaign, IL: Research Press.
- Shonkoff, J. P., & Phillips, D. A. (2000). *From neurons to neighborhoods: The science of early childhood development*. Washington DC: National Academy Press.
- Sigman, M., Cohen, S. E., Beckwith, L., & Topinka, C. (1987). Task persistence in 2-year-old preterm infants in relation to subsequent attentiveness and intelligence. *Infant Behavior and Development*, 10(3), 295–305. [https://doi.org/10.1016/0163-6383\(87\)90018-X](https://doi.org/10.1016/0163-6383(87)90018-X)
- Wang, P.-J., Morgan, G. A., Hwang, A.-W., & Liao, H.-F. (2013). Individualized behavioral assessments and maternal ratings of mastery motivation in mental-age matched toddlers with and without motor delays. *Physical Therapy*, 93(1), 79–87. <https://doi.org/10.2522/ptj.20120068>
- Webster-Stratton, C. (2002). *Effective classroom management skills training and Dina dinosaur's social skills and problem-solving curriculum training for the classroom: Leader's guide*. Seattle, WA: Incredible Years.
- White, R. (1959). Motivation reconsidered: The concept of competence. *Psychological Review*, 66(5), 297–333. <https://doi.org/10.1037/h0040934>
- Wigfield, A., Eccles, J. S., Schiefele, U., Roeser, R. W., & Davis-Kean, P. (2006). Development of achievement motivation. In W. Damon, R. Lerner, & N. Eisenberg (Eds.), *Handbook of child psychology: Vol. 3. Social, emotional, and personality development* (6th ed., pp. 933–1002). New York: Wiley.
- Wigfield, A., Guthrie, J. T., Tonks, S., & Perencevich, K. C. (2004). Children's motivation for reading: Domain specificity and instructional influences. *Journal of Educational Research*, 97(6), 299–309. <https://doi.org/10.3200/JOER.97.6.299-310>
- Wingspan, L. L. C. (1999). *Al's pals: Kids making healthy choices*. Richmond, VA: Author.



## Patterns of Mastery Task Behavior in Early School-Age Children in the United States

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### Abstract

This investigation employed a person-oriented approach to explore whether distinct mastery motivation groups are identifiable based on patterns of children's mastery task behaviors (MTBs) in 64 typically developing students ages 7 and 10 years. Relationships among MTBs, mastery motivation ratings, and intrinsic motivation ratings were analyzed using secondary data. Measures included mastery tasks, mother and teacher ratings of the child on the Dimensions of Mastery Questionnaire (DMQ), and two intrinsic motivation subscales (preferences for challenge and independent mastery) rated by teachers. Goals included investigating (a) whether distinct group-case profiles of MTBs would emerge from the data, and (b) to what extent these profiles can be predicted by teacher and mother ratings. A four-cluster solution resulted in the best, interpretable model fit. The four profiles were: 1) Consistently high MTBs, 2) Moderately high MTBs, 3) Inconsistent MTBs, and 4) Lowest MTBs. Mother-rated DMQ object persistence scores effectively predicted children's categorization into mastery task behavior Profiles 1 and 2 (high and moderate MTBs) with Profile 4 as the comparison. Teachers' ratings of independent mastery predicted categorization into Profile 2 over Profile 4. Findings have implications for classroom intervention using small group activities based on profile patterns to support mastery motivation.

**Keywords:** motivation, persistence, elementary school students, mastery tasks, intrinsic motivation, person-oriented approach

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## Introduction

The purpose of this study was to employ a person-oriented approach to exploring whether distinct mastery motivation groups or profiles may be identified based on children's observed patterns of mastery task behaviors assessed in a home setting. This study represents a secondary analysis using data from an earlier study. Measures used in this secondary analysis included individually administered structured behavioral mastery tasks, mother and teacher ratings using the Dimensions of Mastery Questionnaire (DMQ-17; Morgan, 1997), and two subscales from the teacher-rated Harter's Intrinsic versus Extrinsic Motivation In the Classroom Scales (Harter Intrinsic Motivation; Harter, 1981). The current analysis was intended to identify profiles of mastery task behaviors and whether variation in profiles may be predicted by mother and teacher DMQ ratings and by teacher ratings of children's intrinsic motivation observed in the classroom.

### *Parent and Teacher Perceptions and Children's Mastery Task Behavior*

Mastery motivation is an inherent force that stimulates a person to attempt to master a skill or task that is at least moderately challenging for them (Morgan, Harmon, & Maslin-Cole, 1990). Parent and teacher DMQ ratings were validated using observed measures of children's mastery task behavior (e.g., Morgan, Busch-Rossnagel, Barrett, & Wang, 2009); however, it is less clear how these ratings may be related to specific patterns of children's mastery task behaviors. Correlations between parents and teachers on the scales of the DMQ (median  $r = .42$ ) tended to be stronger than those of either parent or teacher with child self-reports (median  $r = .18$ ). All these raters particularly agreed on the child's gross motor persistence, social mastery/persistence with other children and mastery pleasure. In a previous study, Morgan and Bartholomew (1998), found non-statistically significant associations between mastery task behavior and the summary maternal DMQ ratings. Small correlations, for instance, were found between maternal DMQ total persistence with behavioral task persistence scores ( $r = .23$ ) and with choice for challenge ( $r = .15$ ). Parent and Teacher DMQ total mastery motivation ratings (i.e., total persistence plus mastery pleasure) were not correlated with the children's mastery task behaviors (e.g., persistence and choice for challenge).

While the results were unexpected, there were some concerns over ceiling effects on the mastery tasks that may have affected the results. It thus raised the question about whether there were alternative ways of examining children's mastery task behavior scores in conjunction with the DMQ. The current analysis allows for an investigation of mastery task behavior in a more child-centered context, meaning how children performed on the variety of task measures together could be examined in concert rather than individually as variables (e.g., scores of mastery task persistence). In other words, instead of correlating DMQ scores with, for example, mastery task persistence alone, this study examined mother- and teacher-rated scores in association with an array children's mastery task behaviors combined into meaningful patterns.

### ***A Person-Oriented Approach to Examining Mastery Task Behaviors***

Studies have indicated that children's mastery motivation may vary across age (e.g., Barrett & Morgan, 1995), contexts (e.g., culture, socio-economic status, parenting practices; e.g., Józsa, Wang, Barrett, & Morgan, 2014), and domains (e.g., gross motor/sports, cognitive/academic; Józsa et al., 2014). Individual differences in mastery motivation are also acknowledged as important because of their link to later learning and achievement (Barrett & Morgan, 1995; Turner & Johnson, 2003). Individual differences, however, may be treated as error in variable-oriented statistical analyses (Raufelder, Jagenow, Hoferichter, & Drury, 2013).

A majority of mastery motivation studies use a variable-oriented approach. This means that associations among constructs have been examined in the context of means (or other central tendencies) of a variable, looking at variation in how certain variables impact outcomes. What has not been investigated is how these strengths or challenge aspects within this drive interact within an individual to tell a more complex story. They also provide little information with respect to how groups of individuals may exhibit similar patterns or attributes.

Using a person-oriented approach differs from a variable-oriented approach in that it allows for the interplay of individual children's experiences (in this case with regard to their mastery task behaviors). It can also provide an understanding of the relative proportions of children experiencing a given data-identified pattern of behaviors (see Bergman & Magnusson, 1997 and Raufelder et al., 2013). This approach can be helpful for answering questions around group differences in patterns of mastery motivation. Person-oriented approaches analyze the individuals' patterns of experience that emerge from the combined variables of interest. Individuals who share similar patterns of experience or attributes naturally form subgroups that differ from each other (Bergman & Magnusson, 1997).

Employing a person-oriented approach may provide a deeper understanding of how mastery motivation is differentially experienced by children. This may yield a potentially greater opportunity to examine how observed mastery task behaviors may manifest in meaningful and distinct mastery behavior profiles. Testing a theoretical model of mastery motivation, Turner & Johnson (2003) discussed how motivational patterns may develop early as a function of family variables, but the complexity and prevalence of those motivational patterns are not well-defined. In terms of practical implications, Hauser-Cram (1998) discussed how children's motivation can vary in different contexts and that it presents an opportunity to explore how teachers can encourage display of mastery motivation in the classroom or other educational settings. The revelation of patterns of mastery task behaviors may provide clearer guidance, for example, in how teachers provide individual- and group-level instructional support.

As an educational program evaluation tool, the person-oriented approach has advantages over a variable-oriented approach which results in more global estimates of intervention effects. A variable-oriented study may potentially mask efficacy of an intervention even when there is a rigorous control or comparison group (Lapka, Wagner, Schober, Grading, & Spiel, 2011). The person-oriented approach allows for evaluation of program results with deeper consideration to differences (heterogeneity) *within* the intervention group. This information may help teachers understand intervention outcomes for different groups of children in a variety of educational settings. Then, they may learn how to more appropriately individualize and refine their efforts to support children's development in the future. More effective interventions intended to boost children's approaches to learning (such as mastery motivation behaviors) can be created with children's group differences in mind.

### ***Mastery Task Behavior Profiles and Classroom Readiness-to-Learn***

Mastery motivation is an established predictor of kindergarten and later school success (Gilmore, Cuskelly, & Purdie, 2003; Józsa & Molnár, 2013; Turner & Johnson, 2003). Mokrova, O'Brien, Calkins, Leerkes, and Marcovitch (2013), for example, found kindergarten effects on math and literacy predicted by their early persistence. No doubt mastery motivation is a precursor of achievement motivation (Dichter-Blancher, Knauf-Jensen, & Busch-Rossnagel, 1996; Morgan & Yang, 1995). Certainly, mastery motivation is closely related to other readiness-to-learn indicators, such as executive function, intrinsic motivation, and other cognitive abilities. This, then, warrants a closer look at teacher perceptions and support of children's learning-related behaviors. Lee (2014), for instance, found that children's early mastery motivation was linked to memory and problem solving executive functions in the first grade. Some evidence exists related to the persistence of these effects into later elementary grades. For example, Józsa and Molnár (2013) found links between mastery motivation and both grade-point average (GPA) and achievement in specific subjects for third and sixth grade students.

It has become increasingly clear that many factors contribute to children's ability to learn and progress in school aside from pure cognitive capacity. Specifically improving understanding of the links among assessments of mastery motivation, children's demonstrations of mastery behaviors, and ratings of their school behaviors may lead to the development of motivation-enhancing supports. Such supports can be helpful in early childhood settings as a part of school readiness interventions preparing children for elementary school. Keilty and Freund (2004) made specific recommendations regarding interventions with mastery motivation to enhance the learning process. These included adjusting the difficulty level of tasks to increase goal orientation and modeling goal achievement. Ricks (2012) also explored teacher instructional practices linked to the development of mastery motivation in relation to mathematics achievement in kindergarten and beyond. She found that teachers' student-centered approaches (in which early childhood students were encouraged to be involved in their own learning

processes) were, overall, more effective than teacher-centered practices in fostering mastery motivation.

Effective instructional strategies to support growth in mastery motivation, however, may not be one-size-fits-all (Lapka et al., 2011). Children may need more individualized support through one-on-one or small group activities in the classroom. The purpose of the person-oriented approach is not to identify that every child has his/her own type; instead the aim is to learn how children are similar or how they differ from others and in what respects (Bergman, Magnusson, & El-Khoury, 2003). Understanding whether groups of children within a classroom have similar needs related to the development of mastery motivation would help direct teachers' intentionality in classroom practice. They could more appropriately design individual, small group, or full classroom interventions.

The original Morgan and Bartholomew (1998) study used the teachers' rating of children's general competence from the DMQ and intrinsic motivation (Harter, 1981) as criteria of readiness-to-learn (i.e., potential for school success). DMQ and mastery task behaviors were examined as predictors. The current analyses expand on those findings to better understand the complexity of mastery motivation development using a new analytic approach. In addition, it is possible these findings may help identify improved measurement strategies to increase relevance to the skills children need in school (e.g., Józsa, Barrett, Józsa, Kis, & Morgan, 2017).

The goals of this research were to investigate (a) whether distinct group-case profiles of mastery task behavior would emerge from the mastery task data, and (b) to what extent mastery task behavior profiles can be predicted by mother- and teacher-rated DMQ persistence subscales, and by teacher ratings of school classroom behaviors demonstrating intrinsic motivation.

## **Method**

### ***Participants***

The 64 participants were mostly middle class and Caucasian, living in a middle-sized city in the Western United States. The sample was comprised of 31 boys and 33 girls with typical development who were approximately seven and 10 years old. Three out of the 64 children were racial minorities. Five were from working class families, 39 were middle class, and 20 were upper middle class.

### ***Measures***

#### ***Mastery Tasks***

Four sets of individualized mastery tasks were developed for the original study. Scores were based on observations of the child's behaviors while attempting to solve the tasks within the context of the home setting. The four types or sets of tasks were: (a) spatial

matching (several puzzles of increasing complexity), (b) goal formation (Tower of Hanoi; difficulty increased by the number of required moves of the blocks), (c) fine motor (e.g., pinball; several small toys requiring hand rotation of the object to guide ball through a maze), and (d) gross motor (ring toss; difficulty level increased by lengthening distance required to throw). Each set had five levels of difficulty, varying from an easy level that all 7-year olds could solve in 1 minute to a very hard level that no 10-year old could solve completely in 5 minutes.

Each child was first given a task from each of the four sets that was relatively easy for them. This allowed us to estimate their skill/competence and to provide them with a sense of accomplishment. Then, the child was given a level of the task intended to be moderately challenging but somewhat too hard for him or her to complete *fully* in 5 minutes. The children were told that they could stop working on the task whenever they wanted. This challenging task was judged to be appropriately challenging if the child could solve part of it, but not all of it, in 5 minutes. If the child successfully completed all of a challenging task in less than 5 minutes, he/she was also given the next harder task. A behavioral measure of persistence was based on the duration of the children's *persistence at each moderately challenging task*, plus an adjustment of up to 2 minutes if they finished the challenging task in five minutes or less. Reliability correlations for two observers scoring 10 children was 1.00 (Spearman rho) for the persistence measures (mean scores range from 1 to 7).

After 5 minutes, the tester asked if the child would now like an easier task, a harder task, or continue with the same task. The child was asked this to obtain a measure of *choice for challenge*. Reliability for choice for challenge was 1.00 (mean scores range from 1 to 3).

In addition to the persistence and choice for challenge scores coded during mastery tasks, an overall ratings of negative reactions was made by the tester after each home visit on a 5-point Likert-type scale (i.e., 1 *very low* to 5 *very high*). The reliability correlation for the negative reaction to challenge rating on 10 children was .80.

#### *Dimensions of Mastery Questionnaire (DMQ)*

The DMQ (DMQ-17; Morgan, 1997) has been used extensively for school-age children as well as infants and preschool children (Józsa & Molnár, 2013; Morgan, Wang, Liao, & Xu, 2013). Mothers and teachers rated the children on the DMQ-17 school-age version (Morgan, 1997; Morgan et al., 2009, 2013). The survey contain 45 items and seven scales. The items are rated on a 1 to 5 point scale (i.e., 1 is *not at all typical* to 5 *very typical*). The DMQ has four persistence/mastery motivation scales. Two of them, cognitive persistence and motor persistence, were used in this study. In addition, the DMQ provided measures of mastery pleasure, negative reaction to challenge, and general competence.

Internal consistency of these scales was very good for mothers and teachers of these elementary school children; alphas ranged from .76 to .92, with a median of .88. In other studies, alphas have been generally good for parent and teacher/caregiver ratings of infants and preschoolers (Morgan et al., 2013) and also for teen self-ratings (Józsa & Molnár, 2013).

Factor analyses for large, more diverse (in geography, age, and ethnicity) groups of parents and of children/teens support the grouping of items into the four persistence and the mastery pleasure domains (Józsa et al., 2014; Morgan et al., 2013). Factor analysis of parent responses was clean and consistent with the 5-factor model. However, factor analysis for self-ratings by children themselves is somewhat less clear, but still provides considerable support for the factorial validity of these five domains.

Scale scores for the current sample were moderately related. In general, the five persistence and the pleasure scale scores were less highly correlated for the mother ratings (median  $r = .20$ ) than for teacher ratings (median  $r = .37$ ). The object persistence scale was highly correlated with competence, for teachers ( $r = .77$ ) and mothers ( $r = .61$ ) who seem to view cognitive/object persistence and general competence as highly related.

#### *Harter's Intrinsic Versus Extrinsic Motivation in the Classroom Scale*

Teachers completed child ratings using two of the subscales from Harter's (1981) Intrinsic versus Extrinsic Motivation in the Classroom measure (Harter Intrinsic Motivation). The two scales were *preference for challenge* (examining the extent to which select hard or difficult tasks compared with easy tasks) and *independent mastery* (assessing how children may prefer to work on their own or to seek support to accomplish tasks). These were rated on a four-point scale where 1 is low and 4 is high on the subscale items. An overall mean score for each of the two scales is computed to derive the subscale totals. Two validity samples showed the two subscales as distinct constructs, yet moderately correlated ( $r = .48$  and  $.61$ ) with internal consistency reported at  $r = .78$  to  $.84$  for preference for challenge and  $r = .68$  to  $.82$  for the independent mastery subscale (Harter, 1981).

#### **Procedures**

The DMQ, four mastery tasks (cognitive/spatial puzzles, fine motor tasks, cognitive/goal formation activities, and gross motor tasks), and other surveys were administered in the children's homes (see Bartholomew & Morgan, 1997). Teachers were sent the Harter Intrinsic Motivation scale and asked to return it by postal mail to the researcher.

