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MASTERY MOTIVATION AND SUBJECT-SPECIFIC MASTERY MOTIVATION IN
MIDDLE-SCHOOL STUDENTS: CROSS-CULTURAL STUDY IN HUNGARY AND
MOLDOVA

STUDY-BASED DOCTORAL DISSERTATION

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List of Abbreviations

ANOVA	Analysis of variance
Art	Art Mastery Motivation
AVE	Average Variance Extracted
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CI	Confidence Interval
COP	Cognitive/Object Persistence
CR	Composite Reliability
CR	Critical Ratio
DMQ18	Dimensions of Motivation Questionnaire 18
English	English as a Foreign Language Mastery Motivation
GMP	Gross Motor Persistence
GPA	Grade Point Average
HTMT	Heterotrait-monotrait ratio of correlations
HU	Hungarian
IQ	Intelligence Quotient
ISCED	International Standard Classification of Education
MANOVA	Multivariate analysis of variance
Math	Mathematics Mastery Motivation
MM	Mastery motivation
MP	Mastery Pleasure
Music	Music Mastery Motivation
NRC	Negative Reactions to Challenge
Reading	Reading Mastery Motivation
RMSEA	Root-Mean-Square Error of Approximation
RO	Romanian
RU	Russian
Science	Science Mastery Motivation
SD	Standard Deviation
SPA	Social Persistence with Adults
SPC	Social Persistence with Children
SRMR	Standardised Root Mean Square Residual
SSMM	Subject-specific mastery motivation
SSMMQ	Subject-Specific Mastery Motivation Questionnaire
TLI	Tucker-Lewis Index

Introduction

Affective factors such as anxiety (Du et al., 2021; Fréchette-Simard et al., 2023; Henschel & Roick, 2017; Steinmayr et al., 2018), well-being (Holzer et al., 2022; Mendoza & Yan, 2023), self-efficacy (Usher et al., 2019) and interest (Lee et al., 2014) were found to explain the academic outcomes in a variety of recent research in middle school students. Accordingly, educators and researchers have increasingly focused their attention on these factors. Motivation, as a significant affective factor, contributes to the cognitive, social, and motor development of children across various age groups and is correlated with students' academic performance, curiosity and persistence (Camacho-Morles et al., 2021; Collie & Martin, 2019; Lazowski & Hulleman, 2016). Shankoff and Philips (2000) states that it is critical to consider the assessment of mastery motivation as a pivotal factor in child development.

George Morgan using the theoretical developments of Robert White and Leon J. Yarrow defined mastery motivations as a multidimensional, intrinsic and psychological drive that compels an individual to try independently and persistently to achieve a task of moderate difficulty, solve a problem or master a skill or outcome (Morgan et al., 1990; White, 1959; Yarrow et al., 1975). Mastery motivation is considered multifaced, attributable to the context that it can be employed (educational, domestic or social environments), due to the developmental domains it consists of and its two principal aspects (Busch-Rossnagel & Morgan, 2013; J. Wang & Barrett, 2013).

The multifaced characteristic of master motivation is explained by its two overarching aspects which are the instrumental and affective ones. The affective aspect, also called expressive, of mastery motivation includes both stimulating emotions like pleasure and interest, which encourage individual's persistence in mastering challenges, and demotivating feelings such as sadness and shame, which can lead to withdrawal and abandonment of efforts in overcoming challenging in a mastery activity (Barrett & Morgan, 2018; Calchei et al., 2022). Whereas, the instrumental aspect refers to an individual's focus, persistence, control, and attempt during a mastery activity. The domains of instrumental aspect: object/cognitive mastery motivation, social mastery motivation, and gross motor mastery motivation and the one of the expressive aspects are mastery pleasure and negative reactions (Morgan et al., 2020).

Mastery motivation centers on persistence, as well as emotions in different domains. Persistence has been delineated as a key 21st century skill that is one of the fundamental skills for success in a dynamic setting of the workplace and education (DiCerbo, 2014; Woods-

Groves, 2015). Persistence models view persistence as the resistance to temptation or urge to quit, but they do not theoretically explain its causes (Moshontz & Hoyle, 2021). The causes of persistence were interpreted by motivation and self-control theories (Moshontz & Hoyle, 2021). Some motivation theories (such as expectancy-value theory, self-regulation theory) consider that persistence is explained by the significance people attach to a particular goal and the probability of attaining it (Eccles & Wigfield, 2002; Lunkenheimer et al., 2019; Wigfield et al., 2004). Persistence, in other theories such as self-determination theory, is perceived as a manifestation of the reasons people have for their pursuit or achievement (Deci & Ryan, 2000). These motivation frameworks are not directly centered on persistence, but they emphasize the process of pursuing goals that is pertinent for understanding persistence. Besides, research has identified that motivation is associated with persistence (both short-term and longitudinal) (Pelikan et al., 2021; Yeager et al., 2014). In mastery motivation theory emphasizes that the pursuit process is realized regardless of the challenges that are encountered by an individual and it recognizes three instrumental measures: cognitive, social and gross motor persistence (Józsa & Morgan, 2014).

Cognitive persistence affects performance and outcomes in challenging, at the same moderately difficult cognitive tasks or activities and not the tasks that are either more difficult or easier than the person's ability level (Teubner-Rhodes, 2020). Researchers affirm that cognitive persistence is crucial in challenging cognitive activities for outcomes are not only explained by a person's cognitive ability, but also by their cognitive persistence; which is defined as the motivation to accomplish a task or activity and also the effort an individual invests in completing a task (Ackerman & Lohman, 2006; Militello et al., 2006; Rammstedt, 2018; Teubner-Rhodes, 2020; Wechsler, 1950). Notably, cognitive/object persistence in mastery motivation correlates with students' basic skill development, as well as GPA (when rated by parent and teacher); it is also sound to be a stronger predictor of GPA as compare with IQ and executive function (Józsa et al., 2020; Józsa & Molnár, 2013).

Mastery pleasure and negative reactions dimensions¹ are established within the context of the role that emotions play in mastery motivation theory (Barrett & Morgan, 2018). Emotions are significant as they can encourage an individual to either preserve or disengage with a mastery situation or task (Barrett & Morgan, 2018). Besides, emotions of a variety of

¹ In this study project we will operate with two terms dimension and domain. Dimension refers to a trajectory along which an individual can exhibit various levels of a characteristic (Cochrane, 2009). Within the framework of mastery motivation these are cognitive/object persistence, social persistence with adults, mastery pleasure, etc. Domain, which in the field of motivation related to a specific academic context, is interchangeable with the term subject that refers to an academic area or school subject.

valences arise in situations that involve pursuit of mastery or success (Barrett, 1998; Harley et al., 2019; Józsa & Barrett, 2018). Empirical research indicates that there is a demonstrated positive association between mastery goals and pleasure (mastery pleasure), and negatively associated with negatively valenced emotions such as anger and boredom (Pekrun et al., 2006). At the same time negative emotions like shame and hopelessness were predictors of performance-avoidance goals (Pekrun et al., 2006). Students that reported positive emotions after failure exhibit a bigger inclination towards mastery (Tulis & Ainley, 2011). Negative reaction as well as mastery pleasure were identified as predictors of achievement (Józsa & Barrett, 2018). Cognitive/object persistence along mastery pleasure is the dimension that was pivotal in the development of the subject-specific mastery motivation dimensions (Józsa, 2014).

Within the research on mastery motivation in the educational context there are studies on subject-specific mastery motivation that are founded on the hypothesis that mastery motivation is subject-specific suggesting that more contextualized measurement of mastery motivation can increase the predictiveness of school achievement compared with the domain general mastery motivation assessment instrument (Hornstra et al., 2016; Józsa, 2014; Józsa et al., 2017; Wigfield, 1997). The specificity of mastery motivation is considerably shaped by the students' educational experience, the pedagogical strategies implemented on the national and school levels (Lazowski & Hulleman, 2016). Thus, the need for contextualized study of motivation is supported by several arguments. First, students can have different degrees of motivation depending on the academic subject or domain. Next, performance in each subject requires different competences, so the experience of success can range from one subject to another. Another reason for investigating subject specific motivation is that students' self-efficacy across various subjects differs, thus their intrinsic motivation can also differ across subjects. The fact that education is structured around specific subjects can also be a factor that leads to variations in motivation depending on the situation or specific context (Bong, 2001; Michel et al., 2020; Wigfield et al., 2014).

Research comparing the validity of domain-specific measures versus domain-general ones also offer a rationale for using a domain-specific scale in the mastery motivation theory. Measurement instruments that were framed specifically or contextualized were empirically validated as more reliable predictors of outcomes as they refer to a more specific frame (Michel et al., 2020; Shaffer & Postlethwaite, 2012; Weiß et al., 2024). Also, contextualization of the items in our case in the context of specific school subjects or domains, changed the level of abstraction of the item which in its turn leads to better alignment with specific outcomes as

compared to the items included in domain-general measurement instruments (Kretzschmar et al., 2018).

Subject-specific mastery motivation was developed on the foundation of cognitive persistence and mastery pleasure dimensions of mastery motivation. The theoretical explanation of using cognitive persistence lies on an individual's inherent drive to endure and excel in the face of challenges while striving to master a diverse range of cognitive and educational tasks (Ackerman & Lohman, 2006; Rammstedt, 2018; Teubner-Rhodes, 2020; Teubner-Rhodes et al., 2017). Besides, performance depends not solely on an individual's cognitive abilities but also on their persistence to succeed and the effort they invest in mastering a task. As for the mastery pleasure dimension, it is operationalized with the understanding that emotions play an important role, because they can both encourage and demotivate a person to continue persevering in a mastery educational situation (Barrett & Morgan, 2018). Next, emotions of a variety of valences arise in situations that involve pursuit of mastery or success (Barrett, 1998; Harley et al., 2019; Józsa & Barrett, 2018). Subject-specific mastery motivation is measured within seven subjects/domains: reading, mathematics, science, English as a foreign language, German as a foreign language, art and music (Józsa et al., 2017, 2020). These are the subjects for which scales were developed and validated. However, the mastery motivation framework allows for the development of scales in other subjects as well.

Indisputably, culture has an impact on motivation in an educational context and consequently triggers cultural differences and variations (within- and between-countries) in motivation (Marambe et al., 2012). Research on cross-cultural studies in education and psychology highlights the importance of exploring the relationship between cultural factors and motivational constructs (Oishi & Choi, 2017; Zusho & Clayton, 2011). Thus, the significance of cross-cultural studies is explained by the need to investigate the degree of universality of motivation as well as its cultural specificity (Artelt, 2010; Elliot & Resing, 2012). This can be grounded by the idea that individuals are inclined to adopt and consequently internalized the cultural practices, values and behaviors of the community they are exposed to during their developmental years (Ryan & Deci, 2009). Therefore, culture is not perceived just as a standardized set of behaviors, customs, etc., that are practiced by members of a culture acting as a precursor of psychological events. Rather, it influences the worldview of a person and its psyche, thereby influencing its motivation (Kotera et al., 2022; Tóth-Király & Neff, 2021).

Research showed that sociocultural and contextual factors explain help explain motivational differences across nations: these factors can include behavior norms, social

expectations or attitudes (M.-T. Wang et al., 2020). Cross-cultural studies on subject or domain specific motivation demonstrated that culture explains the difference in reading, mathematics, science, creativity, physical education (Artelt, 2010; Chiu & Klassen, 2010; Kim, 2022; Shen et al., 2022; Zhang et al., 2021).

However, the question that is raised in some of the studies concerns the choice of cultures or countries that are included in cross-cultural educational and psychological research. There are researchers that consider that there should be a cross-cultural psychological distance (Muthukrishna et al., 2020) and cultural distance (Triandis, 1998) between countries or populations to be included in a cross-cultural study (Muthukrishna et al., 2020). In contrast, there are cross-cultural studies that include countries based on factors such as aspects of the educational systems (Johannesson et al., 2002; Lowe, 2019; Quinaud et al., 2020; Shin et al., 2018), geographical proximity (Długosz et al., 2022; Kyttälä et al., 2021; Yu et al., 2021). Hungary and the Republic of Moldova are included in this study project based on the difference in the elements of the educational systems that will be summaries below.

