

Swahili version of the Dimensions of Mastery Questionnaire: Adaptation and Psychometric Properties

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Abstract

Introduction. The current focus of empirical studies demonstrates the significance of mastery motivation in child development, academic achievement and school success. Consequently, it is critical to have reliable and valid tools to measure this important variable accurately. The Preschool version of the Dimensions of Mastery Questionnaire (DMQ) 18 has been validated in English, Hungarian, and Chinese and translated to many other languages. This has opened cross-cultural and cross-ethnic studies among these countries.

Method. In this study, we evaluate the psychometric properties of the Swahili version of the DMQ 18. Teachers and parents evaluated 397 preschool children recruited using a stratified random sampling technique from Kenya's counties.

Results. Reliability was established by good internal consistency, construct reliability, test-retest and parallel forms reliability values. Factorial validity was proven by confirmatory factor analysis and this fitted the theoretical model quite well.

Discussion and Conclusion. The Swahili Preschool Dimensions of Mastery Questionnaire was valid and reliable for collecting data in the Kenyan context and that of East Africa. This version compared well with other versions such as Hungarian, Spanish, Turkish, Persian and Indonesian.

Keywords: Adaptation, DMQ 18, Confirmatory Factor Analysis, Mastery motivation, Psychometric properties.

Resumen

Introducción. El enfoque actual de los estudios empíricos ha demostrado la importancia de la motivación de dominio en el desarrollo infantil, el rendimiento académico y el éxito escolar. En consecuencia, es fundamental contar con instrumentos confiables y válidos para medir con precisión esta variable crítica. La versión preescolar del cuestionario Dimensions of Mastery (DMQ) 18 fue validada en Inglés, Húngaro, Chino y Español. Esto ha abierto estudios interculturales y étnicos entre estos países.

Método. En este estudio, evaluamos las propiedades psicométricas de la versión Swahili del DMQ 18. Maestros y padres evaluaron a 397 niños en edad preescolar que fueron reclutados mediante la técnica de muestreo aleatorio sistemático en uno de los condados de Kenia.

Resultados. La confiabilidad se estableció mediante una buena consistencia interna, constructo confiable, test-retest y valores de confianza de formas paralelas. La validez del constructo se demostró mediante un análisis factorial confirmatorio que se ajustó bien al modelo teórico.

Discusión y conclusiones. La versión preescolar Swahili del cuestionario Dimensions of Mastery fue válido y confiable para recopilar datos en el contexto Keniano y de África Oriental en general. Esta versión se comparó bien con otras versiones tales como Húngaro, Español, Turco, Persa e Indonesio.

Palabras clave: Adaptación, DMQ 18, Análisis factorial confirmatorio, Motivación de dominio, Propiedades psicométricas.

Introduction

Recent studies have demonstrated the significance of mastery motivation in the evaluation of young students. Studies have demonstrated an association between mastery motivation and school-related skills such as language and math (Kikas & Silinskas, 2015; Mercader et al., 2017) and school achievement (Józsa & Morgan, 2014). Furthermore, mastery motivation can predict the transition from one class to another better than developmental scores in typically developing children (Józsa & Barrett, 2018; Józsa & Molnár, 2013) and for children with developmental disabilities (Gilmore & Cuskelly, 2009). Mastery motivation is also positively correlated with social competence (Berhenke et al., 2011), and parental influences on children's school achievement (Józsa et al., 2019). Using the Preschool version of the Dimensions of Mastery Questionnaire 18 (DMQ: Morgan, Liao, & Józsa, 2020) to assess mastery motivation, researchers have found that it predicts school performance and has educational implications for practice (Green & Morgan, 2017; Józsa & Barrett, 2018; Józsa et al., 2017). Child growth and development domains such as social, cognitive and psychomotor development are also affected by mastery motivation (Busch-Rossnagel & Morgan, 2013; Wang & Barrett, 2013). Mastery motivation has also much relevance in the clinical profession since it helps explain how children carry out purposeful tasks that are critical, especially during rehabilitation (Salavati et al., 2018). For these reasons, mastery motivation was declared by the "From Neighborhood to Neurons" seminal report to be a critical component of child growth and development that should be assessed during child evaluations (Shonkoff & Philips, 2000). Despite numerous calls, low and middle-income countries (LMICs) are, however, unable to carry out these evaluations because the tools have not been adapted to suit these countries' needs (Ruan-Iu et al., 2020; Willoughby et al., 2019; Zuilkowski et al., 2016). However, over 250 million children in LMICs, especially in Sub-Saharan Africa, suffer from environmental deprivation, malnutrition and illness that affect their cognitive development (Lu et al., 2016). Previous questionnaires have favored participants who speak English. Therefore, Preschool DMQ 18 in Kiswahili will create participants' inclusivity in mastery motivation research.