#### **Data Analysis**

This study represents a secondary analysis using data from an earlier study (Morgan & Bartholomew, 1998). Four mastery task behavior variables were used in this analysis.

They were cognitive persistence (mean across the two cognitive tasks, possible scores ranged from 1 to 7), motor persistence (mean across the two motor tasks, possible scores range from 1 to 7), choice for challenge (mean across all tasks, possible score ranges from 1 to 3) and negative reaction to failure (Likert-type rating, possible scores range from 1 to 5). Means for negative reaction to failure were reversed to indicate a lack of negative reaction, this way they could be interpreted in the same way (high=good) as the other variables. The cognitive persistence score was calculated as the average of the persistence score of the spatial matching task and goal formation task (possible mean score range from 1 to 7). Motor persistence score was the average of the persistence score of the fine motor and gross motor task (possible scores ranged from 1 to 7).

The DMQ variables used in this study were mother-rated and teacher-rated scores on the object persistence and the gross motor persistence subscales (possible means ranged from 1 to 5 for each scale), intended to align with the two persistence mastery task behaviors above. The two Harter Intrinsic Motivation variables were preference for challenge and independent mastery (possible means ranged from 1 to 4 for each scale). Please see Table 1 for means and standard deviations. Correlations among the four mastery task behaviors, the DMQ, and the Harter measures are provided in Table 2.

Another experimenter-rated mastery task behavior variable linked to the affect component of mastery motivation, “pleasure at hard tasks”, was omitted from the analyses. Because of the lack of variability in children’s pleasure response to difficult tasks, it was determined that it would not be able to support distinguishing cases into groups. Instead, the affect-related mastery motivation aspect was captured using the reversed negative reaction to failure variable.

A person-oriented analytic approach was used to identify profiles of mastery task behavior based on data from individually administered mastery tasks. Person-oriented approaches empirically identify discrete groups or profiles (among children in this case) that share similar patterns based on correlation among multiple indicators (Hagenaars & McCutcheon, 2002). For this secondary analytic study, two-step cluster analysis was used to identify interpretable groups based on children’s mastery task behaviors. Cluster analysis is a form of classification that uses the data to identify two or more profiles based on their within group similarities and their between group differences (Kaufman & Rousseeuw, 1990).

Identifying profiles is an exploratory process to identify the most accurate division of the cases into clusters and, for this study, cluster quality was gauged on (1) conceptual interpretability of the clusters, (2) comparison of cluster quality across models, and (3) assessment of cluster quality using the silhouette coefficient which represents a combination of cluster cohesion (how closely related are cases within clusters) and separation (how distinct cases are from cases in other clusters). The coefficients range

from -1 to 1 where values at .5 or higher indicate good cluster quality, while those below .2 indicate a lack of cluster structure (Kaufman & Rousseeuw, 1990).

The hypothesis was that a three-cluster solution would best identify groups based on their mastery task behavior (MTB) data, indicating roughly corresponding to groups labeled as “high MTB”, “inconsistent MTB”, and “low MTB”. Two- and four-profile solutions were also planned as comparisons for assessing cluster quality.

Multinomial logistic regression was used to predict cluster classification from the mother- and teacher-rated mastery motivation total scores derived from the DMQ, as well as from the teacher intrinsic motivation scores. This is a flexible and robust method used to predict categorical dependent variables (e.g., cluster membership) when there are more than two levels (Pohar, Blas, & Turk, 2004). The technique uses a maximum likelihood estimation instead of the traditional regression least squares estimation. This analysis examined whether mother or teacher ratings were predictive of the likelihood of a child being in a certain cluster versus another (reference group).

In this case, the analysis yields odds-ratios to reveal the likelihood of mastery task behavior group membership as a function of mother- or teacher-rated mastery motivation variables. An odds-ratio of 1, for example, indicates that scores do not predict membership in a particular mastery task behavior group, while greater than 1 indicates increased likelihood compared with reference group, and less than 1 means the predictor is associated with lower odds of being in a specified group other than the reference group. No age or gender covariates were used in the predictive models since few significant gender or age differences were found in the prior study (Morgan & Bartholomew, 1998).

## Results

### *Preliminary Analysis*

Total group descriptive statistics were computed for each of the MTB variables to be clustered and for the other analytic variables used in the logistic regressions (Table 1).

*Table 1. Descriptive statistics of Mastery Task Behaviors (MTB), DMQ Mastery Motivation Ratings, and Teacher-rated Preference for Challenge and Independent Mastery (n=64)*

Measures	<i>M</i>	<i>SD</i>	Range
MTB - cognitive persistence	5.77	1.10	1.0-7.0
MTB - motor persistence	5.67	1.24	1.5-7.0
MTB - choice for challenge	1.85	0.48	1.0-3.0
MTB - negative reaction to failure (reversed)	3.91	0.90	2.0-5.0
DMQ - mother-rated object persistence	3.66	0.66	1.9-4.8
DMQ - mother-rated gross motor persistence	3.78	0.83	2.3-5.0
DMQ - teacher-rated object persistence	3.71	0.73	2.3-4.9
DMQ - teacher-rated gross motor persistence	3.52	0.68	1.3-5.0
Harter - preference for challenge	2.74	0.70	1.0-4.0
Harter - independent mastery	2.75	0.80	1.0-4.0



Correlations among the study measures are presented in Table 2. Low to moderate correlations were found among the mastery task behavior scores, except for no relation between choice for challenge and negative reaction to failure. Among the MTBs, children’s cognitive persistence was most highly related to their motor persistence. Mother and teacher-rated cognitive persistence and intrinsic motivation were significantly associated with children’s cognitive persistence on tasks. Mother and teacher-rated motor persistence and intrinsic motivation were not significantly related to children’s motor persistence on tasks. Mother-rated object persistence on the DMQ was significantly associated with all other mother- and teacher-rated measures.

Table 2. Pearson Correlations among Mastery Task Behaviors (MTB), DMQ Mastery Motivation Ratings, and Teacher-rated Preference for Challenge and Independent Mastery (n=64)

Measures	1	2	3	4	5	6	7	8	9
MTB - cognitive persistence	-								
MTB - motor persistence	.48**	-							
MTB - choice for challenge	.21	.29*	-						
MTB - negative reaction to failure <sup>a</sup>	.38**	.28*	.04	-					
DMQ - mother-rated object persistence	.42**	.14	.15	.31*	-				
DMQ - mother-rated gross motor persistence	.21	.24	.27*	.10	.37**	-			
DMQ - teacher-rated object persistence	.28*	-.04	.12	.27	.57**	-.03	-		
DMQ - teacher-rated gross motor persistence	.23	-.05	.25	.15	.34*	.30*	.41**	-	
Harter - preference for challenge	.33*	.04	.04	.07	.42**	-.12	.74**	.25	-
Harter - independent mastery	.30*	.19	.24	.08	.28*	-.18	.54**	.18	.66**

<sup>a</sup> reversed; \* $p < .05$ , \*\* $p < .01$

### Identification and Description of MTB Profiles

A key stage in the analysis was to identify any discernable group profiles within the full data set. The two-step clustering process involved the use of standardized scores from each of the MTB-related variables (cognitive persistence, motor persistence, choice for challenge, and negative reaction to failure). Standardized scores (Z-scores) were calculated by subtracting the group mean from each of the individual scores and dividing the result by the standard deviation. The scaling of variables may influence their contribution to the final solution, thus all measures were standardized to the same metric ( $M = 0$ ,  $SD = 1$ ) as shown in the lower half of Table 3. This process also allowed for more interpretable profiles, and they could be graphed together to look at high-low patterns for each group.

While two-cluster and three-cluster solutions were conceptually interpretable, they were of “fair” quality (.4) with regard to SPSS’s measure of cluster quality (i.e., silhouette measure of cohesion and separation). Profile means and standard deviations (unstandardized scale and standardized) are provided in Table 3.

Table 3. Means and Standardized Means (standard deviations) for Variables Representing the Four-cluster Solution

Mastery task behaviors (MTBs)	Profile 1 Consistently high MTBs	Profile 2 Moderately high MTBs	Profile 3 Inconsistent MTBs	Profile 4 Lowest MTBs
Cognitive persistence	6.54 (0.38)	6.10 (0.81)	5.38 (0.58)	4.50 (1.27)
Motor persistence	6.62 (0.36)	6.05 (0.78)	4.75 (1.17)	4.42 (1.46)
Choice for challenge	2.06 (0.36)	2.00 (0.30)	1.19 (0.18)	1.71 (0.64)
Negative reaction to failure <sup>a</sup>	5.00 (0.00)	3.73 (0.45)	4.75 (0.46)	2.69 (0.48)
Cognitive persistence (Standardized)	.697 (0.35)	.297 (0.74)	-.363 (0.53)	-1.160 (1.16)
Motor persistence (Standardized)	.760 (0.29)	.304 (0.63)	-.743 (0.94)	-1.006 (1.17)
Choice for challenge (Standardized)	.432 (0.75)	.311 (0.63)	-1.391 (0.37)	-.293 (1.35)
Negative reaction to failure <sup>a</sup> (Standardized)	1.211 (0.00)	-.191 (0.50)	.933 (0.51)	-1.343 (0.53)

<sup>a</sup> Reversed

Contrary to the hypothesis, and compared with the other models, the four-cluster solution (see Figure 1) was the best fit resulting in “good” cluster quality (.5) and yielding interpretable groups as follows:

1. “Consistently high MTBs” profile with 13 (20.3%) of cases fit this profile, cases were approaching ceiling for cognitive and motor persistence, had high scores for selecting challenging tasks, and the cluster contained no cases with negative reactions to failure;
2. “Moderately high MTBs” profile with 30 (46.9%) of cases fitting this pattern. Yielded high cognitive and motor persistence, likely to select challenging tasks, but more likely than profile 1 to display a negative reaction to failure;

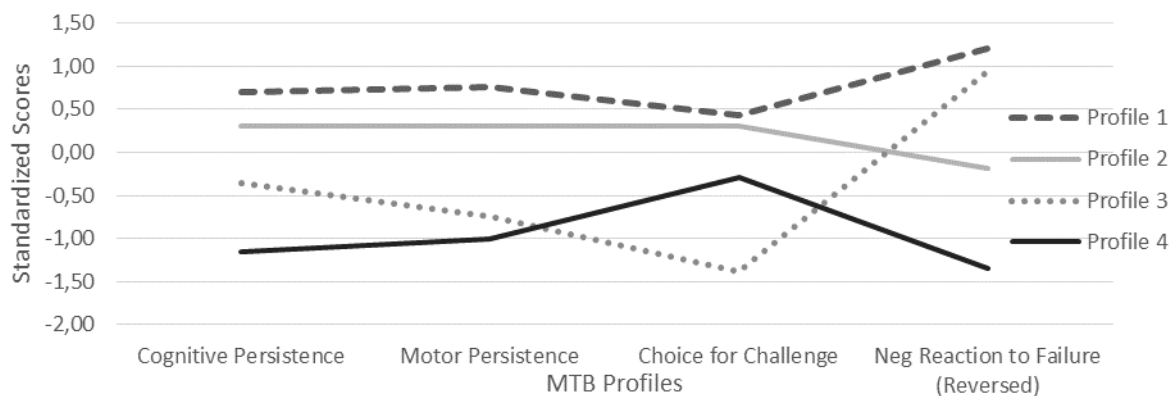


Figure 1. Mastery task behavior (MTBs) profiles for a - four-cluster solution using standardized scores. Note: Profile 1 = Consistently high MTBs Profile; Profile 2 = Moderately high MTBs Profile; Profile 3 = Inconsistent MTBs Profile; Profile 4 = Lowest MTBs Profile.

3. “Inconsistent MTBs” profile comprised of 8 (12.5%) of cases in which there was moderate cognitive persistence, slightly lower motor persistence, low choice for challenge, but little negative reaction to failure, and;
4. “Lowest MTBs” profile consisted of 13 (20.3%) of cases and describes as the cases with the lowest scores in cognitive and motor persistence, inconsistent choice for challenge, and the greatest likelihood of the profiles to show negative reaction to failure.

## Predicting MTB Profiles from Mother and Teacher DMQ Ratings

Multinomial logistic regression was conducted to examine the extent to which mother and teacher ratings on the DMQ predicted the likelihood of being in a certain profile compared with a reference group (in these analyses Profile 4, the “lowest MTBs” profile was selected as the reference group). The analysis yields odds ratios describing how a one-point increase on the predictor variable impacts the likelihood of classification into a particular profile. Parameter estimates are provided in Table 4. Results using the predictors showed that children in Profile 1 (consistently high MTBs), were over six times more likely to be classified into Profile 1 than in Profile 4 for every one-point increase on the mother-rated DMQ object persistence subscale. Results also showed that cases in Profile 2 were 3.8 times more likely to be included in Profile 2 than 4 for every one-point increase on the object persistence scale. Mother-rated gross motor persistence and the two teacher-rated subscales did not predict profile classification.

In sum, mother-rated DMQ object persistence scores effectively predicted children’s categorization into two of the mastery task behavior profiles. Neither mother-rated gross motor persistence nor teacher ratings predicted classification of child cases into MTB profiles.

Table 4. Multinomial Logistic Regression Estimates with Mother- and Teacher-rated DMQ Persistence Scores as Predictors and Using Profile 4 as the Reference Group

Variable	Profile 1			Profile 2			Profile 3		
	<i>B</i>	<i>SE</i>	O.R.	<i>B</i>	<i>SE</i>	O.R.	<i>B</i>	<i>SE</i>	O.R.
Intercept	-6.96	2.71	-	-3.85	1.94	-	-2.68	2.35	-
Mother object persistence	1.86*	.729	6.402	1.34*	.553	3.803	.653	.675	1.922
Intercept	-2.89	1.94	-	-1.38	1.56	-	-.453	1.99	-
Mother gross motor persistence	.772	.505	2.164	.600	.420	1.821	-.009	.558	.991
Intercept	-2.39	2.42	-	-.250	1.88	-	-2.40	2.75	-
Teacher object persistence	.647	.641	1.909	.323	.514	1.381	.515	.713	1.674
Intercept	-3.63	2.73	-	.534	2.03	-	-1.13	2.82	-
Teacher gross motor persistence	1.04	.745	2.818	.143	.585	1.153	.211	.805	1.234

\* $p < .05$ , \*\* $p < .01$

## Predicting MTB Profiles with Harter’s Intrinsic Versus Extrinsic Motivation In the Classroom Scale

The extent to which the two intrinsic motivation subscales (preference for challenge and independent mastery,  $r = .66^{**}$ ) predicted MTB profiles was also examined using multinomial logistic regression. The Harter preference for challenge subscale scores did not predict an increased likelihood of membership in Profiles 1, 2, or 3 compared with Profile 4. However, cases in Profile 2 were nearly 5 times as likely to be classified into Profile 2 compared with 4 for every one-point increase on the independent mastery subscale. Independent mastery did not predict increased likelihood of membership in Profile 1 or 3 relative to Profile 4 in these analyses.

Table 5. Multinomial Logistic Regression Estimates with Teacher-rated Preference for Challenge and Independent Mastery as Predictors and Profile 4 as the Reference Group

Variable	Profile 1			Profile 2			Profile 3		
	<i>B</i>	<i>SE</i>	O.R.	<i>B</i>	<i>SE</i>	O.R.	<i>B</i>	<i>SE</i>	O.R.
Intercept	-.638	1.397	-	-.635	1.235	-	-2.666	1.978	-
Preference for challenge	.282	.518	1.325	.587	.453	1.799	.757	.680	2.131
Intercept	-1.973	1.670	-	-3.308	1.641	-	-.606	1.760	-
Independent mastery	.815	.638	2.260	1.579*	.612	4.852	.000	.722	1.000

\* $p < .05$ , \*\* $p < .01$ 

In sum, children's likelihood of membership in Profile 2 (compared with Profile 4) was significantly predicted by teacher-rated scores on the independent mastery subscale. Children were 4.9 times more likely of being categorized into Profile 2 than in 4 for every one-point increase on the independent mastery subscale. Preference for challenge scores did not significantly predict increased likelihood of being in any profile compared with Profile 4. Also, no association was observed for Profile 3 with the more inconsistent pattern of MTBs with either Harter measure.

## Discussion

The person-based approach yielded different information regarding the association of MTBs with the DMQ and Harter's intrinsic motivation scales than did the original study. Namely, for the whole sample, MTB variable *means* represented moderate levels of mastery motivation, while the cluster analysis used in this study yielded MTB *profiles* showed meaningful variations of patterns of MTB behaviors. These profiles indicated differences among and within groups of children in their pattern of MTBs. These classifications could imply how prepared they are to learn and contribute to their ultimate academic success.

Considering mother-rated object persistence and teacher-rated independent mastery as significant predictors of membership in certain profiles supports partial validity of this categorization. Perhaps more useful for teachers in understanding children's grouping into potential MTB profiles, may be the future inclusion of other child demographic variables or family data collected by schools or programs as predictors. For instance, understanding whether the families' socio-economic status or dual language learner status influences children's patterns of mastery task behaviors in the classroom may have practical, in-the-classroom salience.

In terms of the lack of significant predictors of Profile 3 classification relative to Profile 4, it is possible the subsample was too small. The issue could be that the low frequency of cases assigned to Profile 3 contributed to under-powering the analysis. The low frequency, in and of itself, is not grounds for eliminating the category of students, however. The composition of the group is valid in the same sense that the numbers of students in a classroom with other developmental challenges or delays may be low. Understanding who comprises these low-frequency groups may be especially important when considering appropriate interventions for students with high neEds.