Though Hungary and the Republic of Moldova went through 40-year and 70-years, respectively, socialist era in which these countries shared some social and educational values, at this point in time these two entities on the educational, social, economic and cultural levels differ. Hungary has population of about 9,7 million people and with a GDP per capita in 2022 of 18,390.2 (current US\$) (*World Bank*, 2022a). The country exhibits a relatively homogeneous ethnic composition, with minorities constituting less than 10% of the population. Whereas Moldova is a country situated in Eastern Europe with a population of 2.6 million people and a GDP per capita in 2022 of 5,714 (current US\$) (*World Bank*, 2022b) Moldova is ethnically diverse as minorities represent around 25% of its population (Goreainov, 2019). Both systems are structures based on ISCED classification. As the differences in the educational systems, each system is different in terms of law and regulations, curriculum, resources, funding and organization etc. Also, in Hungary, students are tested annually, whether to determine competence levels in various subjects or for tests that influence progression to the next educational level or graduation. In contrast, in the Republic of Moldova, students are tested at the end of an ISCED level (gymnasium and lyceum) (*Eurydice. National Education Systems*, 2021). Besides on the PISA 2018 the difference on the PISA 2022 scores were statistically significant. For instance, the differences between Hungary and the Republic of Moldova for changes in averages for all students from 2018 to 2022 were higher and statistically significant on PISA reading scale $t(5) = 10$, $p = .0460$, PISA science scale $t(5) = 17(4.9)$, $p = .0006$ (*Organization for Economic Cooperation and Development (OECD), Program for*

International Student Assessment (PISA), 2018 and 2022 Reading, Mathematics and Science Assessments., 2023a; *Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2018 and 2022 Reading, Mathematics and Science Assessments.*, 2023b).

There have been several studies that explored the similarities and differences in mastery motivation dimensions across cultures (Gilmore et al., 2017; A. W. Hwang et al., 2017; Józsa et al., 2020). These studies defined culture as “country”, though cultural differences are present within certain countries. Cross-cultural studies on affective factors are very often focused on contrasting Asian and Western nations therefore the identified variations were attributed to the dichotomy of individualism/collectivism of Asian versus Western countries or to the structure of the educational system (A.-W. Hwang et al., 2017; Józsa et al., 2014; Morgan et al., 2013). Nevertheless, research examining the influence of ethnicity within countries is scarce, specifically outside the U.S., where uniformity in educational systems cannot be presumed due to its state based-government educational system. Within the Moldovan context, it is possible to determine if the cultural factors play a role in differences in mastery motivation given that the educational system in schools with Romanian and Russian language of instruction is identical.

Besides, we attempted to carry out a cross-cultural study of subject specific mastery motivation between Hungary and the Republic of Moldova. And due to the fact that the social organization of these two countries are similar we adopted the perspective of cultural values based on Hofstede’s 6-D cultural map models to identify the cultural difference between these countries (Hofstede, 2001, 2018).

The focus of this research project is to explore mastery motivation and subject-specific mastery motivation within the Moldovan context and the cross-cultural analysis of subject-specific mastery motivation in middle school student from Hungary and the Republic of Moldova. What is more, examining mastery motivation in education among closer societies provides valuable cultural and educational insights for the contexts under study. Contrasting mastery motivation in educational settings within culturally closer societies yields valuable insights for the studied contexts (Elliot & Resing, 2012). The perspective differences and similarities can contribute to a theoretical comprehension of mastery motivation construct and its factors, as well as their influence on the educational outcomes included in the study. Besides, comparison of subject-specific mastery motivation in Hungary and Moldova can explain the functioning mechanism of mastery motivation in their educational settings and if closer culture can be used in cross-cultural studies.

Notably, in the Republic of Moldova there are no empirical studies on motivation of middle school students using advanced statistical methods. Middle-school students encompass a particularly significant age group to be studied as this cohort of students are enrolled in compulsory education and after middle school students begin to navigate through a variety of education and career options available in Moldova.

Despite there being empirical studies on mastery motivation there exists a gap in further exploration of its measurement instrument both of the general domain of mastery motivation: Dimensions of Mastery Questionnaire (DMQ 18) (Morgan et al., 2020) (Appendix A) and specific domains of mastery motivation: Subject-Specific Mastery Motivation Questionnaire (SSMMQ) (Józsa et al., 2017) and to explore its stability in other cultures (Appendix B). Moreover, there is a need to explore the levels of mastery motivation in Moldova and its trajectory in schools with Romanian language of instruction and schools with Russian language of instruction as the culture of the students and teachers and the school culture might have influence students' mastery motivation. And though we do not investigate the influence of culture on these two categories of students in the Republic of Moldova, we explore its trajectory.

Besides, despite existing literature on the predictive power of mastery motivation, research on the predictive value of subject-specific mastery motivation and mastery motivation in specific subjects remains unexplored (Józsa et al., 2020; Józsa & Barrett, 2018). This study project, therefore, intends to fill these research gap, contributing to the broader understanding of how mastery motivation functions across different domains and cultural educational settings. This last problem has not yet been published at the moment of the submission of this paper.

In response to the stated problem, this study-based dissertation aimed to explore mastery motivation as a general domain and specific domain in Hungary and the Republic of Moldova.

The study project aimed to discuss in the published articles the following research aims:

RA1 to adapt DMQ 18 and SSMMQ into Russian and Romanian and analysis of the psychometric properties of these versions of student self-rated.

RA2 to analyze the differences of mastery motivation and subject-specific mastery motivation levels across languages, grade levels, and gender in the Moldovan context.

RA3 to investigate the cross-cultural differences in subject specific mastery motivation levels in Hungary and the Republic of Moldova.

The present dissertation contains three articles published in Q1 and Q2 journals:

Calchei, M., Barrett, K. C., Amukune, S., & Józsa, K. (2022). Comparative study of Russian- and Romanian-speaking students' mastery motivation in the Republic of Moldova. *Cogent Education*, 9(1). <https://doi.org/10.1080/2331186X.2022.2143039>

Calchei, M., Oo, T. Z., & Józsa, K. (2023). Subject specific mastery motivation in Moldovan middle school students. *Behavioral Sciences*, 13(2), 166. <https://doi.org/10.3390/bs13020166>

Calchei, M., Amukune, S., & Józsa, K. (2024). Comparing subject-specific mastery motivation in Hungary and the Republic of Moldova. *Frontiers in Education*, 8. <https://doi.org/10.3389/educ.2023.1259391>

The findings published in these articles were part of the dissertation project designed to explore mastery motivation and subject-specific mastery motivation in the Republic of Moldova, explore their predictive power and also compare mastery motivation levels of the Hungarian and Moldovan middle school students. In the published articles the findings of the adaptation and validation studies of the instruments measuring mastery motivation (DMQ18) and subject-specific mastery motivation (SSMMQ) in Romanian and Russian languages, comparison of mastery motivation and subject-specific mastery motivation levels of students receiving instruction in Romanian and Russian languages in the Republic of Moldova and a cross-cultural analysis of middle school students' mastery motivation between Hungary and Moldova. The last stage of the dissertation project focused on the predictive validity of subject-specific mastery motivation and mastery motivation will be published in another paper.

All data collection procedures were performed in compliance with relevant laws and institutional guidelines (Appendix C). Moreover, in the Republic of Moldova the data was collected in May 2019 and April -May 2022, in Hungary, it was collected in April 2022. In the Republic of Moldova two instruments using the pen and paper approach. Each student had to rate themselves on two instruments: DMQ18 and SSMMQ. DMQ18 consisted of 41 5-point Likert items ranging from 1 – ‘not at all like me’ to 5 – ‘exactly like me’. SMMQ included 42 items were used. Each of the scales, comprising Reading Mastery Motivation (Reading), Mathematics Mastery Motivation (Math), Science Mastery Motivation (Science), English as a Foreign Language Mastery Motivation (English), Art Mastery Motivation (Art), Music Mastery Motivation (Music), and School Mastery Pleasure (SMP), contained six five-point Likert scale items, the meaning of the Likert scale in SSMMQ is the same as in DMQ18. In Hungary, only DMQ18 was administered.

Article 1



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EDUCATIONAL PSYCHOLOGY & COUNSELLING | RESEARCH ARTICLE

Comparative study of Russian- and Romanian-speaking students' mastery motivation in the Republic of Moldova

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Abstract: Recent empirical research has demonstrated the importance of mastery motivation in child development. Therefore, it is essential to have valid and reliable instruments to measure this variable. The Dimensions of Mastery Questionnaires (DMQ 18) was validated in English, Hungarian, Chinese and Spanish. In this article, we evaluate the psychometric properties of Romanian and Russian versions of DMQ 18 that were piloted simultaneously. The study sample consisted of 315 fifth-grade students studying in Russian language schools or Romanian language schools. Reliability of these two versions was demonstrated by good internal consistency. Factor analysis that fits well the theoretical dimensions provided evidence of construct validity. Moreover, this publication presents a comparative ethnic study of

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PUBLIC INTEREST STATEMENT

The study investigates the psychometric properties of the Romanian and Russian versions of the Dimensions of Mastery Questionnaire in 5th grade students and explores the level of mastery motivation between the students that study in schools with Romanian and Russian language of instruction. This is the first validity study of the DMQ18 in two languages simultaneously in the Republic of Moldova. The use of measurement invariance allowed a cross-ethnic comparison of mastery motivation between students enrolled in schools with different languages of instruction and using the same curriculum. Both versions of DMQ18 showed satisfactory psychometric properties, and the comparison of the means of the DMQ18 scales of the Romanian and Russian groups of students proved that only the Romanian-speaking students rated themselves significantly higher on one scale. Our results make DMQ18 a valid tool for use in all the schools of the Republic of Moldova, regardless of the language used in instruction.

Russian- and Romanian-speaking school-aged students from the Republic of Moldova and highlights ethnic differences in mastery motivation as perceived by students.

Subjects: Educational Research; Middle School Education; Educational Psychology

Keywords: Motivation; mastery motivation; dimensions of mastery questionnaire; measurement invariance; cross-ethnic study; measurement invariance

1. Introduction

Mastery motivation is a multifaceted, intrinsic, psychological drive that generates in a child the need to try to master a skill or solve a problem that is at least moderately challenging for them. If one is unmotivated to master challenging tasks, then one is unlikely to continue to work on them until one has mastered them; thus, mastery motivation would seem to be a prerequisite of competence development. Mastery motivation is multidimensional, in terms of the contexts in which it is displayed (e.g., home and school), in terms of the domains of development it encompasses (Busch-Rossnagel & Morgan, 2013; Wang & Barrett, 2013), and in terms of two overarching aspects of mastery motivation (Barrett & Morgan, 1995).

The two overarching aspects of mastery motivation are the instrumental and affective/expressive aspects (Józsa & Barrett, 2018). Instrumental aspects are goal-oriented, focusing an individual on pursuing, controlling, and attempting to solve a problem or master a skill, task, or outcome. They include goal-directed persistence and inclination to control and/or have an impact on the environment. Affective/expressive aspects are the emotions produced while the individual is trying to solve a challenging problem or master a skill or task or immediately after mastering or failing to master it, which contribute to ongoing and future motivation. Affective aspects include mild-to-moderate positive and negative emotions that typically stimulate continued mastery attempts, such as pleasure, interest, and enthusiasm in trying to master challenging tasks, as well as mild frustration at perceived impediments to that mastery. In addition, affective mastery motivation includes emotions that may undermine mastery motivation, promoting withdrawal and giving up, such as sadness and shame at less successful mastery (Barrett & Morgan, 2018).