Barrett and Morgan (2018) defined mastery motivation as "the urge or psychological push to solve problems, meet challenges, and master ourselves and our world" (p. 4). Mastery motivation is closely related to, but not the same as achievement goals theory, expectancy-value approach and self-determination theories of motivation (Józsa et al., 2019). The achievement goals theory addresses why students will be motivated to get involved in some

tasks and not in others (Harackiewicz et al., 2012), and it involves the aspects of mastery and performance goals (Anderman & Wolters, 2006). However, mastery motivation is more concerned with the process and attempts to master something, despite the difficulties of an ongoing task that is not necessarily an academic goal. Mastery motivation has two aspects, namely instrumental and expressive/affective aspects (Barrett & Morgan, 2018). One similarity between the mastery of goals and mastery motivation is that one keeps going despite failing to achieve goals, and also one keeps going despite experiencing challenges or difficulties (Józsa & Barrett, 2018). In the expectancy-value approach, the emphasis is placed on the value of the activity and the expectation that we will succeed (Eccles et al., 1983). Whether we succeed or not is not essential in mastery motivation, but persistence is critical (Barrett & Morgan, 1995). Self-determination theory, in turn, focuses on autonomy, relatedness and competence (Deci & Ryan, 2017).

In contrast, mastery motivation treats self and relationships as mastery domains and the inclination to master something as a motive in itself (Józsa & Molnár, 2013). Mastery motivation also involves an assessment of other broad domains, including the cognitive, social, and physical domains. The same person can have different mastery motivation in different domains. For this reason, it is essential to put mastery motivation as a process in context (Wang & Barrett, 2013).

From the child development point of view, children are born with the inherent internal motivation to interact and collect information about their environment. At the age of 24-36 months, they have developed some autonomy, critical for internal motivation (Carlton & Winsler, 1998). If well developed at preschool, this internal motivation will have a significant impact on future learning and academic achievement (Theodotou, 2014). The concept of intrinsic motivation is related to mastery motivation, and it assumes that mastery motivation is initially intrinsic (McCall, 1995). Moreover, intrinsic motivation plays a role in establishing social relations and succeeding in environmental and physical activities (Ryan & Deci, 2000; Yıldırım & Akamca, 2017).

In early childhood, mastery motivation is assessed utilizing free play (McCall, 1995), structured-mastery tasks (Yarrow et al., 1983), individually determined, moderately challenging tasks (Green & Morgan, 2017) and questionnaires (Józsa & Morgan, 2015). Recently, game-based assessment was introduced to assess mastery motivation (Józsa et al., 2017).

Moreover, four sets of questionnaires are available to assess mastery motivation: the infant questionnaire for 6- to 23-month-olds is scored by adults; the preschool questionnaire for 2- to 6-year-olds is scored by adults; the school-age questionnaire is either scored by adults or self-reported; and the adult questionnaire is self-reported. Questionnaires have an advantage since the rater – for instance, the teacher, parent or caregiver – spends a lot of time with the child on structured tasks and free play.

Using the decentering procedure (Marín & Marín, 1980), the DMQ has been translated into English, Chinese, Spanish and Hungarian. Other translations are also available in Hebrew, Farsi and Turkish (Morgan, Liao, & Józsa, 2020). Swahili is emerging as a significant language in Africa, and the African Union advocates it as the continent's language. Approximately 150 million people speak it in East Africa and Central Africa, and another 50 million people speak it outside Africa (Mazrui & Mazrui, 1995). Presenting the Preschool DMQ 18 in Swahili will open up a new research frontier that will connect Africa with all other researchers of mastery motivation in the rest of the world. This is crucial because, according to the socio-ecological perspective, the macro environment shapes culture around an individual which influences mastery motivation (Oishi & Graham, 2010).

Objectives

The objective of this study is four-fold. The first is to translate the Preschool DMQ 18 from English to Swahili. The second is to determine the psychometric properties of the Swahili version in the Kenyan context. The third is to compare the ratings of parents and teachers who are the primary users of the DMQ 18. Finally, the fourth is to determine measurement invariance across age and gender of the DMQ 18 in Swahili.

Method

Participants

A total of 397 preschool children were sampled from one of the counties in Kenya. Due to the diversity of preschools in this region, schools were placed into four strata: rural but public school; rural but privately owned; urban but publicly owned and rural but privately owned. From each stratum, three schools were chosen randomly. From each school, children were selected using simple random sampling. We recruited children who were attending preprimary II, which is a second-year class for children attending preschool in Kenya. Chil-

dren in preprimary II have spent over a year with the teacher and have built up a two-way relationship, hence they are easier to evaluate. Children below three years do not attend preschool classes (Republic of Kenya, 2017). Of the total number of 397 preschoolers chosen at random, 210 (52.9%) were male and 187 (47.1%) female. Their ages from 5 to 12 years ranged ($M=6.93$, $SD=1.40$) as follows: 5-6 years, 203 (51.13%), 7-8 years, 136 (34.26%), 9-10 years, 46 (11.59%) and 11-12 years, 12 (3.02%). In Kenya, it is common to find children older than six years who still are attending preschool classes. This is mainly due to the Government declaration that elementary education is free and compulsory (Republic of Kenya, 2010), and therefore all children who had dropped out or had other challenges are strongly encouraged to go back to school.