Even with a fairly homogeneous sample such as this, (and MTB tasks prone to ceiling effects), discernable profiles emerged. Thus, in further studies with larger, more diverse samples, the findings could reveal more subgroups or subgroups with different patterns of observed mastery task behaviors. Clearly, the small sample size is a limitation of this study, particularly as the group sizes get smaller with classification. In addition, greater accuracy in profiling would be possible with larger samples. Then, one could use stronger analytic techniques such as latent class analysis, which is the preferred method for person-oriented analyses. Latent class analysis offers more precise statistics for assessing model fit than does cluster analysis.

Another way to strengthen categorization into mastery motivation profiles would be to increase the number and type of mastery motivation variables and data sources in the modeling. A greater variety of variables in the cluster or latent class modeling may improve the power and precision in identifying similarities and differences within groups of children. Another limitation of these findings was that these data were comprised of children 7 and 10 years old. It is unknown whether there may be developmental or age differences in the prediction of a child's mastery task behavior profile, and, while it was not a focus of this study given the small sample size, it would be helpful to address in future studies of this sort.

Given that distinct interpretable group profiles emerged, the findings from this study suggest that differential classroom educational strategies for enhancing mastery motivation may be helpful based on these groups. Considering that some groups of children may not already possess good or consistent foundational cross-domain skills in persistence and motivation, they may require different instructional or developmental supports compared with those who do. School instructional teams could craft more effective individualized or small group-based interventions for children to influence the cultivation of mastery motivation with the knowledge of their profile categorization or exhibited mastery task "style".

## **Conclusion**

Using cluster analysis with children's mastery task behavior data, child cases were able to be grouped into four different interpretable profiles. These included consistently high MTBs, moderately high MTBs, inconsistent MTBs, and lowest MTBs groups. These profiles illustrate the interplay of children's mastery task behaviors using four aspects of this motivation (cognitive persistence, motor persistence, negative reaction to failure, and their choice for challenging tasks). The question of whether mother or teacher-rated measures of children mastery motivation could predict classification into the different profiles was explored. The discovery was that mother-rated cognitive persistence was an effective predictor of membership in Profile 1 ("consistently high MTBs") rather than into Profile 4 (i.e., the reference group, lowest MTBs profile). Children were also more likely to be classified into Profile 2 than into Profile 4. In addition, teacher ratings of

Harter's independent mastery subscale scores significantly predicted children's classification into Profile 2 rather than into Profile 4.

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## References

- Barrett, K. C., & Morgan, G. A. (1995). Continuities and discontinuities in mastery motivation in infancy and toddlerhood: A conceptualization and review. In R. H. MacTurk, & G. A. Morgan (Eds.), *Mastery motivation: Origins, conceptualizations, and applications* (pp. 67–93). Norwood, NJ: Ablex.
- Bartholomew, S., & Morgan, G. A. (1997). *School-aged home visit procedures and scoring manual*. Unpublished document, Colorado State University, School of Education.
- Bergman, L. R., & Magnusson, D. (1997). A person-oriented approach in research on developmental psychopathology. *Development and Psychopathology*, 9(2), 291–319.  
<https://doi.org/10.1017/S095457949700206X>
- Bergman, L. R., Magnusson, D., & El-Khoury, B. M. (2003). *Studying individual development in an interindividual context: A person-oriented approach*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Dichter-Blancher, T. B., Knauf-Jensen, D. E., & Busch-Rossnagel, N. A. (1996). A description of developmental progress in mastery motivation. *Infant Behavior and Development*, 19(1), 424–424.  
[https://doi.org/10.1016/S0163-6383\(96\)90478-6](https://doi.org/10.1016/S0163-6383(96)90478-6)
- Gilmore, L., Cuskelly, M., & Purdie, N. (2003). Mastery motivation: Stability and predictive validity from ages two to eight. *Early Education and Development*, 14(4), 411–424.  
[https://doi.org/10.1207/s15566935eed1404\\_2](https://doi.org/10.1207/s15566935eed1404_2)
- Hagenaars, J. A., & McCutcheon, A. L. (2002). *Applied latent class analysis*. New York, NY: Cambridge University Press. <https://doi.org/10.1017/CBO9780511499531>
- Harter, S. (1981). A new self-report scale of intrinsic versus extrinsic orientation in the classroom: Motivational and informational components. *Developmental Psychology*, 17(3), 300–312.  
<http://dx.doi.org/10.1037/0012-1649.17.3.300>
- Hauser-Cram, P. (1998). I think I can, I think I can: Understanding and encouraging mastery motivation in young children. *Young Children*, 53(4), 67–71.
- Józsa, K., Barrett, K. C., Józsa, G., Kis, N., & Morgan, G. A. (2017). Development and Initial Evaluation of an Individualized Moderately Challenging Computer-tablet Mastery Motivation Measure for 3-8 Year-olds. *Hungarian Educational Research Journal*, 7(2), 106–126.
- Józsa, K., & Molnar, É. D. (2013). The relationship between mastery motivation, self-regulated learning and school success: A Hungarian and wider European perspective. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook on self-regulatory processes in development: New directions and international perspectives* (pp. 265–304). New York, NY: Psychology Press.  
<https://doi.org/10.4324/9780203080719.ch13>

- Józsa, K., Wang, J., Barrett, K. C., & Morgan, G. A. (2014). Age and cultural differences in mastery motivation in American, Chinese, and Hungarian school-age children. *Child Development Research*, 2014. Article ID 803061, 1–16. <https://doi.org/10.1155/2014/803061>
- Kaufman, L., & Rousseeuw, P.J. (1990). *Finding Groups in Data*. New York, NY: John Wiley & Sons. <https://doi.org/10.1002/9780470316801>
- Keilty, B., & Freund, M. (2004). Mastery motivation: A framework for considering the "how" of infant and toddler learning. *Young Exceptional Children*, 8(1), 2–10. <https://doi.org/10.1177/109625060400800101>
- Lapka, D., Wagner, P., Schober, B., Grading, P., & Spiel, C. (2011). Benefits of the person-oriented perspective for program evaluation: Analyzing the differential treatment effects of the Vienna e-lecturing program. *Journal of MultiDisciplinary Evaluation*, 7(16), 65–83.
- Lee, J. A. (2014). *The development of mastery motivation in young children*. Retrieved from ProQuest Dissertations Publishing. (3616023)
- Mokrova, I. L., O'Brien, M., Calkins, S. D., Leerkes, E. M., & Marcovitch, S. (2013). The role of persistence at preschool age in academic skills at kindergarten. *European Journal of Psychology of Education*, 28(4), 1495–1503. <https://doi.org/10.1007/s10212-013-0177-2>
- Morgan, G. A. (1997). *Dimensions of Mastery Questionnaire DMQ 17 (Database Record)*. Retrieved from PscyTESTS. <https://doi.org/10.1037/t04950-000>
- Morgan, G. A., & Bartholomew, S. (1998). *Assessing mastery motivation in 7- and 10-year olds* (ERIC Document Reproduction Service No. ED 422 110).
- Morgan, G. A., Busch-Rossnagel, N. A., Barrett, K. C., & Wang, J. (2009). *The Dimensions of Mastery Questionnaire (DMQ): A manual about its development, psychometrics and use*. Unpublished document, School of Education, Colorado State University, Fort Collins, CO. Retrieved from <http://mycahs.colostate.edu/George.Morgan/MasteryMotivation.htm>
- Morgan, G. A., Harmon, R. J., & Maslin-Cole, C. A. (1990). Mastery motivation: Definition and measurement. *Early Education and Development*, 1(5), 318–339. [https://doi.org/10.1207/s15566935eed0105\\_1](https://doi.org/10.1207/s15566935eed0105_1)
- Morgan, G. A., Wang, J., Liao, H.-F., & Xu, Q. (2013). Using the Dimensions of Mastery Questionnaire to assess mastery motivation of English- and Chinese-speaking children: Psychometrics and implications for self-regulation. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook of self-regulatory processes in development: New directions and international perspectives* (pp. 305–335). New York, NY: Psychology Press. <https://doi.org/10.4324/9780203080719.ch14>
- Morgan, G. A., & Yang, R. K. (1995). Toward a multifaceted conceptualization of mastery motivation: An organized summary of research. In R. B. MacTurk, & G. A. Morgan (Eds.), *Mastery motivation: Origins, conceptualizations, and applications* (pp. 317–337). Norwood, NJ: Ablex.
- Pohar, M., Blas, M., & Turk, S. (2004). Comparison of logistic regression and linear discriminant analysis: A simulation study. *Metodoloski Zveki*, 1(1), 143–161.
- Raufelder, D., Jagenow, D., Hoferichter, F., & Drury, K. M. (2013). The person-oriented approach in the field of educational psychology. *Problems of Psychology in the 21st Century*, 5, 79–88.
- Ricks, E. D. (2012). *Cultivating early STEM learners: An analysis of mastery classroom instructional practices, motivation, and mathematics achievement in young children* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses Database. (UMI No. ED547203).
- Turner, L. A., & Johnson, B. (2003). A model of mastery motivation for at-risk preschoolers. *Journal of Educational Psychology*, 95(3), 495–505. <https://doi.org/10.1037/0022-0663.95.3.495>



## Mastery Motivation in School Subjects in Hungary and Taiwan

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### Abstract

This study focuses on the school related dimensions of mastery motivation. The Subject Specific Mastery Motivation Questionnaire (SSMMQ), recently developed in Hungary, measures persistence in trying to master six school domains (reading, math, science, English language, music, and art) and overall mastery pleasure in school. Each scale includes 6 Likert items. The total score of the six school subject scales is called school mastery motivation. The SSMMQ was translated into Chinese. The goal of this study was to compare Hungarian and Taiwanese students' subject specific mastery motivation. Participants in the cross-sectional study were 1359 Hungarian and 623 Taiwanese school children from grades 4, 6, 8, and 10. Exploratory factor analysis confirmed the theoretical structure of the questionnaire in both countries. Each of the seven scales and the total scale had high reliabilities in Hungary and in Taiwan. The relations among the domains were stronger in younger ages. There were significant age differences in each of the domain specific mastery motivation scales. In both countries, academic mastery motivation significantly decreased between grades 4 and 8. The Hungarian students rated themselves significantly higher than did the Taiwanese. The results were generally consistent with the literature. Implications for further research and school practice are discussed.

**Keywords:** motivation, schools, questionnaires, mastery motivation, cross cultural studies, cross sectional study, school subjects

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## **Introduction**

### ***Mastery Motivation***

Mastery motivation encourages one to work hard to master a certain skill or ability. Mastery motivation operates as long as the challenge persists and as long as acquisition is not complete; i.e., until mastery has been reached. Mastery motivation is understood as a “psychological force that stimulates an individual to attempt independently, in a focused and persistent manner, to solve a problem or master a skill or a task which is at least moderately challenging for him or her” (Morgan, Harmon, & Maslin-Cole, 1990, p. 319.).

Mastery motivation functions as the basis of learning in infants, but such motivation can also be active and can be activated in preschool and school-aged children, as well as in adults (Morgan, Józsa, & Liao, 2017). This fact is well exemplified by children who persist at and find great pleasure in learning to count and read, or adults who pursue their profession with expertise. However, the school and the family both have an important role in the development and functioning of mastery motivation (Józsa, 2007; Morgan, Liao et al., 2017).

Mastery motivation has a fundamental impact on cognitive, social, and psychomotor development (Wang & Barrett, 2013; Morgan, Józsa et al., 2017). Some studies indicate that mastery motivation may be a better predictor of cognitive development than intelligence, hence playing a crucial role in school achievement (Józsa & Molnár, 2013; Yarrow, Klein, Lomonaco, & Morgan, 1975). Shonkoff and Philips (2000) state that mastery motivation is a key factor in personality development. They highlight the importance of research in this field, stating that assessment of mastery motivation should be an important part of the evaluation of a child’s development.

There is research evidence that mastery motivation has a relation with school achievement. Gilmore, Cuskelly, and Purdie’s (2003) study found that mastery motivation predicted school-related skills. Mokrova, O’Brien, Calkins, Leerkes, and Marcovitch (2013) studied the prediction of kindergarten academic skills (language and math). More recently, Mercader, Presentación, Siegenthaler, Moliner, and Miranda (2017) found that mastery motivation (persistence) in preschool significantly predicted mathematics achievement in second grade. Józsa and Morgan (2014) found a significant relation between mastery motivation in grade 4 and grade point average (GPA) in grade 8. Józsa and Molnár (2013), in a cross-sectional study of third and sixth graders, also found an association between instrumental mastery motivation and both GPA and achievement in specific school subjects.

### ***Domain Specific Approaches to Academic Motivation***

Wigfield, Guthrie, Tonks, and Perencevich (2004) gave arguments that underlie the domain specificity of academic motivation. (1) Students perceive different self-efficacy in different areas; they can have different interests; and their intrinsic motivation also can be different. (2) Students can be more motivated in one particular area than in another (for example, a student can be strongly motivated in mathematics, but can have much less motivation in reading). (3) Students need different skills to perform well in different areas. (4) The separation of school subjects can lead children to have subject-specific motivation. Bong (2001) also emphasized the role of situation in motivation.

A certain student could be motivated in the field of mathematics, yet the same might not be true in language learning. Research on self-concept has revealed that students' self-concepts are differentiated according to subject domains; e.g., self-concept in mathematics is different from self-concept in reading (Marsh, 1990; Zanobini & Usai, 2002). There is empirical evidence that academic motivation can be differentiated across different areas (Martin, 2008; Wigfield et al., 2004). The theoretical background of domain specificity is mainly based on self-concept theory (Bong, 2001; Martin, 2008) and the factor-analytic investigations of self-efficacy and competence-beliefs (Wigfield, 1997).

Theoretical models and empirical studies showed that self-concept is a hierarchical construct. Although there is a general academic self-concept, according to the hierarchical structure, under general self-concept, there are different subject-specific self-concepts. Moreover, these subject-specific self-concepts often do not connect to each other (Brunner, et al., 2010; Brunner, Keller, Hornung, Reichert, & Martin, 2009; Gogol, Brunner, Martin, Preckel, & Goetz, 2017; Green, Martin, & Marsh, 2007). Students can also have domain specificity in school subject attitudes. They have different attitudes towards different school subjects, e.g., there are math, science, and art attitudes (Csapó, 2000). There are similar results in the field of academic intrinsic motivation (Gottfried, 1985; Gottfried, Fleming, & Gottfried, 2001; Steinmayr & Spinath, 2009) and academic interest (Wigfield, 1997).

School subject-specific motivation research has sometimes focused on just one given school subject; for example, Józsa and Józsa (2014), Szenczi (2010, 2013), and Wigfield (1997) analyzed the aspects of reading motivation; also Hannula (2012) and Hannula, et al. (2016) focused on motivation in math. Some studies analyzed the domain specificity of motivation in several subjects at the same time (e.g., Bong 2001; Green et al. 2007; Leaper, Farkas, & Brown, 2012). Green et al. (2007) argued that academic motivation has dimensions, which are subject-specific. They verified in mathematics, English, and science, that motivation among Australian high school students is a multidimensional construct, and motivation has domain-specific characteristics. According to their results, students' perceptions about their motivation in a given subject is not strongly related with how they perceive themselves in other subjects. Furthermore, subject-specific

motivation in a certain subject shows stronger correlations with behavioral dimensions (e.g., self-handicapping) in the same school subject, compared to correlation between the same construct on two different subjects. Bong (2001) also found that motivation is multidimensional. She pointed out that motivation constructs, like self-efficacy, task-value, and achievement goal orientations, among Korean middle and high school students, are subject-specific mathematics, English, science, and Korean. Based on her results, domain specificity becomes greater by age; older students more clearly differentiate verbal and quantitative subjects than younger students. This finding is consistent with the research results that mathematics and verbal self-concepts are significantly differentiated (Brunner et al., 2010).

Martin (2008) found domain-specificity of motivation across academic, sport, and music domains. Wigfield (1997) noted that one of the most important questions in connection with domain specificity is to discover which motivation constructs are domain-specific and which are domain-general. Based on a literature review, he grouped competence beliefs and self-efficacy beliefs as domain-specific motivational constructs; on the other hand, achievement goal orientation was rather general. In connection with intrinsic and extrinsic motivation, there was evidence for domain specificity and for domain generality as well. Peklaj, Podlesek, and Pecjak (2015) found that self-efficacy, interest, and motivation strategies (immediate action, procrastination/distractibility) are subject-specific constructs.

### ***Domain Specific Approach to Mastery Motivation***

Mastery motivation was conceptualized by Barrett and Morgan (1995) to be a complex psychic concept consisting of two main aspects: 1) instrumental and 2) expressive or affective. The instrumental component is shown by behavioral manifestations of persistence, which was the principle measure of mastery motivation in most studies. These manifestations include a) cognitive persistence, b) social persistence, and c) gross motor persistence (Morgan et al., 1995). Experiencing mastery pleasure provides the necessary feedback and reinforcement in relation to mastery motives (Barrett & Morgan, 1995).

Early mastery motivation studies mainly focused on young children. The source of Barrett and Morgan's definition of mastery motivation was based on this early childhood research. However, recently there is a growing body of research on school age children (e.g., Green, & Morgan, 2017; Józsa & Morgan, 2014; Józsa & Molnár, 2013; Józsa, Wang, Barrett, & Morgan, 2014) and young adults (Doherty-Bigara & Gilmore, 2015; Gilmore, Islam, Younesian, Bús, & Józsa, 2017).