Although most people have some degree of mastery motivation, there are individual differences in level of mastery motivation. Individual differences in the instrumental aspect of mastery motivation involve how motivated a person is to persist physically or cognitively in solving a task of a moderate level of difficulty or mastery of a skill or ability. Regarding the expressive aspect, the primary indicator that has been used is task pleasure, but sometimes other emotions associated with efforts to master, such as anger, sadness, frustration, shame, are also measured. Finally, Barrett and Morgan (2018) identify three domains of instrumental aspect: (1) object mastery motivation, (2) social mastery motivation, and (3) gross motor mastery motivation.

Empirical studies of mastery motivation demonstrated that early development and display of mastery motivation predict cognitive and social competence development and achievement in school; hence, mastery motivation is treated as one of the predictors of school achievement and social life success (Józsa & Molnár, 2013; Józsa & Morgan, 2014). Therefore, mastery motivation is a crucial factor to assess and incorporate into children's preschool evaluation (Shonkoff & Phillips, 2000).

While mastery motivation theory shares the concept of mastery with other approaches to learning motivation such as achievement goal orientations, it conceptualizes mastery from a different perspective. The achievement goal theory theorizes that individuals adapt either a mastery goal or performance goal orientation to learning (Elliot & Murayama, 2008). The pursuit of mastery is regarded as being a core concept in both mastery motivation and achievement goal

theories, but in mastery motivation theory a person persists despite challenges/difficulties, whereas, in the achievement goal orientation approach, mastery-goal oriented children strive despite failure (Józsa & Barrett, 2018). Thus, mastery motivation theory focuses on mastering various challenging tasks and skills in any or all multiple mastery domains, rather than an overall orientation to keep striving despite failure.

Mastery motivation has been assessed in various cultural contexts, which enables research to investigate cultural and social contextual differences in mastery motivation and other variables that are correlated with mastery motivation. However, it is important to ascertain whether the questions in a questionnaire have comparable meaning and psychometric properties after they are translated into different languages. The present study provides data regarding this for the Russian and Romanian translations of the Adult-report DMQ.

2. Ethnic differences

There have been several studies of similarity and differences in mastery motivation between cultures (Józsa et al., 2020). However, to date, cross-cultural psychological studies on mastery motivation have operationalized culture as “country”, despite acknowledging cultural differences within countries (Keller, 2012). Moreover, since the majority of studies compared Asian and Western countries, any observed cultural differences were further overgeneralized to stem from differences in individualism/collectivism of Asian versus Western countries and/or the specific structure of the educational system of each country. However, it was not possible to directly test hypotheses regarding the origins of any differences between countries. One exception to this was a study that examined cultural differences related to mastery motivation of preschool children in Taiwan (Taipei) and People’s Republic of China (Hangzhou) who share the same traditional Chinese culture (Morgan et al., 2013). The differences that were identified at that time were hypothesized to stem from PRC’s one-child policy, which might motivate parents to have higher expectations from their children. This explanation pointed to the possibility that cultural differences in mastery motivation are conditioned by country-specific political and educational systems, even when the cultural tradition of those countries is similar. However, to date, there is very little research on the impact of ethnicity within a country on mastery motivation, and to our knowledge none in countries beyond the U.S., where it is not possible to assume homogeneity in school systems. Therefore, it is not clear whether observed differences are due to ethnic differences or differences in schools that serve children from different ethnic communities.

3. Context of the Republic of Moldova

The educational system of the Republic of Moldova is regulated by the Education Code of the Republic of Moldova and by the National Curriculum, with the latter being obligatory for all pre-university educational institutions. Children are enrolled in primary education (ISCED 1) at the age of seven, but in some cases, they can enter at the age of 6. This level lasts four years and is followed by five years of lower secondary/gymnasium education (ISCED 2). These two levels are compulsory for all children. Later, the students can choose between various types of ISCED 3 schools (lyceum education and—secondary technical and vocational education) and ISCED 5 institutions (post-secondary non-tertiary technical and vocational education and training).

The Republic of Moldova is an ethnically and linguistically diverse country where education is provided in Romanian and Russian languages. A total of 76.31% of the schools (ISCED 1,2) are schools that provide instruction in the Romanian language, 17.54% are Russian language schools, 5.74% are mixed schools where education is offered both in Romanian and Russian, and 0.4% of schools are immersion schools. Thus, 76.17% of the Moldovan students study in a single language, Romanian, and 16.66% study in a single language, Russian. The students from these two types of schools are the target population for the present study.

There is little systematic research on the differences between these two types of educational institutions at any level in the Republic of Moldova, most studies being carried out

based just on the native language of the researcher. But due to the fact that this country was part of the former USSR, it has some geopolitical and socioeconomic similarities with other countries from the former Soviet Union (Connolly, 2014), allowing us to predict some commonalities in terms of discipline. Even after the disappearance of the USSR, obedience is valued as a socializing goal by Russian-speaking parents and educators in comparison with other cultures in the same country (Saar & Niglas, 2001; Tulviste et al., 2012). Considering this finding, there is a need to analyze potential differences between Russian-speaking and Romanian-speaking schools, to determine if any social, cultural and educational differences have an impact on the motivation of the individuals representing different cultures in this multicultural country.

4. Research AIMS

The main research aim of the present study focuses on the adaptation and testing of the Dimensions of Mastery Questionnaire (DMQ 18) into Russian and Romanian and analysis of the psychometric properties of these versions of student self-rated (Morgan et al., 2020). Moreover, the study aims at determining the differences in the perceptions of mastery motivation between fifth-grade Russian-speaking students and Romanian-speaking students in the Moldovan context.

5. Method

5.1. Participants

The research included 275 fifth-grade students receiving instruction either in Russian (162) or Romanian (113). The inclusion criterion that was used was that the students were enrolled in the relevant grade, i.e., fifth grade. The students were selected from schools that belonged to the same school district in the Republic of Moldova and were academically comparable based on the exam results that are made public every year.

5.2. Materials

The instrument used in the study is Dimensions of Mastery Questionnaire (DMQ 18) in Romanian and Russian languages. DMQ 18 consists of 7 scales and 41 five-level Likert items, each rated from not at all typical (1) to very typical (5). The instrumental aspect of mastery motivation contains four scales: Cognitive/Object Persistence (COP) (six items), Gross Motor Persistence (GMP) (five items), Social Persistence with Adults (SPA) (six items), and Social Persistence with Children (SPC) (six items). The expressive aspect of mastery motivation includes two scales: Mastery Pleasure (MP) (five items) and Negative Reactions to Challenge (NRC) (eight items). Finally, the General Competence scale (COM) (five items) measures the perceived ability to master a skill and is a measure of a potential influence on mastery motivation, rather than mastery motivation itself. The Negative Reactions to Challenge (NRC) scale is divided into two subscales: the frustration/anger subscale containing four items and the sadness/shame subscale consisting of a similar number of items.

The DMQ 18 includes 41 items with 5-point Likert scales ranging from 1 “not at all like me”- (child self-report) to 5 “exactly like me”. Example items for the self-report version include (scale in parenthesis):

- I work on a new problem until I can do it (Cognitive Persistence)
- I am pleased with myself when I finish something challenging (Mastery Pleasure)
- I try to do well at athletic games (Gross Motor Persistence)
- I am sad or ashamed when I do not accomplish a goal (Negative Responses to Challenge)
- I try hard to make other kids feel better if they seem sad (Social Persistence with Children)
- I try hard to interest adults in my activities (Social Persistence with Adults)

5.3. Procedure

To ensure the comparability of the Russian and Romanian translations of the questionnaire, we adopted the back-translation approach to the adaptation and translation of DMQ-18 (for students and adults; Fajrianti et al., 2020). A translator who has a strong command of all three languages (English-Russian-Romanian) and of psychology produced the translations from English into Russian and Romanian. The choice of a trilingual translator for the initial translation from English to both languages facilitated the creation of comparable versions across languages.

For the back-translation stage, we selected different translators for each language, Romanian and Russian, to provide the back translation of the instruments from Russian or Romanian into English. Next, back translations of the instruments were submitted to an expert in DMQ who evaluated DMQ18 back translations concerning content validity. At this stage, the expert estimated the degree to which the items within each variable measure what they were designed to. We received the feedback in an online session where each item was discussed in terms of its content validity and equivalence. As a result, more changes were administered in the Russian version based on the expert's feedback.

We also received ethics approval from institutional review board of the university and permission to collect data from the relevant educational institutions. Parents/guardians were informed on the objectives of the study, and they had the opportunity to sign a non-consent form. Data were collected by the researchers, who informed the students on the purpose of the research and data collection procedures. The data were collected using paper-and-pencil administration mode.

5.4. Data analysis

Given prior theoretical and empirical research on DMQ 18 that specified an expected factor structure, we used the confirmatory approach to statistical analysis. Thus, first, a well-fitted baseline model of DMQ 18 was estimated for Romanian-speaking and Russian-speaking groups separately testing both correlated and second-order factor models that were used in previous studies on DMQ 18 (Amukune et al., 2021; Hwang et al., 2017). The purpose of this first stage was to determine whether or not the entire set of Moldovan data fit the predicted model (Hittner et al., 2018). NRC items are usually not included in DMQ 18 factor analyses when there are limited sample sizes, given that their relatively lower internal consistency besides COM items are usually not included because they do not measure mastery motivation (Józsa & Morgan, 2015).

Moreover, the factor loadings of all the items were assessed. The minimum CFA factor loading considered for the study was .500 (K. C. Barrett et al., 2020). The factor loadings were used in defining the baseline model for both groups and residual variance in the model covariance matrices. The goodness of fit was evaluated by assessing the CFI, TLI and RMSEA fit indexes. The cutoff values for an adequate fit are as follows: CFI and TLI >0.900, RMSEA and SRMR <0.08 (Hair et al., 2018). Composite reliability (CR) was used to assess the internal consistency separately for data from the Romanian-speaking sample and the Russian-speaking sample. CR is based on the factor loadings in CFA (Trizano-Hermosilla & Alvarado, 2016). Convergent validity was considered satisfactory if the CR values for all the variables in the scale were higher than .700 and the average variance extracted (AVE) was higher than .500. AVE values lower than .500 were considered acceptable when the convergent validity values were above .600 (Fornell & Larcker, 1981).

Having merged the data of the Romanian-speaking and Russian-speaking participants and established the baseline model, the configural invariance for both groups was simultaneously established (Yu & Shek, 2014). Finally, measurement equivalency across students' language of instruction was conducted via multigroup CFA which provided further indication of construct validity revealing whether the measurement model structure was equivalent between groups with different characteristics (Putnick & Bornstein, 2016). Metric invariance was conducted to determine whether the constructs used in the DMQ18 were perceived the same in both groups, while scalar invariance was used to establish whether the latent means can be compared across

cultures (Hair et al., 2018). Partial invariance was considered for determining scalar invariance which is a prerequisite for comparisons between groups. A factor can be considered partially invariant if more than half of its items are invariant (Vandenberg & Lance, 2000). Invariance is demonstrated when comparisons of the models produce a $\Delta CFI < 0.01$ and $\Delta RMSEA < 0.015$ (Chen, 2007).

The next step was to compare the latent means of the Romanian-speaking group with the Russian-speaking group as the measurement invariance allows for analysis of group differences. The partial scalar invariance model was used as the baseline to compare the latent means between groups. The critical ratio (CR) was used to estimate the latent mean differences. A CR value > 1.96 indicates statistically significant difference in the latent means (Byrne, 2013). A positive CR value corresponds to a higher latent mean compared to the reference group. The data were analysed employing IBM SPSS Statistics 23.0 Amos 28.0.

6. Findings

6.1. Baseline testing model

Given that the factor structure of DMQ18 was empirically studied previously, CFA models were employed in assessing the factor structure for Romanian and Russian data. Two correlated factor models were used, and one second-order factor model was tested on that.