Instruments

Subscales of the Preschool DMQ 18 as the research instrument

The Preschool DMQ 18 has seven sub-scales (Huang et al., 2020). The first four scales are related to the instrumental (persistence) aspects of mastery motivation, namely (1) Object/Cognitive persistence scale (five items), e.g. "Works for a long time trying to do something challenging"; (2) Gross motor persistence scale (five items), e.g. "Tries to do well in physical activities even when they are challenging (or difficult)"; (3) Social persistence with adults scale (five items), e.g. "Tries to figure out what adults like"; (4) Social persistence with children/peers (six items), e.g. "Tries hard to make friends with other kids". The next two scales assess expressive/affective aspects of mastery motivation; (5) Mastery pleasure measures the positive affect after finishing or while working on a task with five items, e.g. "Gets excited when he or she figures out something"; (6) The negative reactions scale has eight items focusing on sadness/shame, e.g. "Seems sad when he or she does not accomplish a goal" and frustration/anger, e.g. "Gets upset when he or she is not able to complete a challenging task". Lastly, there is the general competence scale, with five items, e.g. "Solves problems quickly". To compute the child's cognitive persistence, the five items in the subscale are averaged as follows: $(1+14+17+23+29)/5$. Averages are calculated for gross motor persistence $(3+12+26+36+38)/5$; social persistence with adults $(8+15+22+33+37)/5$; social persistence with children $(6+7+25+28+32+35)/6$; mastery pleasure $(2+11+18+21+30)/5$; negative reactions for both frustration and anger $(9+13+16+19+5+24+34+39)/8$; and finally, general competence $(4+10+20+27+31)/5$.

Procedure

Translation of the Preschool DMQ 18 from English into Swahili

After requesting official permission from the original developer of the DMQ 18, we followed the procedure suggested by Fajranthi et al. (2020), and Sousa and Rojjanasrirat (2011) to translate and validate the Swahili version of the Preschool DMQ 18. A committee approach was adopted composed of two bilingual English and Swahili speakers working with a research institution as linguists, current researchers, experts in mastery motivation, and preschool teachers (International Testing Commission (ITC), 2018; Fajranthi et al. 2020). The two bilingual translators did the forward translation from Swahili into English (Figure 1). One was versed in the concept of mastery motivation, while the other was knowledgeable in Swahili and acquainted with the cultural nuances of Swahili speakers in Kenya. The two forward translated documents were presented to a committee for the first synthesis. Specific words that were ambiguous in the Swahili translation were 'mastery motivation', 'puzzles', 'motor activities' and 'physical activities'. After deliberations among the committee members, the first version of the Swahili translated tool was developed. This tool was subjected to scrutiny by five parents and 11 teachers, all of whom were graduates specializing in Early Childhood Education and with over five years of teaching experience in Kenyan preschools. These teachers were qualified to teach 3- to 8-year-olds. All the parents involved had at least an undergraduate degree and worked at a research institution. This small sample was checked for colloquial phrases, slang, jargon and emotionally evocative terms that should be removed or replaced in the translated questionnaire (Sperber, 2004).