Based on Barrett and Morgan's (1995) definition, Józsa (2014) described further dimensions of mastery motivation, assuming that mastery motivation had school specific dimensions, and could vary in different school domains; i.e. different subjects. He developed new scales to measure domain-specific dimensions of mastery motivation.

Likert-items were developed for the following domains: reading, mathematics, science, English and German as foreign languages, music, and art. Items were developed based on several related definitions of mastery motivation (Barrett & Morgan, 1995; Busch-Rossnagel & Morgan, 2013; Morgan et al., 1990), the DMQ (Dimensions of Mastery Questionnaire) scales by Morgan et al. (1993), as well as their Hungarian adaptation (Józsa, 2007). A pilot study of 775 children supported the validity and reliability of the scales for Hungarian students' studying the English and German languages in school. The correlations of these foreign language mastery motivation scales and language achievement varied from medium to strong (Józsa, 2014).

### **Schools in Hungary and Taiwan**

This study compares Hungarian and Taiwanese students' motivation. Having insight into the educational systems of the two countries aids in a better understanding of the results. Therefore in the following we briefly introduce the educational systems of the two countries. It will make clear that the major characteristics of schools in the two countries are similar.

#### *Hungarian Schools*

The education in Hungary is regulated by a central curriculum that is mandatory for every school. The Hungarian National Core Curriculum defines the content, which must be acquired during the different grade levels. This national curriculum is supplemented with local curriculums and programs (Hungarian Government, 2012).

Children can enter school in September after their sixth birthday, but beginning school is flexible; developmentally immature children can start first grade one or two years later. Primary education (ISCED 1-2) is eight years long and has two sections. Elementary school (lower primary school) is from the first to the fourth grade. Middle school (upper primary school) is from the fifth to the eighth grade. The lower and the upper primary school classes are usually in the same building (Balázs, Kocsis, & Vágó, 2011; Hungarian Government, 2011).

Secondary education (ISCED 3) is between grades 9-12, and there are three types of secondary schools. The primary goal of academic high school is to prepare for higher education. Vocational high school prepares children for specialized higher education and employment, using both academic and practical education. Industrial high school prepares students to get a skilled job directly after secondary education with academic and practical education in three years, rather than four years (Balázs et al., 2011; Hungarian Government, 2011).

Education in academic high schools and in vocational schools ends with a matriculation exam. All students in these two types of high schools have to take an exam in five subjects: Hungarian grammar and literature, history, mathematics, foreign language, and

a required optional subject, which is a vocational subject in the vocational school (Hungarian Government, 2011).

The mean class size is 23 in the elementary schools, 24–28 in the middle and secondary schools (Hungarian Government, 2011). The education of boys and girls is integrated; they have completely the same requirements. In lower primary school, the same teacher teaches all of the subjects. Sometimes sports and art can be taught by a different teacher. In middle school and secondary school, different teachers teach different subjects. Education in reading, writing, mathematics, science, music, art, and sports starts in the first grade. There are integrated science courses for grades 1–6. After grade 6, the students learn separate science subjects: biology, chemistry, physics and geography/earth science. Learning a foreign language is mandatory from the 4th grade, and learning a second foreign language is possible from the 7th grade (Hungarian Government, 2016). In the academic high schools, the students have to learn two foreign languages; in the vocational and industrial schools, only one is required. About three-fourths of the students learn English and nearly the one-fourth of them learn German as the first foreign language. Other languages (typically French, Italian, Russian, and Spanish) are rare as the first foreign language, but could be learned as the second foreign language (Balázs et al., 2011).

School classes are 45 minutes long in all educational levels, with 10–15 minutes breaks between the classes. Education usually starts at 8 am in the morning and ends early in the afternoon. There are about 25 classes in a week in the lower primary school, 28–30 in the upper primary school and 35 in the secondary schools. Education is five days a week, from Monday to Friday, from 1 September to the middle of June. There are three (about one week long) breaks during an academic year, in Autumn, in Winter, and in Spring (Hungarian Government, 2011).

### *Taiwanese Schools*

The education in Taiwan for every school is regulated by the Ministry of Education and the local government. Children enter elementary schools in the September after their sixth birthday; however, some children with special needs, such as developmental delay, can apply to start first grade one year later (Ministry of Education Republic China (Taiwan), 2011). The Committee of Curriculum Development defines the general content to be acquired during the different grade levels. All schools have the national curriculum and also have local or school-based curriculums (Ministry of Education Republic China (Taiwan), 2015).

In Taiwan, a 9-year compulsory education system consists of two sections: elementary school, from 1st to 6th grade, and junior high school, from 7th to 9th grade. Elementary schools and junior high school are usually separated and located in different locations.

Secondary education is from 10th to 12th grade and can be classified into two categories, general and vocational senior high schools. Generally speaking, the general

senior high school is for children to prepare to enter colleges or universities. The vocational school allows children to gain practical knowledge and training for specific industries, so that students can begin work in that industry immediately or enter a college or university of technology after their graduation. Most schools accept both genders of children; however, a few schools accept only boys or girls.

Compulsory education was extended from 9 years to 12 years to cover senior secondary school in 2014 (Ministry of Education Republic China, Taiwan (2016)). The academic year usually begins on September 1st and ends at the end of June. Each academic year has two semesters, and each semester is about four to five months. Students are required to go to school five days a week, from Monday to Friday. The size of class varies from primary to secondary education. Typically, each class have 21–28, 23–35, and 40–50 students in elementary schools, junior high schools, and senior high schools, respectively.

In lower primary schools, a teacher teaches most subjects, but some subjects such as English, sports, and the arts can be exceptions. Most schools teach Chinese, math, science, art, sport, and music from first grade; however, science, music, and art are integrated into the life curriculum. After grade 7, students start to learn biology; after grade 8, students start to learn chemistry and physics; after grade 9, students start to learn geography. The first foreign language, English, is started between the first grade and third grade in different counties (i.e., some cities begin English in first grade, some in second grade, some in third grade), and a second foreign language (e.g. French, Germany, Japanese) is beginning from the 10th grade (Ministry of Education Republic China (Taiwan), 2012, 2013).

In elementary schools, each class usually lasts 40 minutes and with 10–20 minute breaks between classes. However, in junior and senior high schools, each class lasts 45–50 minutes with a 10–15 minute break. The school schedule starts at 8 am and ends about around 4:00 or 4:30 pm. There are about 22–30, 28–30, and 35 classes a week in elementary schools, junior high schools, and senior high schools, respectively. During the academic year, students usually have a break of about 21 days in the winter, plus about 60 days in the summer.

The weekly courses designed for elementary schools include: six classes of Chinese (including one class of reading), four classes of math, three classes each in English, sports, and science, as well as one class each for music and art. In regard to junior and senior high schools, the weekly courses include six classes of Chinese (including one reading class), six classes of math, five classes of both English and science, two class in sport, as well as one class each in music and art (Ministry of Education Republic China (Taiwan), 2012).

## Objectives

The goals of this study were: (1) to analyze the reliability and construct-validity of the recently developed Subject Specific Mastery Motivation Questionnaire (SSMMQ) in Hungary and Taiwan, (2) to compare mastery motivation in specific school subjects across two different cultural contexts, and (3) to explore school grade level differences in subject specific mastery motivation in both countries.

## Method

### Participants

The total sample included Hungarian ( $n = 1359$ ) and Taiwanese ( $n = 623$ ) children from grades 4, 6, 8, and 10. Table 1 shows the distribution of the sample by grade levels and country. The Hungarian sample consisted of 56 school classes from 29 schools in the south region of Hungary. Primary schools and all three types of high schools were included. The SES background of the students was similar in different grade levels. The schools were located in 15 different towns, from small to medium size cities. The Taiwan sample included 15 schools and a total 34 classes. One of the schools was located in the middle of Taiwan, others were from northern Taiwan. Two schools were located in small towns, and others were located in big towns.

The proportions of boys was 51% in both countries. The education level of parents was significantly higher in Taiwan, where mothers had an average of 13.37 ( $SD = 2.70$ ) years of school and fathers had 13.65 ( $SD = 2.86$ ). In Hungary, mothers had an average of 10.67 years of school ( $SD = 1.79$ ) and fathers had 10.56 ( $SD = 2.06$ ).

Table 1. Distribution of the Sample by Grade Level

Sample	4	6	8	10	Total
Hungary	416	426	304	213	1359
Taiwan	137	215	128	143	623
Total	553	641	432	356	1982

### Instrument

The Subject Specific Mastery Motivation Questionnaire (SSMMQ, Józsa, 2014; Józsa & Kis, 2017) was used in this study. It covers six school subjects/domains (reading, mathematics, science, English as a foreign language, art, and music) and also school mastery pleasure. The questionnaire consists of 5-point Likert items: 6 items in each scale, with 42 items altogether in the seven scales. The total score of the six subject specific scales was considered to be a measure of *school mastery motivation*. The *school mastery pleasure* scale includes 6 items, each of them related with one of the school domains. *Academic mastery pleasure* and *academic mastery motivation* were computed scales based only on the reading, math, and science items. Based on suggestions by Józsa and Morgan (2017), the SSMMQ scales included only positive items.

## Procedure

The Hungarian version of the SSMMQ was translated into English, than the English version into Taiwanese. Back translations were made, and some minor corrections were done before this study.

The data collection procedure was the same in both countries. Children filled out the questionnaires in class, which required about 20–30 minutes. Teachers in Hungary and researchers in Taiwan helped with the data collection.

Scale means were calculated for each student, then linear transformations were conducted on the means, using the formula  $(x-1)*25$ . This way, the scale would range between 0 and 100, called a percentage points (%p) scale. Correspondences between the 1-5 values of the scale and the percentage points are as follows: 1 = 0%p, 2 = 25%p, 3 = 50%p, 4 = 75%p, and 5 = 100%p.

## Results

### Reliability

Table 2 shows the excellent internal consistency reliabilities of the scales for the Hungarian and Taiwanese samples, and also for the total sample. Alphas were higher (above 0.8) for all six school subjects. Somewhat lower, but still acceptable alphas were found for the school mastery pleasure scale. Reliability indices of the two countries were similar. The aggregated index of the six subject-specific mastery motivation was called *school mastery motivation*; with 36 items the alphas for this scale were understandably high for both countries. With only 3 items (reading, math, science), *academic mastery pleasure* alphas were, as expected, lower but still at least marginally acceptable because they were above .6. The internal consistencies of the overall *academic mastery motivation* scales were excellent. Thus, for both countries, there was strong evidence to support the internal consistency of the measures.

Table 2. Reliabilities of the Subject Specific Mastery Motivation Scales (Cronbach- $\alpha$ )

Country	Reading	Math	Science	English	Art	Music	SMP	SMM	AMP	AMM
N of items	6	6	6	6	6	6	6	36	3	18
Hungary	.815	.818	.828	.883	.892	.923	.785	.936	.621	.888
Taiwan	.854	.887	.844	.915	.847	.905	.786	.943	.704	.903
Total	.816	.848	.831	.916	.883	.920	.785	.939	.673	.896

Note. SMP = school mastery pleasure, SMM = school mastery motivation, AMP = academic mastery pleasure, AMM = Academic mastery motivation. The "academic" scales were computed from the reading, math, and science items.

### Validity

Evidence for construct validity of the instrument was provided by exploratory factor analysis. The Kaiser-Meyer-Olkin indices were high: .946 for Hungary, .907 for Taiwan, and .953 for the total sample. The analysis revealed seven factors, which were clearly matched with the theoretical model. The seven factors together explained 63% of the total variance. The factor weights given in Table 3 were for the total sample.



Table 3. Factor Loadings of the Subject Specific Mastery Motivation Questionnaire for the Total Sample

Scales and items	1	2	3	4	5	6	7
<b>1 Reading Mastery Motivation</b>							
I practice reading to do it well.	.71						
I want to master reading even if it takes a long time.	.70						
I do my best to become a good reader.	.65						
I read things again and again to gain deeper understanding.	.50						
I keep on reading until I completely understand.	.47						
If I do not understand a sentence, I read it again.	.46						
<b>2 Math Mastery Motivation</b>							
If I do not understand a math task, I try it again.		.74					
I keep on working on a math task until I completely understand.		.72					
If I make a mistake in my calculation, I start it again.		.70					
I do my best to solve a math problem.	.46	.68					
I practice calculation to do it well.		.49					
I want to learn to calculate even if I need to practise a lot.		.48					
<b>3 Science Mastery Motivation</b>							
I persist in observing things and phenomena in nature.			.76				
I want to understand nature even if it takes a long time.			.75				
I do experiments to get answers to my nature-related questions.			.73				
If I am interested in a natural phenomenon, I keep questioning and inquiring until I know everything about it.			.65				
I observe how weather changes.			.61				
I wonder why the day turns into night and vice versa.			.54				
<b>4 English Language Mastery Motivation</b>							
I do my best to be good at English.				.81			
I practice English words until I know them well.				.81			
I practice English to get better in it.				.79			
I do my best to be a better and better speaker of English.				.79			
If I cannot spell something in English, I practice until I learn it well.				.72			
If I do not understand an English sentence, I read it again.				.68			
<b>5 Art Mastery Motivation</b>							
I would like to get better and better at painting and drawing.					.79		
I want to master drawing even if it takes a long time.					.79		
I practice drawing to do it well.					.75		
I keep on drawing until it looks beautiful.					.68		
I do my best to be able to paint beautifully.					.68		
If I do not like my drawing, I start it again.					.61		
<b>6 Music Mastery Motivation</b>							
I want to master singing even if it takes a long time.						.82	
I do my best to be a good singer.						.81	
I keep on learning a song until it goes perfectly.						.81	
I practise singing to do it well.						.79	
If I do not sing clearly and precisely, I practise until I get better.						.77	
If I sing poorly, I try it again.						.74	
<b>7 School Specific Mastery Pleasure</b>							
I am pleased when I solve a math problem.							.63
I am pleased when I can say something in English.				.47			.63
I am pleased when I understand the text.							.62
I am pleased when I can sing a song nicely.						.53	.59
I am pleased when my drawing looks beautiful.					.49		.57
I am pleased when I understand a natural phenomenon.			.61				.46

There was only one item out of the 42 that loaded to a different scale from that intended, and that was a science pleasure item which loaded more highly of the science scale than the mastery pleasure scale. Four of the items from school mastery pleasure (science, music, art, and English) loaded above .40 on the corresponding subject-specific mastery scale in addition to the mastery pleasure scale. Factor analyses carried out separately for the two countries revealed similar patterns. With few exceptions, these analyses confirmed that items loaded most highly to the intended scales.

### Correlations

Relationships among the subject-specific mastery motives were investigated by correlation analyses. The analyses were carried out by grade level because subject specific mastery motives generally declined with age. These declines are discussed in the next section. Correlations for grade 4 students are shown in Table 4, and those of grade 10 students are shown in Table 5. In both tables, the lower triangle includes the Taiwanese data, and the upper triangle includes the Hungarian data.

In Table 4, all correlations were moderate to strong and all values were significant ( $p < .01$ ). Corresponding correlations were similar for the two countries. The six subject-specific mastery motives were related to school mastery pleasure with medium to strong correlations ( $r = .41-.49$ , median .47 for Hungarian, and  $r = .47-.63$ , median .48 for Taiwanese students). Correlations among the seven subject specific scales, which included school mastery pleasure, varied widely in both groups: .31-.72, median .41 for Hungarians, and .28-.64, median .47 for Taiwanese. Tables for grade 6 and 8 correlations were similar to those for grade 4 students.

Table 4. Correlations between the Variables in Grade 4

Scales	Reading	Math	Science	English	Art	Music	Pleasure	School
Reading		.72**	.39**	.68**	.41**	.47**	.49**	.79**
Math	.64**		.36**	.64**	.37**	.41**	.41**	.73**
Science	.50**	.36**		.31**	.38**	.33**	.47**	.65**
English	.46**	.50**	.37**		.31**	.44**	.43**	.76**
Art	.39**	.28**	.43**	.32**		.52**	.48**	.71**
Music	.34**	.35**	.55**	.49**	.40**		.49**	.77**
Pleasure	.57**	.47**	.55**	.48**	.47**	.63**		.71**
School	.77**	.71**	.73**	.72**	.64**	.74**	.81**	

Note. The upper triangle contains Hungarian data, the lower triangle contains Taiwanese data, school = school mastery motivation scale; \*\*  $p < .01$ .

For grade 10 students, the correlations were substantially lower than for grade 4 students. In Table 5 there are correlations that were not significant. For the Hungarians, music mastery motivation was not significantly related to reading, mathematics, or English as a foreign language (EFL) mastery motivation. Because art and music were not assessed in these Taiwanese 10<sup>th</sup> graders, there were no correlations of them with other subjects. In Taiwan, the correlations among the subject-specific mastery motives in the academic subjects of reading, math, and science were much lower than in grade 4, indicating an increased differentiation in mastery motives at that age. In both countries,

the correlation between English and Science was the lowest of the correlations among the academic subjects. In Hungary, the motivation to mastery English was not significantly related to either art or music, but mastering English was significantly related to the motive to master reading and math in both countries. In general, the relations between subject-specific mastery motives in grade 10 were lower than in grade 4, 6, and 8.