First, the correlated five-factor model, which contained 28 items, was tested on the Romanian-speaking group since it contained a smaller sample. The first results proved a poor model fit: $\chi^2(113) = 478.232$, $p < .001$, $df = 337$, $CFI = .900$, $TLI = .888$, $RMSEA = .061$, 90% CI [.048, .073], $SRMR = .0704$. A model modification was necessary. As the sample size was small, we did not examine the multivariate outliers. However, we examined the standardized factor loadings and residual variance in the model covariance matrices (Molt & Conroy, 2000). Item 30 from the MP scale was dropped as it performed the poorest among all the items with a factor loading of 0.515 and it exceeded the criterion of ± 2.000 of residual variance and it was associated with two items; therefore, it was dropped. The fit indices of the final baseline model were as follows: $\chi^2(113) = 428.014$, $p < .001$, $df = 311$, $CFI = .914$, $TLI = .903$, $RMSEA = .058$, 90% CI [.044, .071], $SRMR = .0658$ which indicated an acceptable fit. All factor and item loadings for this correlated five-factor model were significant (0.48–0.96, $p < 0.01$) with CR ranging from .861 to .931 and AVE .496–.731 (Table A1). Next, based on the first-order five-factor model (27 items), the second-order factor model was tested. The results of fit indexes for this model did not fit the data as shown in Table 1.

Next, the same procedure was used for the data of the Russian-speaking students. Thus, the correlated five-factor model (that did not include item 30) was fit to the Russian-speaking data. The fit indices for the Russian group were as follows: $\chi^2(162) = 475.816$, $p < .001$, $df = 311$, $CFI = .924$, $TLI = .914$, $RMSEA = .057$, 90% CI [.047, .067], $SRMR = .0662$, thereby indicating a good fit. We also examined the correlated five-factor model (that included item 30) on the Russian-speaking sample which produced the following fit indices: $\chi^2(162) = 500.431$, $p < .001$, $df = 337$, $CFI = .927$, $TLI = .918$, $RMSEA = .055$, 90% CI [.045, .065], $SRMR = .0651$. The last second-order factor model provided acceptable fit indexes: $\chi^2(162) = 477.767$, $p < .001$, $df = 316$, $CFI = .925$, $TLI = .917$, $RMSEA = .056$, 90% CI [.046, .066], $SRMR = .0667$. All the factor loading for the correlated five-factor model (27 items) ranged from .574 to .924, $p < 0.01$ with composite reliability of scale varying from .868 to .932. and AVE from .523 to .735 (Table A1).

Since for the Romanian data only model 2 correlated five-factor model 27 items had acceptable fit index values, this model was chosen to be the baseline model for the Romanian and Russian data. The model fit of the total sample was of the baseline model had also an acceptable fit $\chi^2(311) = 509.253$, $p < .001$, $df = 311$, $CFI = .942$, $TLI = .934$, $RMSEA = .048$, 90% CI [.041, .056], $SRMR = .0529$.

Table 1. Goodness-of-fit statistics for the CFA models of DMQ18

	χ^2	df	p	CFI	TLI	RMSEA	SRMR
Romanian-speaking data							
Model 1: correlated five-factor model, 28 items	478.232	337	<.001	.900	.888	.061	.070
Model 2: correlated five-factor model, 27 items	428.014	311	<.001	.914	.903	.058	.065
Model 3: second-order factor model, 27 items	440.121	316	<.001	.909	.899	.059	.072
Russian-speaking data							
Model 1: correlated five-factor model, 28 items	500.431	337	<.001	.927	.918	.055	.065
Model 2: correlated five-factor model, 27 items	475.816	311	<.001	.924	.914	.057	.066
Model 3: second-order factor model, 27 items	477.767	316	<.001	.925	.917	.056	.066

6.2. Measurement invariance analyses

Measurement invariance was conducted within the framework of multigroup CFA. This analysis entailed testing the goodness of fit of a series of increasingly restrictive CFA models and its purpose was to test factorial invariance across groups which will allow to compare the groups (Romanian and Russian) on the mastery motivation constructs.

As presented in Table 2, the configural invariance model among language groups yielded an acceptable fit to the data, $\chi^2 (275) = 903.985, p < .001, df = 622, CFI = .920, RMSEA = .041, 90\% CI [.035, .046], SRMR = .065$. The next, more restrictive model which tested metric invariance also produced an acceptable model fit, $\chi^2 (275) = 930.513, p < .001, df = 644, CFI = .919, RMSEA = .040, 90\% CI [.035, .046], SRMR = .069$.

Finally, the scalar model was tested, but the results proved a statistical change in the fit of the model. Thus, we proceeded to test the partial scalar invariance model (Vandenberg & Lance, 2000). The intercepts of item 3 of GMP scale, item 1 from COP, items 22 and 33 of SPA and items 25 and 28 of SPC were allowed to vary across the language groups. The model-fit results of the partial scalar invariance were $\chi^2 (275) = 984.128, p < .001, df = 665, CFI = .919, RMSEA = .042, 90\% CI [.036, .047], SRMR = .070$. The change criteria ΔCFI and $\Delta RMSEA$ values met the recommended ones.

6.3. Cross-ethnic comparisons

In the quest for an improved understanding of cross-ethnic variations of mastery motivation in the Republic of Moldova, we conducted analyses to determine the differences in perception of the students of their mastery motivation using the DMQ18. Using the tested partial scalar invariance model across Romanian-speaking and Russian-speaking groups, the latent means across these two groups were compared. As shown in Table 3, there are no significant differences between the

Table 2. Goodness-of-fit statistics of measurement invariance for the correlated five-factor first-order model of the DMQ18

	χ^2	df	CFI	RMSEA	ΔCFI	$\Delta RMSEA$
Configural invariance	903.985	622	.920	.041		
Metric invariance	930.513	644	.919	.040	.001	.001
Partial scalar invariance	984.128	665	.910	.042	.009	-.002

Table 3. Latent means and differences in DMQ18 scales among two groups

DMQ18 scales	Means (SD)		CR	d
	Russian-speaking group	Romanian-speaking group		
1. COP	3.557 (.838)	3.904 (.750)	-3.500	.803
2. GMP	3.800 (1.148)	4.033 (.895)	-1.388*	1.052
3. SPA	3.822 (.948)	3.792 (.814)	0.269	.89584
4. SPC	3.896 (.892)	3.792 (.813)	-1.248	.84027
5. MP	4.461(.745)	4.544 (.595)	-1.196	.68767

Note: CR = critical ratio, d = Cohen d.

* $p < .001$.

latent means of COP, SPA, SPC and MP scales. But their latent mean comparison demonstrated that the Russian-speaking group 3.800 (1.148) had statistically significant lower GMP than the Romanian-speaking group 4.033 (.895) (CR = -1.388; $p < .001$; Cohen's $d = 1.052$), indicating the greater tendency of Romanian-speaking children to persist on challenging physical activities, in comparison to Russian-speaking children.

7. Discussion

The DMQ18 has been used to assess dimensions of mastery motivation among school children and was used in various empirical studies, including cross-cultural studies aimed at researching education and human development (Hwang et al., 2017; Józsa et al., 2020). We conducted this study with the aim of adapting the DMQ to the Russian and Romanian languages, analyzing the psychometric properties of the Russian and Romanian versions of the DMQ-18 for school-aged students, and determining whether there were any differences between the two language groups at the level of reported mastery motivation domains. The instrument contains 41 items and seven subscales that measure six aspects of mastery motivation, as well as perceived competence.

In the current study, we tested as the baseline model the five-factor first-order and five-factor second-order factor model using CFA for the Romanian-speaking group and for the Russian-speaking group. This first stage of the study is a prerequisite for establishing the whole data baseline model that must fit separately the group data sets. In our study, we started with the Romanian-speaking data set as it was the smallest and the small sample size could have caused model fit issues. The result of the CFA analysis concluded that the model fit of the Romanian-speaking data set was acceptable with the deletion of item 30 from MP scale. The factor loading of this item was acceptable, above .500 but the residual variance was above the cutoff value of ± 2 and was associated with two items. The five-factor first-order models test (with and without item 30) yielded an acceptable model fit for the Russian-speaking data. However, since the criterion for the baseline model establishment is to obtain acceptable model fit values for both groups, we selected model 2. The behaviour of item 30 in the Romanian-speaking data set cannot be explained by its correlation coefficient between the observed variable and the latent common factor as it met the cutoff value, but at the same time, it had a large amount of variance that remained unexplained by the other items. We believe that the main cause of this behaviour was the sample size of the Romanian-speaking data set, as in the Russian-speaking data set, its behaviour was acceptable both on the factor loading and residual variance analyses. Moreover, in the previous DMQ18 CFA analyses, all the items of the MP scales fit the five-factor model (Amukune et al., 2021; Morgan et al., 2017; Shaoli et al., 2019).

Measurement invariance is a compulsory condition for comparison of latent means in cross-cultural studies. This analysis is not common within mastery motivation research. It was used in

few recent studies on a preschool sample (Hwang et al., 2017) and school-aged children (Wang et al., 2020) in across-country analysis. This is the first study in which measurement invariance is used to establish appropriateness of questionnaires using different languages to measure mastery motivation within a single country. Thus, consistent with our hypothesis, the configural and metric invariance of the data set was achieved. This provided evidence that the first-order factor structure of the DMQ18 supported the inference that items and scales had equivalent meaning to participants across the Romanian- and Russian-speaking groups (configural invariance), and the items used to measure the underlying factors of the DMQ18 were equivalently associated with the latent variables for both ethnic groups (metric invariance). Partial scalar invariance was achieved which allowed a meaningful comparison of the latent means. The partial scalar invariance was achieved by relaxing six out of 27 intercepts. On the SPA and SPC scale, two intercepts were relaxed and COP and GMP only one which met the most strict recommendations for partial invariance (Steinmetz, 2011). Partial measurement invariance findings indicate that a meaningful comparison of latent means of DMQ18 is valid and that there are differences between the Romanian-speaking and the Russian-speaking 5th grade students in terms of mastery motivation scales.

Finally, an important contribution of the present study is the investigation of ethnic differences in mastery motivation in a country where the educational system provides complete instruction in two different languages to fit the needs of most of the population. Thus, addressing the last aim of the present research related to the differences between the perceptions of mastery motivation of Russian-speaking students and Romanian-speaking students in the Moldovan context, we determined that the 5th graders rate themselves similarly on the COP, SPC, SPA and MP scale. On the GMP scale, the Romanian-speaking students rated themselves significantly higher than the Russian-speaking students with a very large effect size.

When comparing the self-ratings of mastery motivation of the Russian and Romanian-speaking students only one difference was identified, on GMP, where the Romanian-speaking students rated themselves higher than the Russian-speaking students. These findings both support the comparability of the Russian and Romanian language versions of the DMQ18 and the similarity in perceived motivation across these ethnic groups in Moldova. This finding is in line with the results of cross-cultural comparisons of Hungarian-, Chinese-, and English-speaking school-aged children who determine a difference on the same scale on which the English and Hungarian-speaking students rated themselves statistically significantly higher than the Chinese-speaking students.

This study's limitation to fifth grade students suggests the need to include cross-ethnic studies of mastery motivation at various stages of school evaluation to determine the possible impact of ethnicity at different ages and levels of schooling. Such results could inform interventions to support student's mastery motivation and subsequently their academic achievement (Józsa & Barrett, 2018; Vansteenkiste et al., 2014). This is supported by the established evidence that mastery motivation is a predictor of school achievement (Hashmi et al., 2017; Józsa & Molnár, 2013). However, it is also important to determine to what extent the ethnicity of the student and language of the educational system explain variation in mastery motivation within one educational system (Józsa et al., 2020).

