



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
2017, Vol. 7(2) 48–67
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<http://herj.lib.unideb.hu>
Debrecen University Press



DOI:10.14413/HERJ/7/2/4

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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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Recommended citation format: 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. doi:10.14413/HERJ/7/2/4

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 <i>mean (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)
Persistence scales					
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	-
Expressive scales					
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
Social mastery with adults					
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			
Gross motor persistence					
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			
Cognitive/object persistence					
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		
Mastery pleasure					
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	
Social mastery with peers					
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>
Persistence scales					
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
Expressive scales					
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
Persistence scales					
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
Expressive scales					
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 (≥ 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.

Acknowledgement

Sample 1 data collection was supported by Fu Jen Catholic University, Taiwan (grant 9991A01/A0103013). The data for sample 2 was supported by a scholarship from the National Taiwan University Children and Family Research Center and the School of

Graduate Institute of Physical Therapy. Sample 3 data collection was supported by the Hungarian Scientific Research Fund, OTKA-K83850 and by the János Bolyai Research Scholarship of the Hungarian Academy of Sciences. Project EF (NIDILRR grant number 901F0084) provided the data for sample 4. Sample 5 data collection was supported by a fellowship from the Center for Personalized Prevention Research in Children's Mental Health at the University of Minnesota.

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