Table 5. Correlations between the Variables in Grade 10

Scales	Reading	Math	Science	English	Art	Music	Pleasure	School
Reading		.47**	.42**	.49**	.21**	.10	.41**	.65**
Math	.21*		.36**	.42**	.14*	-.07	.25**	.53**
Science	.27**	.46**		.21**	.30**	.20**	.50**	.68**
English	.45**	.24**	.07		.10	.09	.25**	.54**
Art	-	-	-	-		.23**	.45**	.62**
Music	-	-	-	-	-		.39**	.53**
Pleasure	.51**	.34**	.36**	.45**	-	-		.76**
School	.68**	.65**	.60**	.64**	-	-	.74**	

Note. The upper triangle contains Hungarian data, the lower triangle contains Taiwanese data; \* $p < .05$ ; \*\* $p < .01$ .

### Age Differences

There were significant age differences in subject specific mastery motives in both countries (see Figures 1 to 6). We performed one-way ANOVAs to test the differences between grade levels. The significant grade level decreases in Hungary were: reading ( $F = 55.95$ ,  $p < .001$ , grade levels 4 >6 >8, 10), math ( $F = 70.90$ ,  $p < .001$ , grade levels 4 >6 >8, 10), science ( $F = 47.75$ ,  $p < .001$ , grade levels 4 >6 >8, 10), English ( $F = 4.46$ ,  $p < .05$ , grade levels 4 >6, 8, 10), art ( $F = 128.53$ ,  $p < .001$ , grade levels 4 >6 >8 > 10), and music ( $F = 82.90$ ,  $p < .001$ , grade levels 4 >6 >8 > 10). Thus, In Hungary mastery motivation decreased from grade 4 to 8 in all subjects except English as a foreign language, where it stayed the same at grades 6, 8, and 10.

The grade level differences in Taiwan were: reading ( $F = 7.43$ ,  $p < 0.001$ , grade levels 4, 10 > 6, 8), math ( $F = 14.38$ ,  $p < 0.001$ , grade levels 4, 10 > 6, 8), science ( $F = 7.63$ ,  $p < .001$ , grade levels 4, 10 > 6, 8), English ( $F = 4.17$ ,  $p < .05$ , grade levels 4 > 8), art ( $F = 19.10$ ,  $p < .001$ , grade levels 4 >6 >8), and music ( $F = 1.07$ ,  $p = .344$ ), so the motive to master music skills did not decline from grade 4 to 8. Taiwanese students do not have art and music in grade 10, so we computed those ANOVAs just for grade 4–8. There were age differences in Taiwan, but they were less consistent. Except for music, there was a decline from grade 4 to 6 in all subjects, but grade 10 motivation was often higher than for grade 6 and 8. Similar to Hungary, the motive to master English as a foreign language stayed essentially constant from grades 6 to 10.

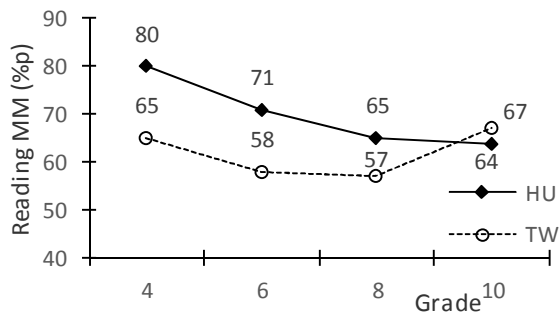


Figure 1. Age changes in Reading MM for Hungarian and Taiwanese Students

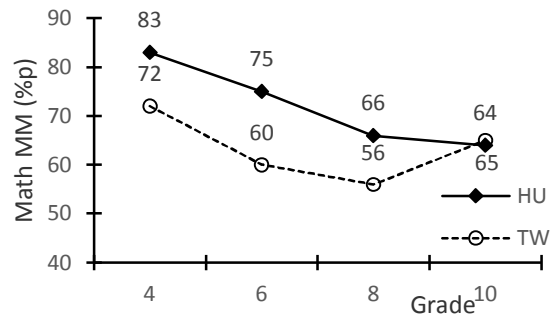


Figure 2. Age changes in Math MM for Hungarian and Taiwanese Students

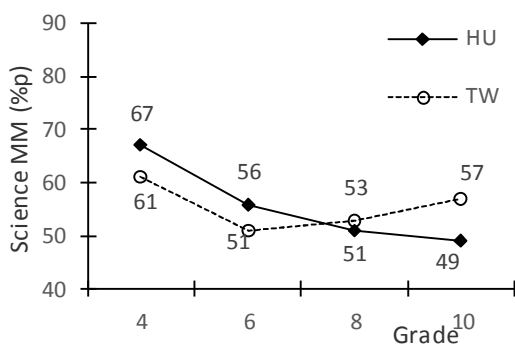


Figure 3. Age changes in Science MM for Hungarian and Taiwanese Students

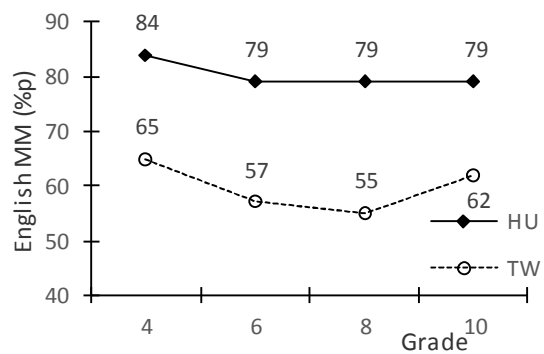


Figure 4. Age changes in English MM for Hungarian and Taiwanese Students

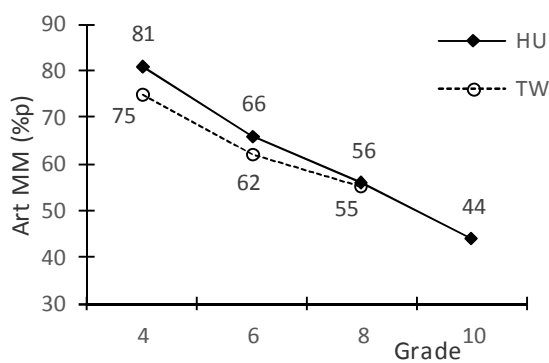


Figure 5. Age changes in Art MM for Hungarian and Taiwanese Students

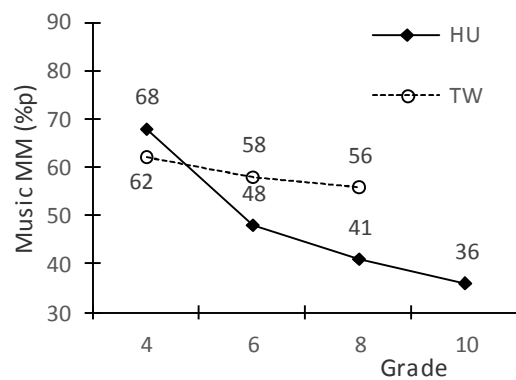


Figure 6. Age changes in Music MM for Hungarian and Taiwanese Students

There were significant grade level changes in school mastery pleasure in both countries (one-way ANOVA, Hungary  $F = 64.24$ ,  $p < .001$ , grade levels 4 > 6 > 8, 10; in Taiwan,  $F = 5.25$ ,  $p < .05$ , grade levels 4 > 8). The Taiwanese student do not have art and music in grade 10, thus, we computed the ANOVA just for grade 4–8.

A country x grade level MANOVA was run for grades 4–8 and also separately for grades 4–10 for reading, science, and English (Table 6). There were several significant country and grade differences and some significant interactions. For both the analysis of grades 4–10 and 4–8, there were significant grade level differences on all variables, but the effect sizes for English were small, reflecting the decrease from grade 4–6, but not thereafter. On the subjects of English, reading, math, and art the Hungarian children rated themselves more motivated to master the subject, but on science there was no country difference. The Taiwanese students rated themselves higher on music. There were notable grade by country interactions in science and music where the students from Taiwan rated themselves higher than the Hungarian at the older grades but lower at grade 4.

Table 6. Multivariate Analyses of Variance for SSMM Scales as a Function of Grade Level and Country

DMQ scale		Grade 4–8			Grade 4–10		
		<i>F</i>	<i>p</i>	$\eta^2$	<i>F</i>	<i>p</i>	$\eta^2$
MANOVA	Grade Level	12.72	<.001	.07	12.27	<.001	.03
	Country	43.98	<.001	.20	83.34	<.001	.16
	G x C	2.84	<.001	.02	5.92	<.001	.01
Reading	Grade Level	20.46	<.001	.03	19.88	<.001	.03
	Country	74.89	<.001	.06	68.90	<.001	.04
	G x C	4.11	.017	.01	14.57	<.001	.03
Math	Grade Level	37.60	<.001	.05	39.17	<.001	.06
	Country	61.07	<.001	.05	66.04	<.001	.04
	G x C	2.62	.073	.00	9.76	<.001	.02
Science	Grade Level	20.47	<.001	.03	22.98	<.001	.04
	Country	2.18	.14	.00	0.01	.912	.00
	G x C	5.51	.004	.01	7.56	<.001	.01
English	Grade Level	3.94	.02	.01	7.98	<.001	.01
	Country	191.88	<.001	.13	307.71	<.001	.15
	G x C	.31	.734	.00	1.56	.199	.00
Music	Grade Level	21.63	<.001	.03	-	-	-
	Country	5.43	.020	.00	-	-	-
	G x C	9.02	<.001	.01	-	-	-
Art	Grade Level	63.64	<.001	.09	-	-	-
	Country	4.83	.028	.00	-	-	-
	G x C	1.22	.294	.00	-	-	-
Pleasure	Grade Level	13.83	<.001	.02	-	-	-
	Country	94.63	<.001	.07	-	-	-
	G x C	1.05	.351	.00	-	-	-

The academic mastery motivation score was the mean of the math, reading and science mastery motivation scores. (Similarly, academic mastery pleasure was based on math, reading and science mastery pleasure items.) A country x grade level ANOVA was run using the academic mastery motivation score as the dependent variable. All effects were statistically significant at the 0.01 significance level (Figure 8). The main effect for country was:  $F = 50.49$ ,  $p < .01$ , partial  $\eta^2 = .02$ , indicating a significant overall difference

between Hungarians ( $M = 67.15$ ,  $SD = 18.22$ ) and Taiwanese ( $M = 59.65$ ,  $SD = 18.70$ ). Again the Hungarian rated themselves higher. The main effect for grade level was:  $F = 49.83$ ,  $p < .01$ , partial  $\eta^2 = .06$ , indicating a significant difference between grades:  $4 > 6 > 8$ . There was no significant difference between grade 8 and grade 10. The interaction effect was significant  $F = 17.60$ ,  $p < .05$ , partial  $\eta^2 = .02$  because in grade 10 children from Taiwan seemed to increase their academic motivation.

A country x grade level ANOVA was also run using the academic mastery pleasure score. All effects were statistically significant at the 0.01 significance level (Figure 9). The main effect for country yielded  $F = 120.95$ ,  $p < .001$ , partial  $\eta^2 = .05$ , indicating a significant difference between Hungarian ( $M = 83.56$ ,  $SD = 19.24$ ) and Taiwanese ( $M = 72.00$ ,  $SD = 23.46$ ). Again, the Hungarians rated themselves higher, this time on pleasure. The main effect for grade level was  $F = 17.74$ ,  $p < .001$ , partial  $\eta^2 = .02$ , indicating that grade  $4 > 6$ . Thus, there was a decline in academic mastery pleasure from grade 4 to 6 but then there was no further decline and what seems to be an increase at grade 10. The interaction effect was also significant  $F = 13.70$ ,  $p < .001$ , partial  $\eta^2 = .02$ .

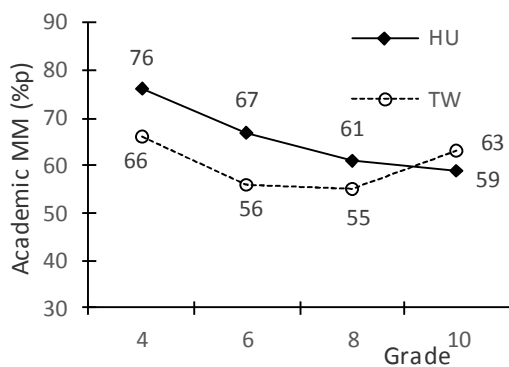


Figure 8. Age changes in Academic MM for Hungarian and Taiwanese Students

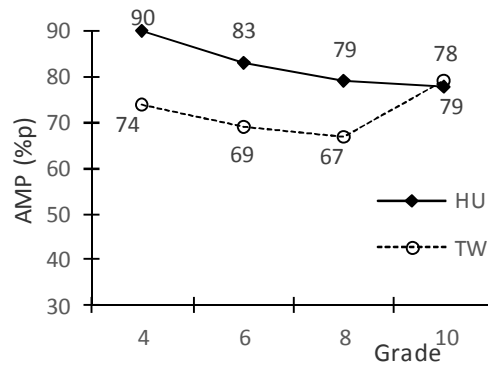


Figure 9. Age changes in Academic Mastery Pleasure for Hungarian and Taiwanese Students

## Discussion

This study presented the results of a cross-cultural comparison of school related mastery motivation in the subjects of reading, math, science, English language, music, and art and in overall mastery pleasure in school between grade 4 and 10. The study used the Subject Specific Mastery Motivation Questionnaire (SSMMQ, Józsa, 2014; Józsa & Kis, 2017), whose scales had high reliabilities in both Hungary and Taiwan. The summative scale of school related mastery motivation also had high reliability. Exploratory factor analysis supported the 7-factor structure of the questionnaire for the total sample and for the Hungarian and Taiwanese samples separately. Based on these

findings, we assume that the Subject Specific Mastery Motivation Questionnaire can be used in different cultures with a wide age range of students.

We found that motivation decreased between grade 4 and 8 for most of the school-subject mastery motives, school mastery pleasure, and also for overall school mastery motivation in both countries. Józsa and Morgan (2014), Józsa et al. (2014) found similar decreases in mastery motivation. The results were consistent with previous studies, for example Lepper, Corpus, and Iyengar (2005), which found that intrinsic motivation decreased as the age of students increased from grade 3 to grade 8. Gottfried et al. (2001) in a longitudinal study, also found a decrease from middle childhood to adolescence in intrinsic motivation for reading, math, science, and total school motivation. Józsa and Morgan (2014) also found a decrease in the cognitive persistence domain of mastery motivation in school-age children from grade 4 to grade 8.

However, it is important to note that English as a foreign language did not decrease in either Hungary or Taiwan from grade 6 to 10. This is similar to Józsa's (2014) finding about a lack of decline in Hungary of the motive to master English. Furthermore, in Hungary the motivation to master English was considerably higher than any of the other subjects during grades 6–10 but was similar to the high ratings of school mastery pleasure. In Taiwan, mastery motivation in English was not especially high and the trend across grades was somewhat similar to that for other school subjects. It is also interesting to point out the relatively low ratings for motivation in science in both countries.

In the present study, there were different trends between grade 8 and grade 10 in Hungary and Taiwan. There were non-significant decreases in academic subjects in Hungary; however, the Taiwan students indicated that they were more motivated at grade 10 than 8 in reading, math, and science. These differences may be due to the learning environment of these two countries and the sample characteristics at grade 10. For example, senior secondary (high school) education consists of three years of schooling from 10th to 12th grade in Taiwan. Taiwanese students in grade 10 have recently finished the examination for entrance into senior high school and most students have transferred to a new learning environment from junior high school to senior high school at grade 10. However, Hungarian students move to high school at grade 9. More importantly, in Taiwan class placements in grade 1–9 are different from those grade 10–12. During primary and junior high school, the student attends the school in the school district where they live, and they are randomly assigned to classrooms. However, during senior high school most students attend different schools based on their entrance examination scores. In Taiwan, two senior high schools were sampled in the present study. One was a top ranked high school and the other was a community high school ranked average. Thus, there was a less diverse sample of students at grade 10 than grades 4 to 8 in Taiwan. Because half of the students at grade 10 were from a top ranked high school, they had better academic records, which may have led to higher mastery motivation than the students in grades 4–8. In Hungary, all types of high school were

represented so there wouldn't have been SES differences between primary and secondary education for students, as there probably was in Taiwan.

Hungarian students rated themselves higher than the Taiwanese students in every school subject (except for music), mastery pleasure in school, and the total school related mastery motivation. Morgan, Liao et al. (2017) also found that Hungarian parents rated their preschool children higher on the DMQ than the Taiwanese parents, and they discuss possible explanations including that Chinese parents probably have higher expectations for academic achievement and, thus, may rate their children lower.

There were similar medium to high correlations in the two countries among the motives in grade 4, 6 and 8. However, we found lower correlations (i.e., more differentiation) among the motives in grade 10 in both countries. Bong (2001) and Brunner et al. (2010) also found more domain specificity as participants become older.

Our study has some limitations. One of them is that we used a cross-sectional design, so the age differences do not directly indicate that there would be similar changes as the same students got older. This cross-sectional design was clearly a problem for interpreting the apparent increase in motivation from grade 8 to 10 in Taiwan. Further research should use longitudinal designs. We should also study age change trends in other countries and cultures. Teachers', parents', and peer ratings also can give us useful information. Because social desirability can influence questionnaire responses, behavioral measures would be more appropriate for studying mastery motivation. However, there are no behavioral measures yet for school age children.

## **Conclusion**

Our study showed that in general, subject specific mastery motivation and mastery pleasure in school tend to decrease between grade 4 and 8 in both countries and continue to decline to grade 10 in music and art in Hungary. These motivation decreases can impact students' school achievement, which can strongly impact life success. Schools, teachers, parents, and peers may have a role in these motivational decreases with age. An important question is how can these decreasing trends in motivation be stopped, or at least slowed down? What are appropriate methods for improving mastery motivation in school settings? Future studies are needed in this field.