8. Limitations

The present study's findings contribute to the understanding of mastery motivation of Russian- and Romanian-speaking fifth grade students in the Republic of Moldova. However, the results of this study should be considered with caution because there are several limitations related to the sampling. Although the sampling procedures included such criteria as schools using a single language of instruction, location in urban areas, and similar school size, the results might not generalize to understanding mastery motivation in rural areas of the Republic of Moldova, as the rural and small schools were excluded from the study.

9. Conclusion

Results of the study of mastery motivation in the Republic of Moldova on subjects studying in school with Romanian language instruction and Russian language instruction contribute to the growing research on mastery motivation around the world, it establishes the research on motivation on secondary school students in this country, and it highlights the issue of the role of ethnicity related to mastery motivation in an educational system that provides schooling to different languages (Hwang et al., 2017; Józsa et al., 2014).

The empirical analysis of the Russian and Romanian versions of the DMQ18 sets the path to advance longitudinal and complex research on mastery motivation in the Republic of Moldova to assess whether the development of mastery motivation follows established patterns in other countries. Moreover, having both Russian and Romanian versions enables further study of whether a homogeneous educational system of a country can override the ethnic values of an ethnicity, leveling their mastery motivation levels. If so, one might predict that similarities would be greater at older ages relative to younger ages, when children have less exposure to the school environment. Much more research is needed regarding the role of the culture in child development and school achievement within the Moldovan educational system.

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Author contributions

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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Appendix

Table A1. Factor loadings of the items from DMQ-18 of the Russian and Romanian version of student self-rated CR and AVE

No	Factor	Russian			Romanian		
		Factor Loading	CR	AVE	Factor Loading	CR	AVE
	Cognitive-Oriented Persistence		.868	.523		.890	.574
17	I try to figure out all the steps needed to solve a problem	.779			.684		
40	I prefer to try challenging problems instead of easy ones	.582			.649		
1	I work on a new problem until I can do it	.588			.760		
14	I complete my schoolwork, even if it takes a long time	.696			.594		
23	I work for a long time trying to do something challenging	.647			.728		
29	I will work for a long time trying to solve a problem for school	.658			.715		
	Gross Motor Persistence		.932	.735		.931	.731
3	I try to do well at athletic games	.809			.837		
36	I try hard to get better at sports	.924			.849		
26	I repeat sports skills until I can do them well	.865			.838		
12	I try to do well in physical activities even when they are challenging	.833			.834		
38	I try hard to improve my ball-game skills	.656			.718		
	Social Persistence with Adults		.888	.569		.874	.539

(Continued)

Table A1. (Continued)

No	Factor	Russian			Romanian		
		Factor Loading	CR	AVE	Factor Loading	CR	AVE
22	I try hard to get adults to understand me	.632			.647		
19	I try to get adults to see my point of view	.574			.715		
33	I try to find out what adults like and don't like	.780			.778		
15	I try hard to interest adults in my activities	.729			.676		
37	I try hard to understand the feelings of adults	.734			.656		
8	I often discuss things with adults	.640			.523		
	Social Persistence with Children		.891	.578		.855	.496
28	I try hard to make friends with other kids	.812			.619		
25	I try hard to understand other children	.710			.557		
6	I try hard to make other kids feel better if they seem sad	.663			.653		
7	I try to say and do things to keep other kids interested	.599			.644		
32	I try to get included when other kids are doing something	.774			.670		
35	I try to keep things going when I am playing with other kids	.692			.688		
	Mastery Pleasure		.871	.628		.861	.609
2	I get excited when I figure something out	.672			.658		
11	I get excited when I am successful	.808			.669		

(Continued)

No	Factor	Russian			Romanian		
		Factor Loading	CR	AVE	Factor Loading	CR	AVE
18	I am pleased when I solve a problem after working hard at it	.679			.638		
21	I smile when I succeed at something I tried hard to do	.670			.810		



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Article 2

Article

Subject Specific Mastery Motivation in Moldovan Middle School Students

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Abstract: Given the crucial role of mastery motivation in the cognitive development of children, the present study investigates subject-specific mastery motivation in the multilingual educational system of the Republic of Moldova. We applied cross-sectional data from fifth, seventh, and ninth graders studying either in the Romanian (n = 583) or Russian (n = 353) language using the Subject Specific Mastery Motivation Questionnaire (SSMMQ). To ensure the validity of the comparison of latent mean differences, the Romanian and Russian versions of SSMMQ were validated and measurement invariance of the constructs across language, grade, and gender was assessed. The full scalar invariance across grades and gender and the partial scalar invariance across language held. Thus, a comparison of latent mean differences across these three groups is plausible. The findings proved that there was no difference between the Romanian and Russian samples, but we found girls self-rated themselves significantly higher than boys in the Reading, Art, and Music mastery motivation scales. Results with respect to the comparison of latent mean differences between the grade levels demonstrated that the Reading mastery motivation of the Moldovan students stayed stable from fifth to ninth grades, whereas Art had a constant declining path.

Keywords: subject-specific mastery motivation; measurement invariance; latent mean differences; gender differences



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1. Introduction

Mastery motivation is a person's intrinsic urge that drives and maintains a behavior focused on mastering a challenging task, skill, or competence [1,2]. The exhibit of mastery motivation generates mastery pleasure in success, and a further drive to complete a challenging task. Empirical studies demonstrated that mastery motivation is a valid predictor of children's social, cognitive, and psychomotor developments [3–6]. Mastery motivation mediates learning and school achievement in both formal and informal educational setups [1]. There is an extended body of research focusing on mastery motivation as an explanatory factor of various school achievement, engagement, psychological well-being, cognition, future professional choices, etc. [1,7–16]. Therefore, exploring the pattern of mastery motivational specificity in academic domains can explain the school achievement trajectories and further understand how students' learning in different subjects can be supported by education stakeholders in school settings.

Although subject-specific mastery motivation has an important role in the academic trajectory of the students, sparse research has been carried out to empirically explore it [4,9]. In the Moldovan context, there is also limited research that investigates the importance of subject-specific mastery motivation for middle school students. Given the fact that school subjects differ in competences, skills, tasks, teachers, etc., the individual mastery motivation of the students in subject-specific contexts also varies, thus influencing academic outcomes specifically in middle school [9,10,17]. Therefore, the present study was conducted to

address these research gaps by measuring subject-specific mastery motivation in middle schools and plausibly exploring the grade, gender, and language of instruction.

2. Theoretical Framework

2.1. *Evolving Concept of Mastery Motivation*

Mastery motivation is a multifaceted concept that is focused on the process of accomplishing an ongoing task regardless of the possible challenges [18]. The focal components of mastery motivation discriminating it from other concepts of motivation are the focus on the cognitive, object, or social persistence during the process of achieving/attempting to achieve a task in a specific domain along with the emotions that arise during the process of mastering endeavors [19–21]. Thus, mastery motivation is a process aimed to accomplish a task that is at least not easy and not the finally attained outcome. Mastery motivation theory is based on a two-aspect framework including the instrumental and affective aspects [19]. The instrumental aspect consists of four domains: cognitive/object persistence, gross motor persistence, social persistence with adults, and social persistence with children. The affective aspect refers to the positive or negative reaction of a person during the process of mastering a task or acquiring a skill materialized into mastery pleasure and negative reactions to challenge domains [22]. The multifaceted conceptualization of mastery motivation was first established in America and the concept has since evolved in many contexts of other countries such as Hungarian, Taiwanese, Iranian, and Moldovan school-aged students [23], Turkish, Chinese, Spanish, Bangla, and Iranian school contexts [24], Indonesian contexts [25], and Kenyan educational contexts [26].

2.2. *Subject-Specific Mastery Motivation*

In addition to the multifaceted aspect of mastery motivation, there has been research regarding the domain specificity of mastery motivation [5]. As highlighted by Józsa et al. [27], the domain specificity of mastery motivation is scarce since this is a new area of research in mastery motivation. From a theoretical standpoint, additional dimensions of mastery motivation we described, assuming that mastery motivation is school-specific, assumes that mastery motivation level fluctuates in specific contexts. The recent trends in motivational research focus in motivational research has shifted from general domains to specific domains [28]. The rationale underlying the study of domain-specific mastery motivation points to the fact that motivational constructs in a general domain may or may not emerge or repeat the same trajectory/pattern in specific situations [7,29]. In addition, the skills and competences that are required in studying a specific subject differ, which can impact motivation perceptions across domains [30]. Specifically contextualized motivation measurements can increase the predictiveness of school achievement compared with the domain general motion instruments [9,31]. In predicting increased school achievement, stakeholders (e.g., parents, teachers, curriculum designers including textbook authors) play a key role when making decisions about the child's mastery motivation [32]. Therefore, the role of the stakeholders is crucial to be able to help students' learning processes adapt their subject-specific mastery motivation and mediation roles of certain subjects.

Thus, Józsa, proceeding from Barrett and Morgan's definition of mastery motivation, designed a scale for measuring domain-specific dimensions of mastery motivation in the following subjects: reading, mathematics, science, English as a foreign language, German as a foreign language, arts, and music [33]. The measurement was developed on the foundation of the cognitive/object persistence domain. Thus, cognitive persistence precisely matters in challenging cognitive activities as performance is not conditioned just by the cognitive ability of a person but also by cognitive persistence, which is the motivation to achieve a task or performance as well as the effort an individual devotes to a task [34–38]. It is considered that cognitive persistence affects performance in challenging cognitive tasks that are at the person's intermediate ability level and not the tasks that are higher or easier than the person's ability level [37]. Józsa et al. [27] identified that students

in primary can differentiate among their perception of mastery motivation in reading, mathematics, science, English/German as foreign language, art, and music.

Thus far, very few studies have researched subject-specific motivation. Studies showed that elementary and secondary school students have differentiated mastery motivation in different academic domains [27,33]. Józsa found medium-cross domain correlations between the reading and math mastery motivation for fourth graders from Taiwan and Hungary. Moreover, based on their cross-sectional study, they concluded that when reading, mathematics, science, music, and arts decreased in both countries, English mastery motivation fluctuated. So, while in Hungary, it decreases minimally from grade four to six and remains stable from grade six to ten, it decreased constantly from grade four to eight, increasing in grade ten to the level of grade four in Taiwan [24]. In another study, when comparing the English mastery motivation with German mastery motivation, it was concluded that the level of German mastery motivation constantly decreased, whereas the English mastery motivation fluctuated [33]. These studies proved the contextual variation of mastery motivation and the need for further research.

Another issue that is worth investigating is the differential distinctiveness of the SSMMQ with age. Józsa et al. [27] discussed the correlations of the SSMMQ scales in the fourth and tenth grades finding a general declining tendency of the correlations. In contrast, Marsh and Ayotte (2003) proposed that with age and cognitive development of the children, the closely related areas of self-concept would be less differentiated and oppositely the divergent areas would be more differentiated, which should be visible in the correlations among the factors [39]. This process is in agreement with the concept of the Matthew effect that stands for the “rich-get-richer and the poor-get-poorer” trajectory [39,40]. Thus, we assume that the differential distinctiveness of the SSMMQ scales will be established for the disparate subjects resulting from decreasing paths of correlations among specific-subject mastery motivation scales across the fifth and the ninth grades.

2.3. Context of the Republic of Moldova

Historically, the Republic of Moldova has been a multicultural country where education is offered in two languages: Romanian and Russian. That is, in this country, there are monolingual schools (with either Romanian or Russian language of instruction) and mixed schools where there are classes that study in either Romanian or Russian. The language of instruction is chosen by the student’s parents or tutors. For this reason, all the educational materials used in the Moldovan pre-university system of education are issued in both Romanian and Russian. The linguistic and educational context of the Republic of Moldova allows the validation of measurement instruments in both the Romanian and Russian languages.