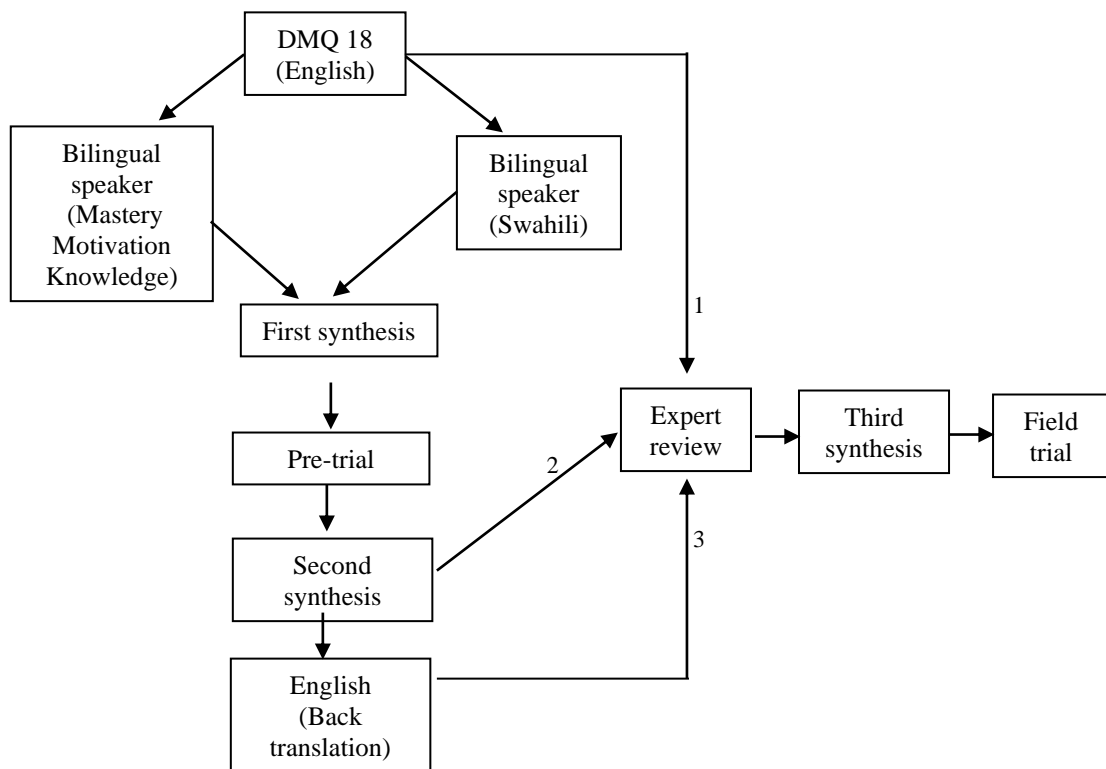


Figure 1. *Process of translating the original English Preschool DMQ 18 into Swahili*

Note: All of the versions were submitted to the experts for expert review

- 1 - Original Preschool DMQ 18 in English
- 2 - DMQ 18 translated into Swahili
- 3 - Back translated from Swahili into English

The Swahili version of the tool was back-translated into English by an independent bilingual translator who had not read the original English version. A back-translation procedure was adopted because it could be compared with the source questionnaire's original expression (Sperber, 2004). This translator had a PhD in the English Language and had published several books for children and teenagers in English. The back-translated version, the original English version and the Kiswahili version were amalgamated into one document and forwarded to the experts who developed the Preschool DMQ 18 (Fajranthi et al. 2020). The aim was to ensure that content validity was maintained and that the Swahili instrument would assess mastery motivation.

One of the committee's experts, an English native speaker, compared all the items and gave further feedback. Out of the 39 items, 30 (79%) items were comparable and similar to

the original questionnaire. Some of the words that were not correctly translated included 'persist', 'shows excitement', 'smile broadly', and 'interested'. Using the comments by the expert, the committee deliberated on the wording and adopted alternative words. This version was accepted, and a small-scale field trial was conducted involving 16 parents (Shaoli et al., 2019). After completing the questionnaire, the 16 parents (who also were preschool teachers) were brought together for a focus group discussion. All the items presented were discussed one after the other, and clarifications were agreed upon. This final version, consisting of the original English version, the back-translated and the refined Swahili version, was presented to an independent expert in the Swahili language for final confirmation. The committee then approved this final Swahili version of the Preschool DMQ 18 to be used for data collection.

Data Collection

Before data collection, the researchers sought ethical approval from the University of Szeged, the Institutional Research Board and the National Council for Science Technology and Innovation in Kenya. Both parents and teachers were requested to sign a consent form after full disclosure of the whole study and its procedure. Two research assistants, one with an M.A. degree and the other with a first degree, helped with data collection. Teachers rated 397 children from 12 preschools using the Swahili version. ITC (2018) recommended a sample size above 300 during the adaptation of questionnaires. However, Floyd and Widaman (1995) proposed a ratio of subjects-to-variable ratio of 5:1. In our case, 39x5 giving 195. To assess the questionnaire's test-retest reliability a sample of 50 children were rated for the second time by their teachers (Shaoli et al., 2019). To get a teacher-parent comparison, a subsample of 50 children from the primary sample was randomly selected, and their parents were asked to rate them for the second time using the Swahili version of the Preschool DMQ 18. Test-retest reliability was derived after examining the intra-class correlation coefficient (ICC). Using a sample size requirement table for intra-class correlation with the power of 80% at an alpha level of 0.05, a sample size of 50 was sufficient (Bujang & Baharum, 2017). A third subsample from the primary sample, consisting of 20 children, was also rated by teachers using the English version of Preschool DMQ 18 to determine the parallel form reliability of the Swahili version.