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## References

- Balázs, É., Kocsis, M., & Vágó, I. (2011). (Eds.). *Jelentés a magyar közoktatásról* [Report about Hungarian Public Education]. Budapest: Oktatáskutató és Fejlesztő Intézet. (in Hungarian)
- Barrett, K. C., & Morgan, G. A. (1995). Continuities and discontinuities in mastery motivation in infancy and toddlerhood: A conceptualization and review. In R. H. MacTurk, & G. A. Morgan (Eds.), *Mastery motivation: Origins, conceptualizations, and applications* (pp. 67–93). Norwood, NJ: Ablex.
- Bong, M. (2001). Between- and within-domain relations of academic motivation among middle and high school students: Self-efficacy, task value, and achievement goals. *Journal of Educational Psychology*, 93(1), 23–34. <https://doi.org/10.1037/0022-0663.93.1.23>
- Brunner, M., Keller, U., Dierendonck, C., Reichert, M., Ugen, S., Fischbach, A., & Martin, R. (2010). The structure of academic self-concepts revisited: The nested Marsh/Shavelson model. *Journal of Educational Psychology*, 102(4), 964–981. <https://doi.org/10.1037/a0019644>
- Brunner, M., Keller, U., Hornung, C., Reichert, M., & Martin R. (2009). The cross-cultural generalizability of a new structural model of academic self-concepts. *Learning and Individual Differences*, 19(4), 387–403. <https://doi.org/10.1016/j.lindif.2008.11.008>
- Busch-Rossnagel, N. A., & Morgan, G. A. (2013). Introduction to the mastery motivation and self-regulation section. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook of self-regulatory processes in development: New directions and international perspectives* (pp. 247–264). New York, NY: Psychology Press/Taylor and Francis.
- Csapó, B. (2000). A tantárgyakkal kapcsolatos attitűdök összefüggései [Connections between subject specific attitudes]. *Magyar Pedagógia*, 100(3), 343–366. (in Hungarian)
- Doherty-Bigara, J., & Gilmore, L. (2015). Development of the Dimensions of Adult Mastery Motivation Questionnaire. *The Australian Educational and Developmental Psychologist*, 32(2), 142–157. <https://doi.org/10.1017/edp.2015.18>
- Gilmore, L., Cuskelly, M., & Purdie, N. (2003). Mastery motivation: Stability and predictive validity from ages two to eight. *Early Education and Development*, 14(4), 411–424. [https://doi.org/10.1207/s15566935eed1404\\_2](https://doi.org/10.1207/s15566935eed1404_2)
- Gilmore, L., Islam, S., Younesian, S., Bús, E., & Józsa, K. (2017). Mastery motivation of university students in Australia, Hungary, Bangladesh and Iran. *Hungarian Educational Research Journal*, 7(2), 178–191.
- Gogol, K., Brunner, M., Martin, R., Preckel, F., & Goetz, T. (2017). Affect and motivation within and between school subjects: Development and validation of an integrative structural model of academic self-concept, interest, and anxiety. *Contemporary Educational Psychology*, 49, 46–65. <https://doi.org/10.1016/j.cedpsych.2016.11.003>
- Gottfried, A. E. (1985). Academic intrinsic motivation in elementary and junior high school students. *Journal of Educational Psychology*, 77(6), 631–645. <https://doi.org/10.1037/0022-0663.77.6.631>
- Gottfried, A. E., Fleming, J. S., & Gottfried, A. W. (2001). Continuity of academic intrinsic motivation from childhood through late adolescence: A longitudinal study. *Journal of Educational Psychology*, 93(1), 3–13. <https://doi.org/10.1037/0022-0663.93.1.3>
- Green, J., Martin A. J., & Marsh, H. W. (2007). Motivation and engagement in English, mathematics and science high school subjects: Towards an understanding of multidimensional domain specificity. *Learning and Individual Differences*, 17(3), 269–279. <https://doi.org/10.1016/j.lindif.2006.12.003>
- Green, S., & Morgan, G. A. (2017). Patterns of mastery task behavior in early school-age children in the United States. *Hungarian Educational Research Journal*, 7(2), 142–157.
- Hannula, M. (2012). Exploring new dimensions of mathematics-related affect: Embodied and social theories. *Research in Mathematics Education*, 14(2), 137–161. <https://doi.org/10.1080/14794802.2012.694281>
- Hannula, M. S., Di Martino, P., Pantziara, M., Zhang, Q., Morselli, F., Heyd-Metzuyanin, E., Lutovac, S., Kaasila, R., Middleton, J. A., Jansen, A., & Goldin, G. A. (2016). *Attitudes, beliefs, motivation and identity in mathematics education: An overview of the field and future directions*. ICME-13 Topical Surveys. Hamburg: SpringerOpen. [https://doi.org/10.1007/978-3-319-32811-9\\_1](https://doi.org/10.1007/978-3-319-32811-9_1)

- Hungarian Government (2011). *Act on National Public Education of 2011*. Retrieved from: [https://www.oktatas.hu/pub\\_bin/dload/nyelvvizsga\\_honositas/elismertetes\\_honositas/english/act\\_national\\_education.doc](https://www.oktatas.hu/pub_bin/dload/nyelvvizsga_honositas/elismertetes_honositas/english/act_national_education.doc).
- Hungarian Government (2012). *110/2012. (VI. 4.) Government Regulation about the publication, implement and usage of Hungarian National Core Curriculum*. Retrieved from: [http://ofi.hu/sites/default/files/attachments/mk\\_nat\\_20121.pdf](http://ofi.hu/sites/default/files/attachments/mk_nat_20121.pdf) (in Hungarian)
- Hungarian Government (2016). *22/2016. (VIII. 25.) Regulations about the modification of 51/2012. (XII. 21.) Regulations about the publication and confirmation of framework curricula*. Retrieved from: <http://kerettanterv.ofi.hu/> (in Hungarian)
- Józsa, G., & Józsa, K. (2014). A szövegértés, az olvasási motiváció és a stratégia-használat összefüggése [Relation of reading comprehension, reading motivation and reading strategies]. *Magyar Pedagógia*, 114(2), 67–89. (in Hungarian)
- Józsa, K. & Morgan, G. A. (2017). Reversed items in Likert scales: Filtering out invalid responders. *Journal of Psychological and Educational Research*, 25(1), 7–25.
- Józsa, K. (2007). *Az elsajátítási motiváció* [Mastery motivation]. Budapest, Hungary: Műszaki Kiadó. (in Hungarian)
- Józsa, K. (2014). Developing new scales for assessing English and German language mastery motivation. In J. Horvath, & P. Medgyes (Eds.), *Studies in honour of Marianne Nikolov* (pp. 37–50). Pécs: Lingua Franca Csoport.
- Józsa, K., & Kis, N. (2017). *Tantárgyi elsajátítási motiváció* [Subject specific mastery motivation]. (submitted).
- Józsa, K., & Molnár, É. D. (2013). The relationship between mastery motivation, self-regulated learning and school success: A Hungarian and European perspective. In K. C. Barrett N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook on self-regulatory processes in development: New directions and international perspectives* (pp. 265–304). New York, NY: Psychology Press/Taylor and Francis. <https://doi.org/10.4324/9780203080719.ch13>
- Józsa, K., & Morgan, G. A. (2014). Developmental changes in cognitive persistence and academic achievement between grade 4 and grade 8. *European Journal of Psychology of Education*, 29(3), 521–535. <https://doi.org/10.1007/s10212-014-0211-z>
- Józsa, K., Wang, J., Barrett, K. C., & Morgan, G. A. (2014). Age and cultural differences in mastery motivation in American, Chinese, and Hungarian school-age children. *Child Development Research*, 2014. Article ID 803061, 1–16. <https://doi.org/10.1155/2014/803061>
- Leaper, C., Farkas, T., & Brown, C. S. (2012). Adolescent girls' experiences and gender-related beliefs in relation to their motivation in math/science and English. *Journal of Youth and Adolescence*, 41(3), 268–282. <https://doi.org/10.1007/s10964-011-9693-z>
- Lepper, M. R., Corpus, J. H., & Iyengar, S. S. (2005). Intrinsic and Extrinsic Motivational Orientations in the Classroom: Age Differences and Academic Correlates. *Journal of Educational Psychology*, 97(2), 184–196. <https://doi.org/10.1037/0022-0663.97.2.184>
- Marsh, H. W. (1990). The structure of academic self-concept: The Marsh/Shavelson model. *Journal of Educational Psychology*, 82(4), 623–636. <https://doi.org/10.1037/0022-0663.82.4.623>
- Martin, A. J. (2008). How domain specific is motivation and engagement across school, sport, and music? A substantive–methodological synergy assessing young sportspeople and musicians. *Contemporary Educational Psychology*, 33(4), 785–813. <https://doi.org/10.1016/j.cedpsych.2008.01.002>
- Mercader, J., Presentación, M-J, Siegenthaler, R., Moliner, V., & Miranda, A. (2017). Motivation and mathematics performance: a longitudinal study in early educational stages. *Revista de Psicodidáctica*, 22(2), 1–14.
- Ministry of Education Republic China (Taiwan) (2011). *Compulsory education act*. <http://law.moj.gov.tw/ENG/LawClass/LawAll.aspx?PCode=H0070002>
- Ministry of Education Republic China (Taiwan) (2012). *General Guidelines of Grade 1-9 Curriculum of Elementary and Junior High School*.

- Ministry of Education Republic China (Taiwan) (2013). *General Guidelines of Curriculum of Senior High School*.
- Ministry of Education Republic China (Taiwan) (2015). *Education in Taiwan. 2014/2015*. Retrieved from: <http://english.moe.gov.tw/public/Attachment/410214334871.pdf>
- Ministry of Education Republic China (Taiwan)(2016). *Education in Taiwan 2016/2017*. Retrieved from: <http://english.moe.gov.tw/public/Attachment/69810423371.pdf>
- Mokrova, I. L., O'Brien, M., Calkins, S. D., Leerkes, E. M., & Marcovitch, S. (2013). The role of persistence at preschool age in academic skills at kindergarten. *European Journal of Psychology of Education, 28*(4), 1495–1503. <https://doi.org/10.1007/s10212-013-0177-2>
- Morgan, G. A., Harmon, R. J., & Maslin-Cole, C. A. (1990). Mastery motivation: Definition and measurement. *Early Education and Development, 1*(5), 318–339. [https://doi.org/10.1207/s15566935eed0105\\_1](https://doi.org/10.1207/s15566935eed0105_1)
- Morgan, G. A., Józsa, K., & Liao, H.-F. (2017). Introduction to the HERJ special issue on mastery motivation: Measures and results across cultures and ages. *Hungarian Educational Research Journal, 7*(2), 5–14.
- Morgan, G. A., Liao, H.-F., Nyitrai, Á., Huang, S.-Y., Wang, P.-J., Blasco, P. M. Ramakrishnan, J., & Józsa, K. (2017). The revised Dimensions of Mastery Questionnaire (DMQ 18) for infants and preschool children with and without risks or delays in Hungary, Taiwan and the US. *Hungarian Educational Research Journal, 7*(2), 48–67.
- Morgan, G. A., Maslin-Cole, C. A., Harmon, R. J., Busch-Rossnagel, N. A., Jennings, K. D., Hauser-Cram, P., & Brockman, L. (1993). Parent and teacher perceptions of young children's mastery motivation: Assessment and review of research. In D. Messer (Ed.), *Mastery motivation in early childhood: Development, measurement and social processes* (pp. 109–131). London: Routledge.
- Peklaj, C. Podlesek, A., & Pečjak, S. (2015). Gender, previous knowledge, personality traits and subject-specific motivation as predictors of students' math grade in upper-secondary school. *European Journal of Psychology of Education, 30*(3), 313–330. <https://doi.org/10.1007/s10212-014-0239-0>
- Shonkoff, J. P., & Phillips, D. A. (2000). *From neurons to neighborhoods: The science of early childhood development*. Washington DC: National Academy Press.
- Steinmayr, R., & Spinath, B. (2009). The importance of motivation as a predictor of school achievement. *Learning & Individual Differences, 19*(1), 80–90. <https://doi.org/10.1016/j.lindif.2008.05.004>
- Szenczi, B. (2010). Olvasási motiváció: definíciók és kutatási irányok [Reading motivation: definitions and current research]. *Magyar Pedagógia, 110*(2), 119–147. (in Hungarian)
- Szenczi, B. (2013). Olvasási motiváció 4., 6. és 8. osztályos tanulók körében [Reading motivation among 4, 6, and 8 graders]. *Magyar Pedagógia, 113*(4), 197–220. (in Hungarian)
- Wang, J., & Barrett, K. C. (2013). Mastery motivation and self-regulation during early childhood. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook on self-regulatory processes in development: New directions and international perspectives* (pp. 337–380). New York, NY: Psychology Press. <https://doi.org/10.4324/9780203080719.ch15>
- Wigfield, A. (1997). Reading motivation: A domain-specific approach to motivation. *Journal Educational Psychologist, 32*(2), 59–68. [https://doi.org/10.1207/s15326985ep3202\\_1](https://doi.org/10.1207/s15326985ep3202_1)
- Wigfield, A., Guthrie, J. T., Tonks, S., & Perencevich, K. C. (2004). Children's motivation for reading: Domain specificity and instructional influences. *The Journal of Educational Research, 97*(6), 299–310. <https://doi.org/10.3200/JOER.97.6.299-310>
- Yarrow, L. J., Klein, K. J., Lomonaco, S., & Morgan, G. A. (1975). Cognitive and motivational development in early childhood. In B. Z. Friedlander, G. M. Sterritt, & G. E. Kirk (Eds.), *Exceptional infant: Assessment and intervention* (pp. 491–502). New York, NY: Bruner/Mazel.
- Zanobini, M., & Usai M. C. (2002). Domain-specific self-concept and achievement motivation in the transition from primary to low middle school. *Educational Psychology, 22*(2), 203–218. <https://doi.org/10.1080/01443410120115265>



## Mastery Motivation of University Students in Australia, Hungary, Bangladesh and Iran

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### Abstract

This study trialed a newly developed measure of adult mastery motivation in four different cultural contexts. The Dimensions of Adult Mastery Motivation Questionnaire was translated into Hungarian and Persian languages. A total of 469 university students in Australia, Hungary, Bangladesh and Iran completed the questionnaire about their levels of persistence, preference for challenge, task absorption, and task pleasure. Cronbach alphas for the total mastery motivation scale and most subscales were acceptable to good. There were no differences in self-reported mastery motivation across the four countries, but significant gender differences were evident. In all countries except Hungary, male students reported higher levels of mastery motivation. The DAMMQ appears to be a useful measure of mastery motivation across diverse cultures. The findings provide some support for the universality of the theoretical construct of mastery motivation and suggest the potential need for universities to encourage and nurture female students in their striving for mastery. Given the importance of university education for a country's prosperity, understanding the motivational factors that underlie academic success is imperative to inform policies and programs for increasing student retention and individual well-being.

**Keywords:** motivation, persistence, adult students, mastery motivation, preference for challenge, cross-cultural studies

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## **Introduction**

University dropout rates are a concern throughout the world (Arulampalam, Naylor, & Smith, 2007; Crosling, Heagney, & Thomas, 2009; Nitza, Whittingham, & Markowitz, 2011; Pryjmachuk, Easton, & Littlewood, 2009). In order to maximize student retention, it is important for universities to attempt to understand why some students succeed and others do not. Low motivation has been identified as one of the factors associated with university drop-out (Cabrera, Bethencourt, González, & Alvarez, 2006, cited in Duque, Duque & Suriñach, 2013; Infante & Marin, 2008).

Most motivation research with university samples has focused on students' motives for studying – that is, their reasons for enrolling in a university course and striving for academic success (e.g., Evans & Bonneville-Roussy, 2016; Guiffrida, Lynch, Wall, & Abel, 2013; Liu, Ye, & Yeung, 2015). Motives include intrinsic, mastery-related factors such as the desire to gain knowledge and skills, as well as more extrinsically motivated performance-focused factors such as the desire to gain recognition and approval from others. In addition, social goals that motivate academic achievement have been recognized, particularly within collectivist societies. Social goals include the desire for social status or group affiliation (King, McInerney, & Watkins, 2013). Based on self-determination theory, the Academic Motivation Scale (AMS; Vallerand et al., 1992) and the Self-Regulation Questionnaire (SRQ; Ryan & Connell, 1989) are popular choices for measuring motives for university study. Research using these instruments has focused on understanding the ways in which the needs for autonomy, competence and relatedness motivate university students and predict their academic achievement. Guiffrida et al. (2013), for instance, found that students who were motivated by the needs for autonomy and competence achieved higher grades.

Mastery motivation is a somewhat different construct of motivation. Rather than addressing motives for pursuing learning and achievement, mastery motivation focuses on the behaviors and emotions that reflect the drive for competence and that are predictive of academic success (Gilmore, Cuskelly, & Purdie, 2003; Józsa & Molnár, 2013). Individuals who have high levels of mastery motivation are more persistent, they choose to challenge themselves and become very absorbed with difficult tasks, and they feel pleasure and pride when successful. Older children and adults are expected to display greater mastery motivation for activities that are within their realm of interest and aptitude, and there is a presumption that, to a large extent, mastery is intrinsically driven. However, extrinsic factors also contribute to mastery motivation; for instance, sensitive encouragement, support of autonomy and judicious reinforcement for effort are all likely to promote and sustain the drive for mastery (Gilmore & Cuskelly, 2014). Cultural, social, economic and political factors may also potentially have an impact. Because mastery motivation reflects a person's general approach across a broader range of life experiences than just academic learning, the construct has potential applications beyond educational settings to areas such as therapy services (e.g., Miller, Ziviani, Ware, & Boyd, 2015). Mastery motivation provides a useful framework for exploring individual

approaches to learning, irrespective of the type of goals (mastery, performance or social) that are endorsed.