2.4. Current Study

To the best of our knowledge, no empirical study has addressed the role of subject-specific mastery motivation of secondary school students in the Republic of Moldova. Moreover, the studies on domain specificity of mastery motivation constructs employed exploratory factor analysis and correlations between subject-specific mastery motivation factors to study the mastery motivation constructs in the school context [27,33]. Therefore, this study aims to use structural equation modeling that will give further insight into the dimensionality of the SSMMQ. Another issue that has not been addressed in previous research is the comparison of latent mean differences across different groups, allowing a better understanding of the subject-specific motivation and the source of its variation. Thus, in the present study, we address the following research aims: (a) to explore the psychometric properties of the Romanian and Russian versions of the SSMMQ; (b) to analyze the age-related differential distinctiveness of the SSMMQ; (c) to explore different degrees of measurement invariance of the SSMMQ across language, grade, and gender; and (d) to investigate the latent mean differences across languages, grade levels, and gender

and their magnitudes. Based on these research aims, we planned to address the following research questions.

RQ₁: What are the psychometric properties of the Romanian and Russian versions of the SSMMQ?

RQ₂: Is there an age-related (grade levels) differential distinctiveness in the SSMMQ?

RQ₃: What is the measurement invariance of the SSMMQ across language, grade levels, and gender?

RQ₄: What are the latent mean differences across languages, grade levels, and gender?

3. Method

3.1. Participants

We employed stratified sampling which included the following explicit stratification variables: (a) schools that offer instruction in just one language, monolingual schools, and mixed-language schools; (b) schools that teach English as the first foreign language; and (c) regarding language of instruction, schools with Romanian language of instruction and schools with Russian language of instruction. All these schools contain at least all of the following levels: ISCED 1 (primary school), ISCED 2 (middle school/gymnasium), and ISCED 3 (high school/lyceum). Therefore, the one implicit stratification variable was schools that offer ISCED 2 level. The total number of the schools that participated in this study was five: two schools with Russian and three with Romanian language of instruction. Since ISCED 2 in the Republic of Moldova comprises grades five to nine, and to meet the objective of determining the trajectory of SSMM in middle school, we selected the entry grade (fifth), the exit grade (ninth), and the one in the middle (seventh).

The sample comprises 939 (472 girls and 466 boys) secondary school students from five public schools in a large city in the Republic of Moldova. The response rate within schools in this study was 90.70%. Two linguistically different samples were used: the Romanian (RO) sample consisting of the students who studied in schools with the Romanian language of instruction ($N_{RO} = 586$ (62.407%)) and the Russian (RU) sample corresponding to the students studying in schools with the Russian language of instruction ($N_{RU} = 353$ (37.593%)). Moreover, the distribution across grade levels was the following: 346 (36.848%) with an average age of 11.147 ($SD = 0.436$) studied in the fifth grade ($N_{RO,5} = 219$ and $N_{RU,5} = 127$), 304 (32.375%) aged 13.059 ($SD = 0.410$) studied in the seventh grade ($N_{RO,7} = 199$ and $N_{RU,7} = 105$ Russian), and 289 (30.777%) aged 13.051 ($SD = 0.326$) were in the ninth grade ($N_{RO,9} = 168$ and $N_{RU,9} = 121$).

3.2. Instrument

In the current study, the Subject Specific Mastery Motivation Questionnaire (SS-MMQ) [27,33] was used. The Subject-Specific Mastery Motivation Questionnaire (SSMMQ) contains the following scales: Reading Mastery Motivation (Reading), Mathematics Mastery Motivation (Math), Science Mastery Motivation (Science), Music Mastery Motivation (Music), Art Mastery Motivation (Art), English as a Foreign Language Mastery Motivation (English), German as a Foreign Language (German), and School Mastery Pleasure (SMP). The English and German scales are used depending on the foreign language that is studied by the student. Each scale consists of six 5-point Likert items. The scales do not consist of parallel items. The SMP scale consists of six items that are worded in parallel, i.e., they all begin with the same words: 'I am pleased when ...'. In the present study, we used the Reading, Math, Science, English, Art, Music, and SMP scales. Previous psychometric studies of the SSMMQ supported a seven-factor structure. The Cronbach's alphas of the Hungarian version of the SSMMQ ranged from 0.785 to 0.923: the SMP had the lowest internal consistency and Music scale had the highest one. The reliability of the Taiwanese version ranged from 0.786 for SMP to 0.915 for English [27].

All SSMMQ scales are reflected in the subjects that are taught in middle school in the Republic of Moldova, e.g., Reading is taught in the Romanian/Russian language and literature, Math in mathematics, Science is taught in the fifth grade as science, from the

sixth to ninth grades, physics is taught, and from the seventh to ninth grades, chemistry is taught. Foreign Language is in the students' curriculum throughout middle school. Music and Art are practiced within music education, art education, and technological education.

3.3. Translation of the SSMMQ English into Romanian and Russian

Having received permission from the author of the SSMMQ, the questionnaire was translated into Romanian and Russian [41]. Due to the fact that the SSMMQ was translated and validated simultaneously in Russian and Romanian in the same context, we used bilingual expert translators (Romanian and Russian). The stages used in this translation process were: (a) forward-translation done by two translators, (b) forward-reconciliation and harmonization among versions, (c) back-translation, (d) evaluation of the back-translation by an expert in mastery motivation, (e) pilot testing of the Romanian and Russian versions of the SSMMQ on fifth-grade students, and (f) final review based on pilot results [42].

3.4. Data Collection

During the preparation stage of data collection, the researchers sought ethical approval from the Institutional Research Board of the University of Szeged and the research followed all procedures requested by the educational institutions where the data were collected. The questionnaire was filled in during class hours using the pen and paper method. Each session lasted 45 min. One of the researchers administrated the questionnaire across all the sessions, ensuring consistent procedures for all questionnaire takers. There was no student who refused to participate. Having completed the questionnaire, students were encouraged to give some feedback and ask questions related to the SSMMQ.

3.5. Analytical Procedure

The procedure used in the study of the equivalence in the latent structure of subject-specific mastery motivation among groups was sequential and progressive. The first step was to analyze the pattern of the missing data and multiply impute the data using SPSS 28.0. Next, normality tests (skewness and kurtosis) were carried out to determine if the data fit the normal distribution.

To establish the dimensionality and psychometric properties of the Romanian and Russian versions of the SSMMQ, we first conducted confirmatory factor analysis (CFA) to analyze the factor structure of the SSMMQ using the overall sample. Thus, we assessed the following models: (1) Model 1 reflected the original seven-factor Subject-Specific Mastery Motivation model proposed by Józsa et al. [27] that included six subject-specific factors (Reading, Math, Science, English Art, and Music) and one school mastery pleasure factor; each factor consisted of six items; (2) Model 2 was a six-factor model in which the school mastery pleasure variables were included in the subject-specific factor, thus each factor contained seven items; and (3) Model 3 contained only six subject-specific factors, with six-items per factor. To ascertain the adequacy of model fit measures of the model, we examined the comparative fit index (CFI), Tucker–Lewis index (TLI), root-mean-square error of approximation (RMSEA), and standardized root mean squared residual (SRMR) [43]. The chi-square test was used to select the best structural models among the nested models. However, due to both the sensitivity of the chi-square test to sample size and statistically significant chi-square results produced in large samples, we considered other fit indexes, namely CFI, TLI, RMSEA, and SRMR. CFI and TLI have values that are highly correlated. Some researchers recommend that one of them be reported even though TLI has a greater relative penalty for model complexity [44]. Moreover, there are studies that concluded that TLI was the only index that had values that were not dependent on sample size [45]. SRMR was used for assessing model fit as it is more accurate when there are a large number of variables in comparison with RMSEA [46]. To evaluate the fit indexes, we referred to the following cut-offs: TLI and CFI ≥ 0.95 , RMSEA ≤ 0.06 , and SRMR ≤ 0.08 [47,48].

Next, reliability, mean, and standard deviation values were computed. The reliability of the Romanian and Russian versions of the SSMMQ was estimated using internal

consistency reliability by calculating Cronbach's alpha, and composite reliability (CR) was measured by coefficient omega (ω) [49]. Values above 0.700 are considered acceptable [50]. To evaluate the construct validity of the investigated version of the SSMMQ, we studied its convergent and discriminant validity. Convergent validity was proved if the factor loadings were above 0.400, with a sample size of 400 for significance, if CR was higher than 0.700, and average variance extracted (AVE) exceeded 0.500 [46]. AVE values that did not meet the 0.500 cut-off could be accepted if the CR of the factor was above 0.60 [51]. Discriminant validity was evaluated by a more traditional approach, the Fornell–Larcker criterion, which has low sensitivity, and by a more modern approach, the heterotrait-monotrait ratio of correlations (HTMT). For the Fornell–Larcker criterion, AVE values should be higher than the squared inter construct correlation estimate. The threshold for HTMT is 0.850, which is quite a conservative one and suggests that the constructs are more distinct [52].

Next, to investigate the validity of the SSMMQ and factor latent differences, we determined the measurement invariance (MI) (by the language of instruction of the student, grade level, and gender). Thus, we identified a model that would fit all the groups, and the baseline model for each group was separately analyzed using CFA with maximum likelihood estimation. MI substantiates the equality of factor pattern on the latent factor (configural invariance), the equality of factor loadings (metric invariance), the equality of item intercepts (scalar invariance) confirming comparisons of factor means across groups, and the equality of item residuals of metric and scalar invariant items (residual invariance) [53]. Full scalar invariance is a desideratum that is difficult to achieve especially on a cross-cultural level; therefore, in case of lack of full invariance, partial invariance could be established [54]. Residual invariance is not a compulsory step for demonstrating full factorial invariance, but it is not required for the interpretation of latent means [55]. The invariance was accepted with a $\Delta CFI \leq 0.010$, $\Delta TLI \leq 0.010$, and $\Delta RMSEA \leq 0.015$, in favor of the least strict model [56].

We opted for using the test of latent means differences to compare the groups. This test does not provide an increase in statistical power in comparison with the traditional multivariate analysis (e.g., *t*-test, ANOVA) [57]. Thus, to determine the model, the latent mean of one group was constrained to zero (reference group) while the latent mean of the second group was freely estimated (comparison group) [58]. Thus, to calculate the latent mean difference across grade levels, we first constrained the fifth-grade latent mean to zero, and the other two group means were freely estimated to obtain the mean differences between the fifth and seventh graders and the fifth and ninth graders. Next, the latent mean of the seventh grade was set to zero, and the other two groups were freely estimated to generate the latent mean difference between the seventh and ninth grades [59]. For language and gender, the reference groups were female and Russian.

The critical ratio (CR) index was used to evaluate the estimated latent mean difference across groups. The CR represents parameter estimate divided by its standard error and it is used to determine if the estimate is statistically different from zero [60]. CR values exceeding ± 1.96 , which corresponds to a 0.05 error level, are considered significant [50], and a negative CR value indicates that the comparison group has lower latent mean values than the reference group. However, in the 5-point Likert scale used in the SSMMQ, there is no true zero value. Therefore, we used Cohen's *d* as effect size index to interpret the mean differences in terms of their magnitude [53,61]. The data were analyzed using IBM SPSS and IBM SPSS AMOS (Version 28.0).

3.6. Preliminary Data Analysis

The initial sample consisted of 942 students. Three students had more than 30% of missing data and were omitted from the study. Before carrying on any statistical analysis, we investigated the frequency of the missing data, its randomness, and patterns. Thus, 9.265% of the subjects contained incomplete data. Missing data constituted 0.400–2.200% on individual items due to non-response, which is in agreement with Kline's recommendations for treating the issue of missing values across items and cases [44].

Two tests were carried out to explore the degree of randomness in the missing data. First, Little's Missing Completely at Random test revealed that the missing pattern could not be considered to be missing completely at random ($\chi^2 = 2054.689$, $df = 1622$, $p < 0.001$) [62]. The next step was to determine the propensity for data points, i.e., if the missing values were associated with some of the observed variables [63]. A series of t-tests revealed that the missing values across some factors were related to the values of other observed factors. Therefore, we concluded that the missing value pattern was Missing at Random (MAR). According to Graham's [64] recommendations, the multiple imputation (MI) approach was selected to deal with missing values.