Data Analysis

Data analysis involved two main steps. Firstly, to obtain reliabilities, means, standard deviations and correlations, IBM SPSS 23 was used. The internal consistency reliability (Crb α ; Chronbach alpha), composite reliabilities (CR: Raykov, 1997), and test-retest reliabilities were computed to judge the instrument's reliability. Values above .70 indicated a good reliability (Hair, 2014). Secondly, to establish validity, a confirmatory factor analysis (CFA) was computed using Mplus 7 (Muthén & Muthén, 2012) to investigate the operationalized measurement model of the Preschool Dimensions of Motivation Questionnaire (Morgan et al., 2020). The data was then checked to establish whether the variable system was appropriate for factor analysis using the Kaiser-Meyer-Olkin (KMO) index (Kaiser, 1970). To determine the estimation procedure, Mardia's coefficients of multivariate kurtosis and its critical ratios < 5.0 were used to judge the data's normality (Mardia & Kanazawa, 1983).

The following model fit indices and their cut offs were used to assess the model fit: Root Mean Square Error of Approximation (RMSEA) $< .08$, Tucker-Lewis Index (TLI) $\geq .90$, and CFI $\geq .90$ (Schreiber et al., 2006; Schumacker & Lomax, 2010). Traditionally, the chi-square statistic has been employed to assess model fit; but it is strongly dependent on sample size (Kline, 2015). An AX^2/df range of between 2 to 5 gives an acceptable fit of the observed sample data and the hypothetical model and (Schumacker & Lomax, 2010). Most studies prefer TLI, CFI and RMSEA as measures of goodness of fit (Schreiber et al., 2006). Convergent validity was determined by examining the average variance extracted (AVE), which should be higher than .50, with a high CR. of above .70 (Hair et al., 2010). Concurrent validity was determined by correlating the data collected using the English version of the Preschool DMQ 18 and the Swahili version.

Results

Internal consistency and reliability

Internal consistency was computed for all seven subscales: gross motor persistence, cognitive persistence, mastery pleasure, social persistence with adults and children, negative reactions and general competency. Reliability values for both internal consistency and test-retest were above .70, which was satisfactory. The negative reactions ($\alpha=.91$) had the highest reliability values compared to the other language versions (Table 1).

Table 1. Cronbach's alpha of the Kiswahili DMQ-18 and other language versions

Study	Country	Language	N	COP	GMP	SPA	SPC	MP	NR	GC
Present study	Kenya	Kiswahili	397	.83	.85	.89	.89	.91	.91	.89
Shaoli (2019)	Bangladesh	Bangla	206	.89	.94	.89	.88	.85	.83	.86
Salavati et al. (2018)	Persia	Persian	230	.76	.74	.61	.62	.68	.65	.80
Özbey (2017)	Turkey	Turkish	207	.86	.84	.88	.87	.88	.84	.91
Józsa & Morgan (2015)	Hungary	Hungarian	211	.93	.96	.91	.90	.90	.79	.94

Note: COP=Cognitive persistence; GMP=Gross motor persistence; SPA=Social persistence with adults; SPA=Social persistence with children; MP= Mastery pleasure; NR=Negative reactions; GC=General competence

Test-retest reliability

After two weeks, a subsample of 50 children from the primary sample was randomly selected and rated by their teachers for a second time to compute the test-retest reliability. Table 2 lists the test-retest intra-class correlation coefficient (ICC) values that ranged from .80 and .94.

Parallel Forms Reliability

Two weeks after data collection, another sample of 20 children was randomly selected from the primary sample. This sample was again rated by the teachers using the English version of the Preschool DMQ 18. Their rating was compared with the Swahili version's rating of the Preschool DMQ 18 to determine the reliability of parallel forms. The reliability of the six subscales ranged from .57 to .87, but gross motor persistence was the lowest at .57 (Table 2). The total persistence was also satisfactory with $r(20) = .88, p < 0.01$. Nevertheless, the total reliability was acceptable with $r(20) = .76, p < 0.01$.

Table 2. Test-retest ICC and parallel forms reliability of preschool teachers' ratings after two weeks of administering the Swahili version of Preschool DMQ18

Subscales	Items	Cronbach's alpha	Test-retest ICC	Parallel form reliability
Cognitive/Object Persistence	5	.83	.80	.80
Gross Motor Persistence	5	.85	.89	.57
Social Persistence with Adults	5	.89	.82	.87
Social Persistence with Children	6	.89	.86	.82
Mastery Pleasure	5	.91	.94	.76
Negative Reactions	8	.91	.89	.73
General Competence	5	.91	.86	.76
Total Reliability of all scales	39	.95	.87	.76

Note. $p < 0.01$

Factorial Validity

Before conducting the CFA, we checked to see whether the data sets were adequate for factor analysis. The KMO index was high at 0.941, with a significant score on Bartlett's Test of Sphericity ($\chi^2 = 6445.97, p < 0.01$). We first analyzed the seven-factor model, as suggested by Schreiber et al. (2006). Since the data had no missing values, and were not normally distributed and ordered with a high ceiling effect, we adopted the WSMV estimation method (Brown, 2015). The CFA results indicated an unacceptable model fit of our data with a general competencies scale displaying unfitting estimates. When we removed this dimension, the model fitness improved significantly ($\chi^2 = 1132.72; df = 413; p < 0.001; CFI = 0.973; TLI = 0.970; RMSEA = 0.069$) (Schreiber et al., 2006; Schumacker & Lomax, 2010). The standardized factor loading, composite reliability and average variance extracted of the Preschool DMQ 18 in Swahili, as rated by teachers, are shown in Table 3.