The Dimensions of Mastery Questionnaire (DMQ; Morgan, Busch-Rossnagel, Barrett, & Wang, 2009) has been widely used as a parent, teacher and self-report of mastery motivation in childhood and adolescence (e.g., Green & Morgan, 2017; Huang & Lay, 2017; Hwang et al., 2017; Józsa & Molnár, 2013; Morgan et al., 2017). Recently, an adult measure of mastery motivation has been developed. The Dimensions of Adult Mastery Motivation Questionnaire (DAMMQ; Doherty-Bigara & Gilmore, 2015) assesses four aspects of mastery motivation across the adult years. To date, the instrument has been used only in the Australian context, and its applicability and value in other countries and cultures is yet to be established. Measures developed in western countries do not necessarily work as well in other cultural contexts (Akoto, 2014). Given that concerns about university drop-out rates are universal, it would be beneficial if a robust measure of mastery motivation was available for use across a range of cultural contexts.

### **Research Context and Aims**

The purpose of the current study was to trial the DAMMQ with young adult university students in four different cultural contexts: Australia, Hungary, Bangladesh and Iran. These four countries have a number of contrasting features. Country and population sizes vary greatly. Geographically, Australia is by far the largest country with an area of 7.69 million km<sup>2</sup>, compared with Iran's 1.65 million km<sup>2</sup> and the considerably smaller Bangladesh (147,570 km<sup>2</sup>) and Hungary (93,000 km<sup>2</sup>). Bangladesh is the most populous country with over 162 million people and a population density of 1.124 per km<sup>2</sup>. This contrasts markedly with 106 per km<sup>2</sup> in Hungary (population approximately 10 million), 48 per km<sup>2</sup> in Iran (population over 80 million) and only 3 people per km<sup>2</sup> in Australia where a considerable proportion of the land is largely uninhabitable by the population of 24 million.

Using the Human Development Index (HDI) from the United Nations 2015 Human Development Report (a composite statistic comprising indicators of life expectancy, education and per capita income), Australia and Hungary both rank in the very high tier, scoring .935 and .828, respectively. Australia's ranking is 2<sup>nd</sup> in the world, and Hungary is ranked 44<sup>th</sup>. Iran is placed in the next tier indicating high human development with a world ranking of 69 and an index score of .766, while Bangladesh is in the medium tier and has a rank of 142 and a score of .570. It is difficult to locate comparable data on the numbers of young adults who are university students in the four countries. Figures for all types of full-time study suggest that around 45% of Australians aged 20-24 are students, compared with 37% of 18-22 year olds in Hungary, and 34% of 18-25 year olds in Iran. In 2016, the number of Bangladeshi students reported to be enrolled in post-secondary school education was 277,151 and the population of young adults aged 20-29 is estimated to be at least 28 million. These figures suggest that only around 1% of young Bangladeshi adults are attending some form of higher education.



Of note, three of the four countries have experienced significant events relatively recently. Hungary became independent of the USSR in 1989, leading to substantial social, political and economic reforms within the country. Bangladesh's independence in 1971 was followed by a period of economic and political turmoil; however, since 1991 there has been increasing stability and economic progress. According to World Bank data, the rate of extreme poverty has dropped from 44% in 1991 to 13% in 2016. School attendance and literacy rates have also improved dramatically. In Iran, the revolution of the late 1970s, followed by the war with Iraq in the 1980s, produced considerable social, economic and political upheaval. In marked contrast, Australia has experienced none of these major events. One other important difference across the four countries is the fact that Bangladesh and Iran are collectivist cultures that encourage the pursuit of group goals and cooperation, whereas Hungary and Australia (with the exception of the country's indigenous population) are individualistic societies in which personal goals, self-reliance and competitiveness are emphasized.

As noted above, mastery motivation is likely to be impacted by a range of contextual factors. Social and cultural groups may have particular expectations about the levels of effort and achievement that are required, and these expectations may differ for boys and girls (Blackhurst & Auger, 2008). Economic and political factors affect educational and career opportunities, which in turn influence individual strivings for mastery. Periods of war and conflict inevitably disrupt education, and reduced opportunities for the achievement of mastery probably impact on motivation. Following times of economic and political instability, education tends to become a strong focus of efforts to rebuild and strengthen a country. Increased opportunities for the achievement of mastery are likely to stimulate mastery motivation. Traditionally, education has been less accessible for women than for men in countries such as Bangladesh and Iran; however, gender differences in educational opportunities have affected all countries. In most western societies, it is only in the past two or three decades that girls have received the same encouragement as boys to proceed to university education. Globally, social, economic and gender inequalities still limit opportunities for tertiary study (Mullen, 2010). In countries where educational and career opportunities have been limited, it would not be surprising if university students, especially women, displayed lower levels of motivation for mastery. Conversely, it is possible that young people respond to educational disruptions and inequalities by subsequently displaying stronger drives for mastery.

In the current study our specific aims were (1) to trial the newly developed adult measure of mastery motivation in different cultural contexts, (2) to compare different aspects of mastery motivation across the four countries, and (3) to explore gender and age differences in mastery motivation in each of the countries.

## Method

### Participants

The participants were 469 university students aged 18 to 29 in Australia ( $n = 137$ ), Hungary ( $n = 123$ ), Bangladesh ( $n = 122$ ) and Iran ( $n = 87$ ). The sample included students from the disciplines of psychology, education, optometry (Australia only) and speech therapy (Iran only). There were some psychology students from each country, but the proportion varied from less than 20% in the Hungarian sample to almost 75% in Bangladesh. The Hungarian group predominantly comprised education students, and there were substantial proportions of optometry students in Australia, and speech therapy students in Iran. Females were over-represented. Participant details are shown in Table 1.

Table 1. Characteristics of Participants in the Four Countries

	Australia $n = 137$	Hungary $n = 123$	Bangladesh $n = 122$	Iran $n = 87$
Gender	79% female	83% female	61% female	79% female
Age	M = 21.03 SD = 2.39 range 19-29	M = 22.09 SD = 2.26 range 18-29	M = 22.94 SD = 1.68 range 19-28	M = 21.26 SD = 2.24 range 18-29
Study area				
Psychology	38%			35%
Education	5%	18%	74%	
Optometry	57%	82%	26%	
Speech Therapy				65%

### Measure

The Dimensions of Adult Mastery Motivation Questionnaire (DAMMQ; Doherty-Bigara & Gilmore, 2015) is a recently developed 24-item questionnaire that measures mastery motivation in adults. The instrument was developed as an adult extension of the Dimensions of Mastery Questionnaire (DMQ). The DAMMQ has five factors: task persistence (8 items; e.g., *I persist with a task even if I feel it is difficult*), preference for challenge (4 items; e.g., *I enjoy being challenged by difficult tasks*), task absorption (4 items; e.g., *I often lose track of time when I am working on a challenging task*), task pleasure (4 items; e.g., *I feel proud of myself when I am successful*), and self-efficacy (4 items; e.g., *I am good at the things I do*). A total mastery motivation score can be obtained by adding the scores for all items, excluding the four from the efficacy scale. Respondents are asked to indicate how typical each statement is on a 5-point Likert scale from 1 = not at all typical to 5 = very typical, with the instruction to “think of a rating of 3 as being average for a person your age”. The DAMMQ had good internal consistency, test-retest reliability and concurrent validity in a sample of 628 Australian adults aged from 18 to 90 years (Doherty-Bigara & Gilmore, 2015).

For the current study, the DAMMQ was translated for use in Hungary and Iran using the process of translation, back translation, discussion with one of the instrument’s authors, and subsequent item refinement. In Bangladesh, where English is the medium of



instruction at most universities, the English version was trialled with a small sample. As there were only two words whose meaning some students did not clearly understand, we decided to proceed to administer the English version in Bangladesh rather than translating it into Bangla.

### *Procedure*

In each of the four countries, university students were recruited in scheduled lectures and tutorials, and invited to complete a hard copy of the questionnaire during or following the class. The targeted students were those studying education, psychology and other areas of allied health (specifically, speech therapy and optometry). Although it may have been preferable to recruit students from the same discipline of study across the four countries, we were restricted by the courses offered at each university, the classes that were scheduled during the period of data collection, and the class sizes. Thus, we recruited within the broader areas of education and allied health, rather than narrower individual disciplines. Recruitment occurred in October or November which was the early part of the academic year for Hungary, Bangladesh and Iran; in Australia, this timing coincided with the approaching end of the academic year. The questionnaire was completed anonymously.

### *Data Analytic Plan*

After screening the data and excluding questionnaires with more than 20% missing data, our plan for analysis was to calculate internal consistencies for the five DAMMQ subscales and the total scale score. To compare aspects of mastery motivation across the four countries, we conducted a multivariate analysis of variance, using country and gender as the independent variables, and the four DAMMQ subscales as dependent variables. We used two separate analyses of variance for total mastery motivation and efficacy. To consider the effects of age, we used correlational analyses.

## **Results**

As shown in Table 2, Cronbach's alphas were above .7 in all four countries for two of the DAMMQ subscales, Persistence and Preference for Challenge, as well as for total mastery motivation. For the other three variables some alphas were below .6, so item analysis using item-total correlations was used to consider the appropriateness of individual items. As suggested by Field (2013), we identified correlations below .3 and considered whether removal of the item would raise the alpha. For Task Absorption, there was one item below .3 in Bangladesh. Although removal of this item raised the alpha from .44 to .65 in Bangladesh, the alphas in all other countries dropped, most markedly in Iran where the alpha fell from .63 to .51. We thus decided to retain this item, while recognising that it was problematic in Bangladesh. On the Task Pleasure subscale, one item correlated below .3 with the total score in all countries except Australia and its removal increased the alphas in every country (see Table 2). Thus, prior to undertaking MANOVA, this item was deleted.

Table 2. Cronbach's Alphas for the DAMMQ Subscales and Total Scale

Scale	Australia	Hungary	Bangladesh	Iran
Persistence	.79	.80	.72	.79
Preference for Challenge	.78	.84	.72	.85
Task Absorption	.72	.65	.44	.63
Task Pleasure	.71	.58	.54	.76
Task Pleasure with #15 removed	.78	.66	.60	.82
Efficacy	.73	.76	.51	.58
Total mastery motivation*	.89	.88	.84	.90

\*excludes Efficacy subscale items

As there were very few instances of missing data (9 unanswered items for 8 participants across the total sample) and the data were missing at random, the values were replaced with the mean of the relevant subscale. A multivariate analysis of variance (MANOVA) was then run using country and gender as the independent variables and the four DAMMQ subscales (Persistence, Preference for Challenge, Task Absorption and Task Pleasure) as the dependent variables. Means and standard deviations are displayed in Table 3.

There were significant main effects for country  $F(4,460) = 5.99, p < .001$ , partial  $\eta^2 = .05$  and gender,  $F(4,458) = 4.88, p < .01$ , partial  $\eta^2 = .04$ , and a significant country by gender interaction,  $F(4,460) = 3.10, p < .05$ , partial  $\eta^2 = .03$ . All of the effect sizes were small to medium (Cohen, 1988).

Univariate results indicated that the only subscale which differed significantly across countries was Task Absorption,  $F(3) = 2.71, p < .05$ , partial  $\eta^2 = .02$ . Post hoc comparisons showed that Bangladeshi students reported significantly lower levels of task absorption than those in Australia or Hungary (both  $p < .05$ ). Males and females differed significantly on two subscales: Persistence  $F(1) = 10.14, p < .01$ , partial  $\eta^2 = .02$ , and Preference for Challenge,  $F(1) = 9.28, p < .01$ , partial  $\eta^2 = .02$ . On both dimensions of mastery motivation, male students reported higher levels than females.

The country by gender interactions were significant for Preference for Challenge,  $F(3) = 3.12, p < .05$ , partial  $\eta^2 = .02$  and Task Absorption,  $F(3) = 3.05, p < .05$ , partial  $\eta^2 = .02$ .

Posthoc comparisons showed that the difference between male and female task persistence was significant in Bangladesh ( $p < .01$ ) and Iran ( $p < .05$ ) with the difference approaching significance in Australia ( $p = .057$ ). Males reported greater preference for challenge in Australia ( $p < .01$ ), Bangladesh ( $p < .01$ ) and Iran ( $p < .05$ ). In addition, Iranian males reported significantly higher levels of task absorption than females ( $p < .01$ ).

Table 3. DAMMQ Subscale &amp; Total Scale Means (Standard Deviations) Split for Country and Gender

	Australia n = 137 <sup>a</sup>	Hungary n = 123 <sup>b</sup>	Bangladesh n = 122 <sup>c</sup>	Iran n = 87 <sup>d</sup>
<b>Persistence</b>				
Total sample	28.19 (4.54)	29.89 (4.58)	29.23 (4.57)	27.09 (4.85)
Female	27.81 (4.50)	29.96 (4.63)	28.35 (4.59)	26.48 (4.87)
Male	29.62 (4.52)	29.52 (4.41)	30.58 (4.23)	29.44 (4.10)
<b>Preference for Challenge</b>				
Total sample	13.78 (2.65)	14.54 (3.14)	14.37 (3.05)	13.38 (3.42)
Female	13.44 (2.59)	14.69 (3.00)	13.78 (2.87)	13.00 (3.53)
Male	15.07 (2.52)	13.86 (3.76)	15.27 (3.13)	14.83 (2.57)
<b>Task Absorption</b>				
Total sample	14.77 (2.67)	15.41 (2.52)	14.02 (2.54)	14.10 (2.80)
Female	14.69 (2.77)	15.57 (2.42)	13.80 (2.61)	13.72 (2.83)
Male	15.07 (2.27)	14.62 (2.87)	14.38 (2.41)	15.56 (2.18)
<b>Task Pleasure</b>				
Total sample	13.51 (1.77)	13.81 (1.51)	13.04 (1.99)	12.95 (2.60)
Female	13.61 (1.69)	13.93 (1.46)	12.81 (2.21)	13.13 (2.69)
Male	13.14 (2.01)	13.24 (1.67)	13.40 (1.54)	12.28 (2.14)
<b>Efficacy</b>				
Total sample	14.43 (2.41)	15.33 (2.56)	14.69 (2.35)	13.80 (2.49)
Female	14.14 (2.37)	15.28 (2.63)	14.50 (2.35)	13.75 (2.60)
Male	15.52 (2.29)	15.57 (2.20)	14.98 (2.35)	14.00 (2.09)
<b>Total Mastery Motivation*</b>				
Total sample	73.56 (9.86)	77.19 (9.93)	74.34 (9.97)	70.59 (11.59)
Female	72.74 (9.77)	77.61 (9.81)	72.31 (9.62)	69.30 (11.92)
Male	76.62 (9.79)	75.14 (10.52)	77.46 (9.79)	75.50 (8.62)

<sup>a</sup> female = 108, male = 29; <sup>b</sup> female = 102, male = 21; <sup>c</sup> female = 74, male = 48; <sup>d</sup> female = 69, male = 18

\* excludes Efficacy subscale items

The profiles of country and gender differences for persistence and preference for challenge are graphically presented in Figures 1 and 2.

A country x gender ANOVA was run using the total mastery motivation score. There was a significant main effect for gender  $F(1,461) = 7.77, p < .01$ , partial  $\eta^2 = .02$ , but no main effect for country. The interaction effect approached significance with a  $p$  value of .05 and partial  $\eta^2 = .02$ . Pairwise comparisons showed significant difference between males and females in Bangladesh ( $p < .01$ ) and Iran ( $p < .05$ ) with a trend towards significance in the Australian sample ( $p = .06$ ).

As the alphas for Efficacy were satisfactory only for Australia and Hungary, just those two countries were included in the ANOVA for this variable. There was a significant main effect for gender,  $F(1,256) = 4.54, p < .05$ , partial  $\eta^2 = .02$ , but no main effect for country. Males reported higher efficacy than females. The interaction effect was not significant, but pairwise comparisons showed a significant gender difference in Australia,  $F(1,256) = 7.19, p < .01$ , partial  $\eta^2 = .03$ . There was no significant difference between males and females in Hungary.