The means and standard deviations of the 42 variables are presented in Table 1. Since the maximum-likelihood method was used in the factor analysis, we investigated the normality of our data [65]. Curran et al. (1996) proposed that the normal distribution should not be severely violated [66]. Kline's (2016) guideline of severe non-normality indicated that a severe violation of normality assumption was defined by skewness (Sk) values which are greater than 3 and kurtosis (K) values which are greater than 10 [44]. As a result, the skewness values of the Romanian sample were between -1.613 and 0.221 and kurtosis scores ranged from -1.387 and 1.818 , while the skewness values of the Russian sample were between -1.814 and 0.266 and kurtosis scores ranged from 2.765 and -1.382 . These values suggest that all variables showed relatively normally distribution.

Table 1. Descriptive statistics: means and standard deviations.

Samples	Reading	Math	Music	Science	English	Art
Overall sample ($N = 939$)	3.651(0.846)	3.814 (0.878)	2.716 (1.310)	3.224 (0.952)	4.091 (0.912)	3.311 (1.266)
Romanian ($N = 586$)	3.691 (0.838)	3.879 (0.846)	2.802 (1.329)	3.270 (0.879)	4.128 (0.938)	3.304 (1.263)
Russian ($N = 353$)	3.584 (0.856)	3.708 (0.919)	2.573 (1.266)	3.148 (1.058)	4.029 (0.863)	3.321 (1.271)
5th grade ($N = 346$)	3.657 (0.833)	3.956 (0.824)	2.926 (1.290)	3.325 (0.961)	4.133 (0.873)	3.677 (1.126)
7th grade ($N = 304$)	3.652 (0.855)	3.675 (0.887)	2.629 (1.307)	3.222 (0.943)	4.183 (0.875)	3.231 (1.237)
9th grade ($N = 289$)	3.641 (0.856)	3.792 (0.907)	2.557 (1.308)	3.106 (0.940)	3.943 (0.978)	2.957 (1.340)
Female ($N = 472$)	3.867 (0.805)	3.859 (0.884)	3.023 (1.315)	3.363 (0.948)	4.241 (0.868)	3.718 (1.145)
Male ($N = 466$)	3.433 (0.832)	3.770 (0.871)	2.402 (1.230)	3.085 (0.937)	3.941 (0.930)	2.899 (1.251)

4. Results

4.1. Dimensionality of Romanian and Russian Versions of SSMMQ

First, we tested the seven-factor SSMMQ model; each factor contains six items (Model 1) proposed by Józsa et al. (2017) that included Reading, Mathematics, Science, English, Music, and Art Mastery Motivation, and School Mastery Pleasure scales [27]. As presented in Table 2, Model 1 did not lead to a sufficient model fit in either the Romanian (χ^2 (798, $N = 586$) = 2605.054, $p < 0.001$, CFI = 0.897, TLI = 0.889, RMSEA = 0.062 [0.060, 0.065], SRMR = 0.064) or Russian samples (χ^2 (798, $N = 352$) = 1998.593, $p < 0.001$, CFI = 0.879, TLI = 0.869, RMSEA = 0.065 [0.062, 0.069], SRMR = 0.070). All standardized factor loadings for this model ranged from 0.581 to 0.933 in the Romanian version; the lowest factor loadings had SMP scale (0.581–0.685). In the Russian version, the factor loadings were lower than the Romanian factor loadings, ranging from 0.531 to 0.923, and again in the Russian version of SMP, the lowest factor loading was yielded by the SMP scale (0.531–0.652).

Model 2 contained the same number of variables, but the SMP items were included in the respective subject-specific mastery motivation scale; thus, it contained six dimensions and 42 items. It had an improved model fit for the Romanian version (χ^2 (804, $N = 586$) = 2255.256, $p < 0.001$, CFI = 0.917, TLI = 0.912, RMSEA = 0.056 [0.053, 0.058], SRMR = 0.056) as well as for the Russian version (χ^2 (804, $N = 352$) = 1780.355, $p < 0.001$, CFI = 0.901, TLI = 0.894, RMSEA = 0.059 [0.055, 0.062], SRMR = 0.061). The factor loadings of the 42 SSMMQ items in the Romanian version ranged from 0.476 to 0.930. The items of the SMP dimension had the lowest factor loadings, proving that they do measure a different factor (0.476–0.611). The Russian version of the SSMMQ with factor loadings of 0.456–0.922 followed the Romanian pattern and the items representing SMP

loaded the lowest on the subject-specific scales (0.456–0.696). The model fit of the SSMMQ considerably improved with dropping the SMP scale.

Table 2. Goodness of fit indicators of the models of the SSMMQ using confirmatory factor analysis.

Version	Model	χ^2 (df)	χ^2/df	TLI	CFI	RMSEA [90% CI]	SRMR
Ro	Model 1	2605.054 (798)	3.264	0.889	0.897	0.062 [0.060, 0.065]	0.064
	Model 2	2255.256 (804)	2.805	0.912	0.917	0.056 [0.053, 0.058]	0.056
	Model 3	1433.384 (579)	2.476	0.940	0.944	0.050 [0.047, 0.054]	0.041
	Model 3a	1090.799 (574)	1.900	0.963	0.966	0.039 [0.036, 0.043]	0.041
Ru	Model 1	1998.593 (798)	2.505	0.869	0.879	0.065 [0.062, 0.069]	0.070
	Model 2	1780.355 (804)	2.214	0.894	0.901	0.059 [0.055, 0.062]	0.061
	Model 3	1228.756 (579)	2.122	0.919	0.926	0.056 [0.052, 0.061]	0.050
	Model 3a	985.752 (574)	1.717	0.948	0.953	0.045 [0.040, 0.050]	0.050

Note: χ^2 = chi-square; *df* = degrees of freedom; TLI = Tucker–Lewis index, CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean squared residual; Model 1 = seven-factor model with 42 variables; Model 2 = six factor model with 42 variables; Model 3 = six-factor model with 36 variables; Model 3a = Model 3 with correlated errors.

As a result, Model 3 (in which the six variables measuring SMP were deleted, thus it included six dimensions comprising six items each and no correlations were imposed) had a good model fit when compared with the other two models. The Romanian yielded the following fit indexes: χ^2 (579, $N = 586$) = 1433.384, $p < 0.001$, CFI = 0.944, TLI = 0.940, RMSEA = 0.050 [0.047, 0.054], SRMR = 0.041, whereas that of the Russian version was as follows: χ^2 (579, $N = 352$) = 1228.756, $p < 0.001$, CFI = 0.926, TLI = 0.919, RMSEA = 0.056 [0.052, 0.061], SRMR = 0.050. These results indicated that model fit did not meet the standard criteria of good fit in both versions of the SSMMQ. Having studied the results of modification indices, we gradually co-varied error terms in each version individually. Thus, χ^2 values decreased. Then, we added five covariances of item errors producing model fit values that met the thresholds. In the Romanian version, the imposed covariances were between the residuals of the following items: Music 1 and Music 2, Music 3 and music 6, English 1 and 2, Art 6 and 5, and Reading 6 and Reading 4. The final SSMMQ model of the Romanian version showed that all the goodness-of-fit indices met the fitting criterion: χ^2 (579, $N = 586$) = 1090.799, $p < 0.001$, CFI = 0.966, TLI = 0.963, RMSEA = 0.039 [0.036, 0.043], SRMR = 0.041 (Table 2), with factor loadings ranging from 0.618 to 0.947 (Table 3). In the Russian version, five covariances were Music 1 and Music 2, English 1 and 2, Art 2 and 4, Reading 1 and Reading 4, and Reading 4 and 6. The fit indexes of the final modified model of the Russian version were acceptable: χ^2 (579, $N = 352$) = 985.752, $p < 0.001$, CFI = 0.953, TLI = 0.948, RMSEA = 0.045 [0.040, 0.050], SRMR = 0.050 (Table 2); the factor loadings in this model were between 0.560–0.932 (Table 3).

A concern of this study is the possible ceiling effect in English scales (Table 1). Approximately, 21.299% of the students endorsed the highest option of the Likert scale, which is above the cut-off of 20% [67]. We identified a ceiling effect of 24.403% in the Romanian sample and 16.147% in the Russian sample. Next, we studied the floor effect in the Music scale as it yielded the lowest scores. A floor effect of 13.418% was established for the whole sample. The Romanian sample produces a floor effect of 11.433%, whereas the Russian one was 16.714%; thus, as these numbers are below the acceptable value of 20%, the floor effect in the Music scales was not identified.

Table 3. Factor Loadings, Composite Reliability, AVE, and Cronbach's Alphas for the Romanian and Russian versions of the SSMMQ.

Items	Factor Loadings		Composite Reliability ω		AVE		Cronbach's α	
	RO	RU	RO	RU	RO	RU	RO	RU
Music Mastery Motivation								
Music 3	0.899	0.873	0.949	0.932	0.757	0.697	0.952	0.936
Music 4	0.947	0.835						
Music 2	0.855	0.825						
Music 6	0.820	0.874						
Music1	0.833	0.787						
Music 5	0.859	0.813						
Art Mastery Motivation								
Art 6	0.869	0.932	0.935	0.935	0.706	0.706	0.935	0.937
Art 3	0.917	0.868						
Art 5	0.763	0.897						
Art 4	0.884	0.803						
Art 2	0.873	0.792						
Art 1	0.718	0.734						
English Mastery Motivation								
ENG3	0.893	0.888	0.921	0.893	0.662	0.573	0.922	0.889
ENG4	0.898	0.811						
ENG6	0.845	0.863						
ENG5	0.783	0.734						
ENG2	0.761	0.678						
ENG1	0.679	0.580						
Mathematics Mastery Motivation								
Math 4	0.799	0.825	0.902	0.903	0.605	0.605	0.901	0.901
Math 6	0.801	0.797						
Math 2	0.812	0.835						
Math 1	0.790	0.738						
Math 5	0.722	0.794						
Math 3	0.740	0.678						
Science Mastery Motivation								
Science 3	0.779	0.876	0.864	0.904	0.517	0.612	0.862	0.903
Science 2	0.776	0.807						
Science 1	0.768	0.788						
Science 5	0.715	0.737						
Science 4	0.641	0.716						
Science 6	0.618	0.758						
Reading Mastery Motivation								
Reading 4	0.720	0.670	0.876	0.854	0.542	0.497	0.878	0.865
Reading 2	0.813	0.760						
Reading 5	0.779	0.817						
Reading 3	0.776	0.722						
Reading 6	0.665	0.673						
Reading 1	0.650	0.560						

4.2. Validity

In terms of convergent validity, AVE values of the Romanian and Russian versions of the SSMMQ were assessed as demonstrated in Table 3. All AVE values for the Romanian sample were above 0.500, whereas the AVE of the Russian version for the Reading scale is 0.497 (which is below the threshold of 0.500); however, the CR is 0.854 (which exceeded the cut-off point of 0.060 and allowed us to accept this AVE value).

To further examine the discriminant validity of the SSMMQ, the heterotrait-monotrait ratio of correlations (HTMT) analysis was carried out. Table 4 shows that all HTMT values for both versions were <0.85, establishing the discriminant validity for the Romanian and Russian six-factor models. The discriminant validity of the SSMMQ was also estimated using Fornell and Larcker's approach. The square root of AVE of each latent factor of the

SSMMQ was higher than the correlations it has with the rest of the latent variables in the model in both samples, as presented in Table 5.

Table 4. HTMT ratio of correlations among the SSMMQ factors of the Romanian and Russian versions.