Table 3. *Standardized factor loadings, average variance extracted (AVE), and construct reliability (CR) of subscales of the DMQ 18 Swahili version rated by teachers*

No.	Items	Factor loading	AVE	CR
Cognitive/object persistence			0.600	0.89
1	Repeats a new skill until he or she can do it	0.869		
14	Tries to complete tasks, even if it takes a long time to finish	0.871		
17	Tries to complete games like puzzles even if it requires a lot of effort	0.672		
23	Works for a long time trying to do something challenging	0.722		
29	Will work for a long time trying to assemble something	0.715		
Gross motor persistence			0.608	0.92
3	Tries to do well at athletic games	0.784		
12	Tries to do well in physical activities even when they are challenging	0.873		
26	Repeats sports skills until he or she can do them better	0.765		
36	Tries hard to be better at sports	0.762		
38	Tries hard to improve his or her ball-game skills	0.706		

Table 3 (continued). *Standardized factor loadings, average variance extracted (AVE), and construct reliability (CR) of subscales of the DMQ 18 Swahili version rated by teachers*

No.	Items	Factor loading	AVE	CR
Social persistence with adults			0.694	0.93
8	Often discusses things with adults	0.860		
15	Tries hard to interest adults in his or her activities	0.838		
22	Tries hard to get adults to understand him or her	0.819		
33	Tries to find out what adults like and do not like	0.863		
37	Tries hard to understand the feelings of adults	0.784		
Social persistence with children				
6	Tries hard to make other children feel better if they seem sad	0.835	0.700	.94
7	Tries to say and do things that keep other children interested	0.833		
25	Tries hard to understand other children	0.903		
28	Tries hard to make friends with other kids	0.809		
32	Tries to get involved when other kids are doing something	0.840		
35	Tries to keep things going for a long time when playing with other kids	0.795		
Mastery pleasure			0.796	0.95
2	Is pleased with self when he or she finishes something challenging	0.874		
11	Gets excited when he or she is successful	0.907		
18	Gets excited when he or she figures something out	0.913		
21	Is pleased when he or she solves a problem after working hard at it	0.906		
30	Smiles when he or she succeeds at something he or she tried hard to do	0.860		

Table 3 (continued). *Standardized factor loadings, average variance extracted (AVE), and construct reliability (CR) of subscales of the DMQ 18 Swahili version rated by teachers*

No.	Items	Factor loading	AVE	CR
	Negative reactions		0.862	.93
5	Seems sad or ashamed when he or she does not accomplish a goal	0.949		
9	Gets frustrated when not able to complete a challenging task	0.931		
13	Gets frustrated when he or she does not do well at something	0.946		
16	Protests after failing at something that he or she tried hard to do	0.953		
19	Tries to get adults to see his or her point of view	0.930		
24	Won't look people in the eye when he or she tries but cannot do something	0.871		
34	Looks away when he or she tries but cannot do something	0.925		
39	Withdraws after trying but not succeeding	0.920		

Convergent validity

The standardized factor loadings for the six-factor model were all above 0.70, except for one item that scored 0.6 in the cognitive persistence subscale, "*Tries to complete toys like puzzles even if it involves hard work*". Standardized loadings of 0.5 and above are acceptable but preferable if they are above 0.7 (Hair et al., 2014). All the values in the measurement model were above 0.5 in the six-factor model, hence confirming convergent validity. Based on the standardized factor loadings, the AVE was computed for each subscale. An AVE value of above 0.5 suggests good convergence, while a value lower than 0.5 suggests more errors in the item than the variance explained by the latent factor structure (Hair et al., 2010). Table 3 indicates that the values ranged from 0.6 to 0.86, above 0.5, confirming convergent validity. The high composite reliability of above 0.7 (Table 3) also confirms convergent validity (Hair et al., 2014).

Divergent validity

Using the Fornell-Larcker criterion, the square root of AVE on the diagonal (Table 4) was higher than the correlations of the scales with each other, thus confirming good divergent

(discriminant) validity (Fornell & Larcker, 1981). In addition, the results showed that the latent factor of DMQ 18 is explained between 60% and 86% of the variance in the items. Since all the items had a variance above 30%, this also suggests good reliability (Bollen, 1989).