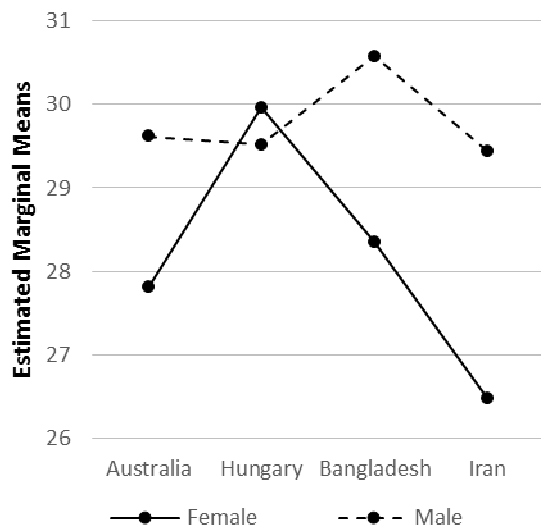


Figure 1. Persistence by country & gender

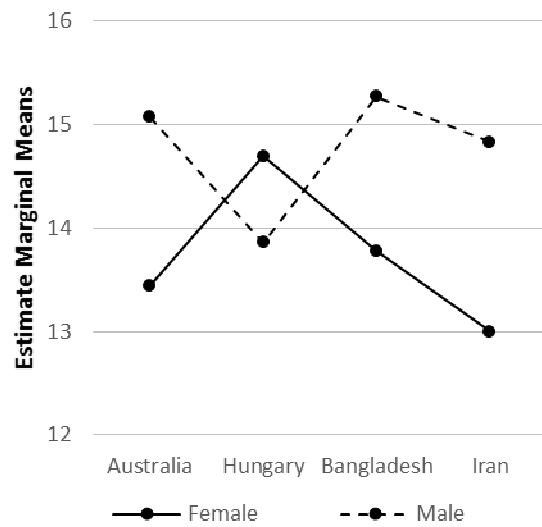


Figure 2. Preference for challenge by country & gender

Correlations of age with mastery motivation indicated significant relationships in Australia for persistence, preference for challenge and task absorption (all  $r = .22$ ,  $p < .01$ ) as well as total mastery motivation ( $r = .27$ ,  $p < .001$ ). In Hungary, there were significant correlations of age with persistence ( $r = .22$ ,  $p < .01$ ) and task absorption ( $r = .20$ ,  $p < .05$ ). All correlations in Bangladesh and Iran were nonsignificant, ranging from  $r = -.08$  to  $.04$ .

## Discussion

This is the first study to examine mastery motivation in university students across cultures, and only the second study to use the newly developed adult measure of mastery motivation. The DAMMQ appeared to be more robust in Australia, the country in which it was developed, than in the other three countries. Nevertheless, alphas for the total scale were similarly high in all countries and subscale alphas reached minimally acceptable levels of .6 (Nunnally, 1978) for all four dimensions of mastery motivation with the exception of one subscale (Task Absorption) in Bangladesh. Interestingly, the two words that Bangladeshi students did not easily understand during pilot testing of the English questionnaire (*immersed* and *absorbed*) are both used only in this subscale. It thus seems likely that the low alpha was related to limited understanding or misunderstanding of two of the four items on this subscale.

In retrospect, it would have been preferable to translate the DAMMQ into Bangla for administration in Bangladesh. However, even the most rigorous translation does not necessarily ensure similar understanding of concepts across cultures (De Castella, Byrne, & Covington, 2013), which may explain why some of the subscale alphas were lower in the other three countries than they were in Australia. In addition, some concepts may be more or less salient in particular cultures, especially when

comparisons are being made between individualist and collectivist societies (King & McInerney, 2014) and motivation constructs may have different meanings or mechanisms in different cultural contexts (Täht, Must, Peets, & Kattel, 2014). Studies with the Achievement Motivation Scale have reported considerably lower alphas in non-western countries (Ghana and Malaysia) than in the USA (Akoto, 2014; Komarraju, Karau, & Ramayah, 2007).

Cultural differences in the ways that individuals respond to Likert-style questions also need to be kept in mind when interpreting self-report questionnaires across cultures. Participants in some countries may be more likely to present themselves in positively biased ways. Cross-cultural differences in self-evaluations have been identified previously (e.g., Furnham, Keser, Arteche, Chamorro-Premuzic, & Swami 2009; Kim, Schimmack, Cheng, Webster, & Spectre, 2016), and are presumed to result from cultural or socioeconomic factors (Loughnan et al., 2011).

Despite these issues, the findings suggest that the DAMMQ may be a useful measure of mastery motivation across diverse cultures. The only difference in mastery motivation across the four countries was for task absorption, with Bangladeshi students reporting lower levels. However, as discussed above, this subscale was not robust in Bangladesh, and the finding thus cannot be considered to be interpretable. Of more interest are the significant gender differences that were evident in all countries except Hungary. Female students self-reported significantly lower levels of mastery motivation than did males, although the effect sizes were small. There is no obvious explanation for the lack of gender differences in Hungary. According to a report prepared for the European Commission, in Hungary female participation in tertiary education and in the work force is lower than European averages. However, young women in Hungary reportedly achieve higher results at university than men, even though males do better at high school.

Globally, in the past few decades, the proportion of female university students has risen dramatically, but in some countries gender equality with respect to employment has lagged behind educational opportunities. This is especially so in Iran where the paradox of tradition and modernity impacts on expectations and opportunities for women. Female university students in Iran and in some other countries may be less motivated because they are not hopeful about gaining employment following graduation.

While it is possible that differences in expectations, opportunities and experiences account to some extent for gender differences in mastery motivation, it is important to remember that our findings are based solely on self-report. Previous research has shown that men tend to report somewhat inflated estimates of their own ability (Bennett, 1996; Syzmanowicz & Furnham, 2011) as well as higher self-efficacy than women (D'Lima, Winsler, & Kitsantas, 2014). It is thus possible that the male university students in Australia, Bangladesh and Iran felt more confident and efficacious, and thus reported more positively on their mastery motivation.

Nevertheless, the relatively small number of males within the sample suggests caution in interpreting gender differences. According to the World Data Atlas 2012, 56.7% of Australian university students and 55.5% of Hungarian students are female. The proportions of female students in Iran and Bangladesh are 49.8% and 41.4%, respectively. Our samples thus are not representative of the gender balance in universities. This is largely due to the fact that we targeted students in faculties of education and health that are generally more popular with female students. As well, males tend to be somewhat less willing to participate in research than females.

Age differences in mastery motivation were evident only in Australia and Hungary. Given the likelihood that older students have more experience and are more committed to university study, it is not surprising that they report higher levels of persistence and preference for challenge. As well, older students are more likely to be specializing in areas of personal interest and expertise which may contribute to higher motivation for mastery. Interestingly, however, there were no relationships between age and any aspect of mastery motivation for students in Bangladesh and Iran.

There are several limitations associated with our study that should be considered in the design of future research. First, we focused only on participants within the disciplines of education and allied health, and the samples across countries were not drawn from exactly the same disciplines. Second, the sample was very unbalanced with respect to gender composition. It is possible that gender differences may be less evident, different, or even more pronounced in larger samples or in samples that are drawn from disciplines which have traditionally been more male dominated, such as engineering. Third, it would have been preferable to translate the DAMMQ into Bangla for use in the Bangladeshi context, and this is strongly recommended prior to conducting further mastery motivation research in that country. Another limitation relates to the fact that we did not collect data about the number of years that the participants had been engaged in university study, nor did we explore student perceptions about their university courses, such as the degree of inherent challenge. These data may have been useful for interpreting group differences in mastery motivation.

Despite these limitations, the current study makes some important contributions to the limited literature about adult mastery motivation. The DAMMQ is now available in Hungarian and Persian languages, thus paving the way for further research in those countries. Our comparisons across four different countries suggest that there are similarities in self-reported mastery motivation for university students cross-culturally, a finding that provides some support for the universality of the theoretical construct of mastery motivation. Although the gender differences we identified need further investigation in larger samples, the finding that young women reported lower levels of mastery motivation than men in all countries except Hungary suggests the potential need for universities to encourage and nurture female students in their striving for mastery. Exploring contributors to mastery motivation, stability of dimensions over time, and the extent to which mastery motivation predicts concurrent and future

academic success would all be potentially fruitful avenues for future research with applied implications for universities globally.

## Conclusion

The present study differs from previous motivation research that has focused mostly on motives for university study. Using the paradigm of mastery motivation and a recently developed adult measure, we investigated the strength of students' drive for mastery, indicated by their self-reported persistence, preference for challenge, task absorption, and task pleasure across four cultural contexts. Given the importance of university education for a country's prosperity, understanding the motivational factors that underlie academic success is imperative to inform policies and programs for increasing student retention and individual well-being.

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## References

- Akoto, E. O. (2014). Cross-cultural factorial validity of the academic motivation scale. *Cross Cultural Management*, 21(1), 104–125. <https://doi.org/10.1108/CCM-11-2011-0100>
- Arulampalam, W., Naylor, R. A., & Smith, J. P. (2007). Dropping out of medical school in the UK: Explaining the changes over ten years. *Medical Education*, 41(4), 385–394. <https://doi.org/10.1111/j.1365-2929.2007.02710.x>
- Bennett, M. (1996). Men's and women's self-estimates of intelligence. *Journal of Social Psychology*, 136(3), 411–412. <https://doi.org/10.1080/00224545.1996.9714021>
- Blackhurst, A. E., & Auger, R. W. (2008). Precursors to the gender gap in college enrolment: Children's aspirations and expectations for their futures. *Professional School Counseling*, 11(3), 149–158. <https://doi.org/10.5330/PSC.n.2010-11.149>
- Cohen, J. (1988). *Statistical power analysis for the behavioural sciences*. Hillsdale, NJ: Erlbaum. <https://doi.org/10.1002/bs.3830330104>
- Crosling, G., Heagney, M., & Thomas, L. (2009). Improving student retention in higher education. *Australian Universities' Review*, 51(2), 9–18.
- De Castella, K., Byrne, D., & Covington, M. (2013). Unmotivated or motivated to fail? A cross-cultural study of achievement motivation, fear of failure, and student disengagement. *Journal of Educational Psychology*, 105(3), 861–880. <https://doi.org/10.1037/a0032464>
- D'Lima, G. M., Winsler, A., & Kitsantas, A. (2014). Ethnic and gender differences in first-year college students' goal orientation, self-efficacy, and extrinsic and intrinsic motivation. *Journal of Educational Research*, 107(5), 341–356. <https://doi.org/10.1080/00220671.2013.823366>
- Doherty-Bigara, J., & Gilmore, L. (2015). Development of the Dimensions of Adult Mastery Motivation Questionnaire. *The Australian Educational and Developmental Psychologist*, 32(2), 142–157. <https://doi.org/10.1017/edp.2015.18>

- Duque, L. C., Duque, J. C., & Suri-ach, J. (2013). Learning outcomes and dropout intentions: An analytical model for Spanish universities. *Educational Studies*, 39(3), 261–284.  
<https://doi.org/10.1080/03055698.2012.724353>
- Evans, P., & Bonneville-Roussy, A. (2016). Self-determined motivation for practice in university music students. *Psychology of Music*, 44(5), 1095–1110.
- Field, A. (2013). *Discovering statistics using IBM SPSS statistics* (4th ed.). London: Sage.
- Furnham, A., Keser, A., Arteche, A., Chamorro-Premuzic, T., & Swami, V. (2009). Self- and other-estimates of multiple abilities in Britain and Turkey: A cross-cultural comparison of subjective ratings of intelligence. *International Journal of Psychology*, 44(6), 434–442.  
<https://doi.org/10.1080/00207590802644766>
- Green, S., & Morgan, G. A. (2017). Patterns of mastery task behavior in early school-age children in the United States. *Hungarian Educational Research Journal*, 7(2), 142–157.
- Gilmore, L., & Cuskelly, M. (2014). Mastery motivation in children with Down syndrome: Promoting and sustaining interest in learning. In R. Faragher, & B. Clarke (Eds.), *Educating learners with Down syndrome: Research, theory and practice with children and adolescents* (pp. 381–402). New York: Taylor & Francis.
- Gilmore, L., Cuskelly, M., & Purdie, N. (2003). Mastery motivation: Stability and predictive validity from ages two to eight. *Early Education and Development*, 14(4), 411–424.  
[https://doi.org/10.1207/s15566935eed1404\\_2](https://doi.org/10.1207/s15566935eed1404_2)
- Guiffrida, D. A., Lynch, M. F., Wall, A. F., & Abel, D. S. (2013). Do reasons for attending college affect academic outcomes? A test of a motivational model from a self-determination theory perspective. *Journal of College Student Development*, 54(2), 121–139. <https://doi.org/10.1353/csd.2013.0019>
- Huang, S.-Y., & Lay, K.-L. (2017). Mastery motivation in infancy and early childhood: The consistency and variation of its stability and predictability of general competence. *Hungarian Educational Research Journal*, 7(2), 15–31.
- Hwang, A.-W., Wang, J., Józsa, K., Wang, P.-J., Liao, H.-F., & Morgan, G. A. (2017). Cross cultural invariance and comparisons of Hungarian-, Chinese-, and English-speaking preschool children leading to the revised Dimensions of Mastery Questionnaire (DMQ 18). *Hungarian Educational Research Journal*, 7(2), 32–47.
- Infante, E., & Marin, M. (2008). Psychosocial profile of unsuccessful university student: Personality and motivational factors revisited. In A. M. Columbus (Ed.), *Advances in psychology research*, Vol. 56 (pp. 135–149). Hauppauge, NY: NovaScience.
- Józsa, K., & Molnár, É. D. (2013). The relationship between mastery motivation, self-regulated learning and school success: A Hungarian and wider European perspective. In K. C. Barrett, N. A. Fox, G. A. Morgan, D. J. Fidler, & L. A. Daunhauer (Eds.), *Handbook of self-regulatory processes in development: New directions and international perspectives* (pp. 265–304). New York: Taylor & Francis.  
<https://doi.org/10.4324/9780203080719.ch13>
- Kim, H., Schimmack, U., Cheng, C., Webster, G. D., & Specgtr, A. (2016). The role of positive self-evaluation on cross-cultural differences in well-being. *Cross-Cultural Research: The Journal of Comparative Social Science*, 50(1), 85–99. <https://doi.org/10.1177/1069397115617902>
- King, R. B., & McInerney, D. M. (2014). Culture's consequences on student motivation: Capturing cross-cultural universality and variability through personal investment theory. *Educational Psychologist*, 49(3), 175–198.
- King, R. B., McInerney, D. M., & Watkins, D. A. (2013). Examining the role of social goals in school: A study in two collectivist cultures. *European Journal of Psychology of Education*, 28(4), 1505–1523.  
<https://doi.org/10.1007/s10212-013-0179-0>
- Komaraju, M., Karau, S. J., & Ramayah, T. (2007). Cross-cultural differences in the academic motivation of university students in Malaysia and the United States. *North American Journal of Psychology*, 9(2), 275–292.



- Liu, E. S. C., Ye, C. J., & Yeung, D. Y. (2015). Effects of approach to learning and self-perceived overall competence on academic performance of university students. *Learning and Individual Differences*, 39, 199–204. <https://doi.org/10.1016/j.lindif.2015.03.004>
- Loughnan, S., Kuppens, P., Allik, J., Balazs, K., de Lemus, S., Dumont, K., Gargurevich, R., Hidegkuti, I., Leidner, B., Matos, L., Park, J., Realo, A., Shi, J., Sojo, V., Tong, Y., Vaes, J., Verduyn, P., Yeung, V., & Haslam, N. (2011). Economic inequality is linked to biased self-perception. *Psychological Science*, 22(10), 1254–1258. <https://doi.org/10.1177/0956797611417003>
- Miller, L., Ziviani, J., Ware, R. S., & Boyd, R. N. (2015). Mastery motivation: A way of understanding therapy outcomes for children with unilateral cerebral palsy. *Disability and Rehabilitation*, 37(16), 1439–1445.
- Morgan, G. A., Busch-Rossnagel, N. A., Barrett, K. C., & Wang, J. (2009). *The Dimensions of Mastery Questionnaire (DMQ): A manual about its development, psychometrics and use*. Colorado State University, Fort Collins.
- Morgan, G. A., Liao, H.-F., Nyitrai, Á., Huang, S.-Y., Wang, P.-J., Blasco, P. M., Ramakrishnan, J., & Józsa, K. (2017). The revised Dimensions of Mastery Questionnaire (DMQ 18) for infants and preschool children with and without risks or delays in Hungary, Taiwan, and the US. *Hungarian Educational Research Journal*, 7(2), 48–67.
- Mullen, A. L. (2010). *Degrees of inequality: Culture, class, and gender in American higher education*. Baltimore: John Hopkins University Press.
- Nitza, A., Whittingham, M., & Markowitz, L. (2011). Transitions: Connecting and succeeding on campus. In T. Fitch, & J. L. Marshall (Eds.), *Group work and outreach plans for college counsellors* (pp. 21–32). Alexandria, US: American Counseling Association.
- Nunnally, J. C. (1978). *Psychometric theory*. New York: McGraw-Hill.
- Prymachuk, S., Easton, K., & Littlewood, A. (2009). Nurse education: Factors associated with attrition. *Journal of Advanced Nursing*, 65(1), 149–160. <https://doi.org/10.1111/j.1365-2648.2008.04852.x>
- Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality and Social Psychology*, 57(5), 749–761. <https://doi.org/10.1037/0022-3514.57.5.749>
- Syzmanowicz, A., & Furnham, A. (2011). Gender differences in self-estimates of general, mathematical, spatial and verbal intelligence: Four meta analyses. *Learning and Individual Differences*, 21(5), 493–504. <https://doi.org/10.1016/j.lindif.2011.07.001>
- Täht, K., Must, O., Peets, K., & Kattel, R. (2014). Learning motivation from a cross-cultural perspective: A moving target? *Educational Research and Evaluation*, 20(4), 255–274. <https://doi.org/10.1080/13803611.2014.929009>
- Vallerand, R. J., Pelletier, L. G., Blais, M. R., Briere, N. M., Senecal, C., & Vallieres, E. F. (1992). The academic motivation scale: A measure of intrinsic, extrinsic, and motivation in education. *Educational and Psychological Measurement*, 52(4), 1003–1017. <https://doi.org/10.1177/0013164492052004025>

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