Table 4. *Inter-correlation for the six-factor model and average variance extracted (AVE) of the Preschool DMQ 18 rated by preschool teachers*

	MP	COP	GMP	SPC	SPA	NR	AVE
MP	.892						0.796
COP	.769	.775					0.600
GMP	.609	.594	.780				0.608
SPC	.724	.619	.731	.837			0.700
SPA	.492	.486	.625	.787	.892		0.694
NR	.610	.714	.544	.471	.372	.928	0.861

Note: COP=Cognitive persistence; GMP=Gross motor persistence; SPA=Social persistence with adults; SPA=Social persistence with children; MP= Mastery pleasure; NR=Negative reactions; Diagonal figures in bold are the square root of AVE; all correlations are significant ($p < 0.0001$).

Comparison of the rating of DMQ 18 by preschool teachers and parents

Teachers' and parents' ratings were compared using a paired sample t-test. Preschool teachers rated their students highly on the cognitive persistence scale ($M = 3.92$, $SD = 0.50$) and gross motor persistence ($M = 3.77$, $SD = 0.62$) was lowest on the persistence scale. On the expressive scale, mastery pleasure was rated the highest ($M = 4.22$, $SD = 0.64$) and sadness/shame the lowest (Table 5). The results of the parent-teacher comparison using a paired sample t-test showed that parents rated their children higher on gross motor persistence, $t(49) = -3.75$, $p < 0.001$ and social persistence with children $t(49) = -2.86$, $p = 0.006$. The differences in cognitive/object and social persistence with adults were not significant. On the expressive scale, the teachers rated the children higher, but these differences were also not significant. In the persistence scales, significant correlations were found between parents' and teachers' ratings of social persistence with adults ($r = 0.30$, $p < 0.05$) and with children ($r = 0.39$, $p < 0.001$). In the expressive scales, significant correlations were found between teachers' and parents' ratings for both mastery pleasure ($r = 0.29$, $p < 0.05$) and negative reactions to failure ($r = 0.45$, $p < 0.001$).

The correlation of parents' and teachers' ratings provided corroborative evidence of the validity of response processes (AERA, 2014), since the parents observed the child's mastery-oriented behavior at home, while the teachers observed their behavior in classroom contexts. Gliner et al. (2017) suggest that if raters or contexts are different, then their correlations can be evaluated based on Cohen's (1988) guidelines: $r = 0.1$ correlation is weak; $r = 0.3$ modest; $r = 0.5$ moderate; $r = 0.8$ strong and $r > 0.8$ very strong. This suggests that the correlation coefficient (effect size) of the parents' and teachers' ratings ranged from modest to strong (see Table 5).

Table 5. Comparisons of parents' and teachers' ratings of typically developing 5- to 11-year-old children on the Preschool DMQ 18

Scale	Items	Teachers (n=50)		Parents (n=50)		<i>t</i>	<i>p</i>	<i>r</i>
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
		Persistence scales						
Cognitive/object	5	3.9	.50	3.90	.63	-.289	.774	.28*
Gross Motor	5	3.7	.62	4.16	.53	-3.75	.000	.22
Social w. Adults	5	3.8	.52	3.73	.56	1.67	.101	.29*
Social w. Children	6	3.9	.41	4.16	.43	-2.86	.006	.39**
Total persistence	21	3.8	.41	3.99	.39	1.56	.125	.33*
Expressive scales								
Mastery Pleasure	5	4.2	.64	4.32	.43	-1.08	.287	.29*
Negative Reactions	8	3.7	.66	3.82	.47	-1.05	.30	.40**
Frustration/anger	4	4.0	.80	3.97	.64	.35	.726	.40**
Sadness/shame	4	3.6	.60	3.67	.57	-.65	.518	.56**

Note. * $p < 0.05$ ** $p < 0.01$

Age Comparison

According to the National Early Childhood Education Policy (2017) children join pre-primary I at 4-years-old and pre-primary II at 5 years old. The DMQ 18 preschool version was created mainly for 3-7 year-olds (Józsa & Morgan, 2015). We therefore tested whether there was a significant difference between the children below 7 years and above 7 years in preschool classrooms. Only the cognitive persistence scale was not significant but all the other scales were significant (Table 6). The older children seem less motivated based on the preschool teachers' ratings.

Table 6. Comparisons of below 7 years and over 7 years old teachers' ratings of typically developing children on the Preschool DMQ 18

Scale	Items	Below 7 (n=397)		Above 7 (n=397)		<i>t</i>
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Persistence scales						
Cognitive/object	5	4.07	.70	3.84	.57	1.78
Gross Motor	5	3.87	.72	3.26	.82	4.40**
Social w. Adults	5	3.72	.69	2.99	.82	5.60**
Social w. Children	6	4.02	.64	3.54	.62	3.87**
Expressive scales						
Mastery Pleasure	5	4.38	.70	3.70	.86	4.96**
Negative Reactions	8	3.64	.99	2.88	.89	3.98**
General Competence	5	3.72	.80	2.92	.80	5.19**

Note. * $p < 0.05$ ** $p < 0.01$

Measurement Invariance of the DMQ 18 in Swahili

We also tested whether the Swahili version of the Preschool DMQ 18 measured the same construct across age (4-12 years) and gender (male and female) since individuals can interpret or respond to questionnaire items differently (Hwang et al., 2017). To do this, we computed a Multi-Group Confirmatory Factor Analysis (MGCFA) of three age groups (5-6, 7-8 and 9-12) and two gender groups to examine factorial equivalence (Rios & Hambleton, 2016) in AMOS. This involves several steps; namely to determine the validity of the models across the groups; test invariance of fully constrained model and their factor loadings (Byrne, 2004). These steps were automated by plugin in AMOS (Gaskin & Lim, 2018). The plugin compares the significance of the constrained and unconstrained models at $p < 0.001$. The global results indicated that there was no significant difference across gender suggesting that the Preschool DMQ 18 in Swahili is unbiased in terms of age and gender.

Discussion and conclusion

The results of the CFA provided more evidence for the factor structure of the Preschool DMQ 18. The analysis revealed that the general competency scale had low factor loadings and resulted in model misspecification. We, therefore, removed the general competency scale to achieve a model fit. The resulting model had six scales with excellent psychometric properties and it was meaningful (according to our data) within the Kenyan context. Similar studies by Morgan et al. (2017) and Józsa & Morgan (2015), using ratings from parents of

Hungarian and Taiwanese children, also did not include the general competence scale because they did not consider it to be part of mastery motivation when determining the factor structure of the Preschool DMQ 18 in their respective countries. However, Salavati et al. (2018) computed a CFA of all the subscales with parent ratings of Persian children with Cerebral Palsy and achieved a good model fit. The final DMQ 18 questionnaire retained cognitive persistence (five items), social persistence with adults (five items), social persistence with children (six items), gross motor persistence (five items), mastery pleasure (five items) and adverse reactions (eight items).

The subscales of the Swahili Preschool DMQ 18 had internal consistency reliability values above the cut-off ranging from .77 to .91. These reliability values were also seen in other translations of the DMQ, such as the Bangla version from Bangladesh .83 to .94 (Shaoli et al., 2019), the Hungarian .79 to .94 (Józsa & Morgan, 2015), .84 to .91 for the Turkish translation (Özbey & Daglioglu, 2017) and .41 to .80 for the Persian version (Salavati et al., 2018). The Swahili DMQ had Parallel forms reliability of .76, which was slightly lower than that of the Bangla version ($r = .85$, $N = 20$, $p < 0.01$) but acceptable (Shaoli et al., 2019).

The Swahili version of test-retest reliability was .87, which was similar to the Bangla version of 0.88 (Shaoli et al., 2019) and slightly lower than the Persian version of .94 (Salavati et al., 2018). The current study also provided further information about the different types of raters. The teachers rated their preschool children more highly than did the parents, and the test-retest reliabilities rated by teachers were also acceptable for all scales. Divergent validity was ascertained using the Fornell-Larcker (1981) criterion, and all values had a lower correlation than the square of their AVE. Construct (convergent, divergent, criterion) validity was confirmed, indicating that the translation of the DMQ 18 was good. The correlation of parents' and teachers' ratings ranged between modest to strong and provided further evidence of convergent validity (Barrett et al., 2020).

Parent-teacher comparisons of raters were computed using paired sample t-tests. The results showed that Kenyan teachers rated children higher than did the parents of the same typically developing children. This could be because Kenyan teachers imagined higher motivation to be equivalent to higher achievement. Nevertheless, other reasons possibly affected the ratings of mastery motivation, such as parent education, children with and without developmental delays, age and gender differences (Morgan et al., 2017). We compared children above and

below 7 years to establish whether they were significantly different. The older children are less motivated in the preschools than the younger one. It is only the cognitive persistence scale that was not significantly different. May be the older children are not getting enough challenge in preschools and therefore they show less motivation, less mastery pleasure. This suggests that preschool classes may be not the best alternative for older children.

Summary and Conclusion

The translated Swahili version of the Preschool DMQ 18 was found to be reliable and valid for assessing mastery motivation of Swahili-speaking participants. Given that parents and caregivers are very close to their children and have access to much information regarding their children's behavior and development, those who cannot understand English now have an opportunity to use the Swahili version. Similarly, those acquainted with English can now use the English version as demonstrated by the parallel forms reliability results. These two versions will provide inclusivity in mastery motivation research in Swahili and English speaking communities in Kenya.

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