SSMMQ Scales	Music	Art	English	Mathematics	Science	Reading
Music		0.295	0.228	0.151	0.400	0.346
Art	0.398		0.164	0.183	0.439	0.335
English	0.172	0.154		0.458	0.312	0.424
Math	0.163	0.223	0.518		0.326	0.458
Science	0.418	0.406	0.378	0.449		0.536
Reading	0.441	0.486	0.437	0.518	0.597	

Note: The upper triangle contains the Russian data, the lower triangle presents the Romanian data.

Table 5. Fornell–Larcker criterion: Correlations between the square roots of the AVE of each variable.

SSMMQ Scales	Romanian						Russian					
	1	2	3	4	5	6	1	2	3	4	5	6
1. Music	0.870						0.835					
2. Art	0.404	0.840					0.299	0.840				
3. English	0.175	0.156	0.814				0.233	0.167	0.757			
4. Math	0.165	0.224	0.386	0.778			0.152	0.184	0.506	0.778		
5. Science	0.421	0.408	0.381	0.448	0.719		0.404	0.441	0.316	0.326	0.782	
6. Reading	0.448	0.491	0.443	0.521	0.600	0.736	0.356	0.343	0.438	0.467	0.547	0.705

Note: Average shared squared variance (in bold).

The relationship between factors of the SSMMQ was analyzed by language and grade level. The correlations among scales by language varied from low to moderate positive: for the Romanian sample, $r_s = 0.167$ to 0.520 and median = 0.391 , and for the Russian one, $r_s = 0.154$ to 0.486 and median = 0.297 . The lowest correlations in both samples emerged for English and Art ($r_{RO} = 0.167$, $r_{RU} = 0.157$), English and Music ($r_{RO} = 0.187$, $r_{RU} = 0.243$), and Math and Art ($r_{RO} = 0.191$, $r_{RU} = 0.174$) (Table 6). Regarding the correlations by language grade, the significant fifth-grade correlation among the SSMM scales varied from 0.131 to 0.532 ; median = 0.375 , and the correlation between English and art was not statistically significant. All the correlations for the seventh grade were significant ($r_s = 0.201$ – 0.503 ; median = 0.383). The ninth-grade correlations that were statistically significant ranged between 0.151 and 0.488 ; median = 0.347 , but the Math scale was not statistically significantly related to the Music and Art scales. The correlations across the Reading, Science, and Math scales had a constantly declining trajectory from fifth to ninth grades. Some of the correlations had an increasing path, namely between Reading and English, Reading and Art, Science and English, Science and Music, and English and Art.

Table 6. Correlations of SSMMQ factors by language and grade.

SSMMQ Scales	Language		Grade Level		
	Romanian	Russian	5th Grade	7th Grade	9th Grade
Reading-Math	0.472 **	0.410 **	0.518 **	0.423 **	0.417 **
Reading-Science	0.520 **	0.468 **	0.532 **	0.383 **	0.488 **
Reading-English	0.438 **	0.417 **	0.391 **	0.474 **	0.415 **
Reading-Art	0.445 **	0.315 **	0.386 **	0.503 **	0.396 **
Reading-Music	0.410 **	0.297 **	0.410 **	0.432 **	0.321 **
Math-Science	0.391 **	0.293 **	0.454 **	0.306 **	0.275 **
Math-English	0.381 **	0.486 **	0.501 **	0.400 **	0.386 **
Math-Art	0.191 **	0.174 **	0.131 *	0.279 **	0.092
Math-Music	0.164 **	0.147 **	0.215 **	0.201 **	0.036

Table 6. Cont.

SSMMQ Scales	Language		Grade Level		
	Romanian	Russian	5th Grade	7th Grade	9th Grade
Science-English	0.368 **	0.291 **	0.315 **	0.205 **	0.347 **
Science-Art	0.367 **	0.408 **	0.365 **	0.331 **	0.342 **
Science-Music	0.394 **	0.379 **	0.314 **	0.446 **	0.397 **
English-Art	0.167 **	0.157 **	0.103	0.201 **	0.151 **
English-Music	0.187 **	0.243 **	0.209 **	0.205 **	0.205 **
Art-Music	0.394 **	0.285 **	0.347 **	0.413 **	0.331 **

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

4.3. Measurement Invariance of the SSMMQ

4.3.1. Baseline Model

To establish the comparison standard for latent means comparison across different groups first, a baseline model was established. Initially the original seven-factor SSMMQ model was assessed independently in each group (language, grade level, and gender). In this model, no measurement errors were correlated. The results of this analysis are presented in Table 7.

Table 7. Goodness of fit statistics: Baseline models.

Groups	Model	χ^2 (df)	TLI	CFI	RMSEA [90% CI]	SRMR
Romanian	Original model	1433.384 (579)	0.897	0.889	0.062 [0.047, 0.054]	0.040
	Modified model	1090.799 (574)	0.963	0.966	0.039 [0.036, 0.043]	0.041
	Baseline model	1136.058 (574)	0.960	0.963	0.041 [0.037, 0.044]	0.042
Russian	Original model	1228.756 (579)	0.879	0.869	0.065 [0.052, 0.061]	0.050
	Modified model	985.752 (574)	0.948	0.953	0.045 [0.040, 0.050]	0.049
	Baseline model	1001.223 (574)	0.946	0.951	0.046 [0.041, 0.051]	0.048
5th grade	Original model	1028.426 (579)	0.896	0.888	0.058 [0.043, 0.052]	0.045
	Modified model	878.451 (575)	0.957	0.961	0.039 [0.034, 0.044]	0.045
	Baseline model	892.844 (574)	0.955	0.959	0.040 [0.035, 0.045]	0.046
7th grade	Original model	1102.555 (579)	0.893	0.884	0.064 [0.050, 0.060]	0.050
	Modified model	938.494 (576)	0.950	0.955	0.046 [0.040, 0.051]	0.051
	Baseline model	920.029 (574)	0.953	0.957	0.045 [0.039, 0.050]	0.050
9th grade	Original model	1294.335 (579)	0.855	0.844	0.075 [0.061, 0.070]	0.052
	Modified model	1006.727 (573)	0.940	0.945	0.051 [0.046, 0.056]	0.051
	Baseline model	1058.615 (574)	0.933	0.939	0.054 [0.049, 0.059]	0.051
Female	Original model	1283.040 (579)	0.888	0.880	0.063 [0.047, 0.054]	0.041
	Modified model	1024.173 (574)	0.958	0.961	0.041 [0.037, 0.045]	0.041
	Baseline model	1043.189 (574)	0.956	0.960	0.042 [0.038, 0.046]	0.041
Male	Original model	1322.864 (579)	0.884	0.874	0.063 [0.049, 0.056]	0.045
	Modified model	1054.240 (575)	0.953	0.957	0.042 [0.038, 0.046]	0.044
	Baseline model	1053.149 (574)	0.953	0.957	0.042 [0.038, 0.046]	0.044

The next step was to analyze the modification indexes of each sample separately, allowing measurement errors to be correlated [58]. The main purpose of this stage was to determine a baseline model that would fit all the groups (language, grade, and gender) and that would allow us to establish measurement invariance. Therefore, we first calculated the fit indices for the model with correlated errors in each sample, as shown in Table 7. The fit values met the thresholds in all the groups except for the Russian and ninth grade groups. The second stage was to identify the correlation that was present in all the samples which led to a strong baseline model that could be replicable in all samples and which would avoid accidental augmentation of fit indexes. Therefore, the final model used for measuring

invariance was modified by establishing the residual covariation correlation between the two items Reading 4—Reading 6, Art 6—Art 5, English 2—English 1, English 4—English 2, and Music 1—Music 2. After re-specification, the baseline models that included the same error correlations were estimated. The fit values were lower in some groups in comparison with the previous model. These results revealed acceptable model fit to the data. This last model was used for testing measurement invariance.

4.3.2. Invariance across Languages

The configural model was evaluated and it produced a good baseline model fit for all indexes (Table 8). In assessing the metric invariance, the factor loadings were constrained to be equal across Romanian and Russian students. Comparison of configural and metric models did not show any decrease in fit, i.e., the factor loadings were fully invariant across languages ($\Delta\text{CFI} = -0.006$, $\Delta\text{RMSEA} = 0.001$, $\Delta\text{SRMR} = 0$). To test for the scalar invariance, the intercepts of all items were constrained to be the same across the groups. However, the change between metric and scalar invariance indicated that the intercepts were not equal based on the ΔCFA ($\Delta\text{CFI} = -0.011$, $\Delta\text{RMSEA} = 0.002$, $\Delta\text{SRMR} = 0.004$). In pursuit of the partial scalar invariance model, we unconstrained each intercept to establish where the misfit between the Romanian and Russian groups occurred (Vandenberg & Lance, 2000). The results revealed that item Music 4 was the cause in the change in CFI. By letting this intercept free, no significant change was occurred in the fit between the metric and the partial scalar model ($\Delta\text{CFI} = -0.009$, $\Delta\text{RMSEA} = 0.002$, $\Delta\text{SRMR} = 0.004$). By constraining item residuals in the partial scalar model, the residual invariance was tested. The fit indexes supported this residual model as well ($\Delta\text{CFI} = -0.010$, $\Delta\text{RMSEA} = 0.003$, $\Delta\text{SRMR} = -0.003$). These results revealed that the intercepts and residual variances were partially invariant across languages [56].

Table 8. Measurement invariance models by language, grade, and gender.

Models	χ^2	CFI	RMSEA [90% CI]	SRMR	ΔCFI	ΔRMSEA	ΔSRMR	Decision
Language invariance models ($N_{\text{RO}} = 586$, $N_{\text{RU}} = 353$)								
Configural	2564.612 (1146)	0.964	0.029 [0.027, 0.030]	0.042				
Metric	2181.757 (1176)	0.958	0.030 [0.028, 0.032]	0.042	-0.006	0.001	0.000	Accept
Scalar	2081.155 (1212)	0.947	0.032 [0.030, 0.034]	0.046	-0.011	0.002	0.004	Reject
Scalar (Music 4)	2050.433 (1211)	0.949	0.032 [0.029, 0.034]	0.046	-0.009	0.002	0.004	Accept
Residual	2715.169 (1247)	0.939	0.035 [0.034, 0.037]	0.043	-0.010	0.003	-0.003	Accept
Grade level invariance models ($N_5 = 346$, $N_7 = 304$, $N_9 = 289$)								
Configural	2887.185 (1719)	0.951	0.028 [0.026, 0.029]	0.051				
Metric	2906.709 (1779)	0.952	0.026 [0.024, 0.028]	0.047	0.001	-0.002	-0.004	Accept
Scalar	3185.840 (1851)	0.944	0.028 [0.026, 0.029]	0.048	0.008	0.002	0.001	Accept
Residual	3315.650 (1923)	0.941	0.028 [0.026, 0.029]	0.048	0.003	0.000	0.000	Accept
Gender invariance models ($N_{\text{FA}} = 472$, $N_{\text{MA}} = 466$)								
Configural	2085.271 (1146)	0.959	0.030 [0.028, 0.032]	0.041				
Metric	2141.529 (1176)	0.958	0.030 [0.028, 0.032]	0.042	-0.001	0.000	0.001	Accept
Scalar	2368.548 (1212)	0.949	0.032 [0.030, 0.034]	0.044	-0.009	0.002	0.002	Accept
Residual	2482.448 (1248)	0.946	0.032 [0.031, 0.034]	0.045	-0.003	0.000	0.001	Accept

4.3.3. Invariance across Grades

The configural model was tested and demonstrated good model fit to the data (χ^2 (1719) = 2887.185, CFI = 0.951, RMSEA = 0.028 [0.026, 0.029], SRMR = 0.051). The difference in examined criteria between the model with equal factor loadings and the configural did not suggest a decrease in fit ($\Delta\text{CFI} = -0.001$, $\Delta\text{RMSEA} = -0.002$, $\Delta\text{SRMR} = -0.004$). Given this, we proceeded to measuring the scalar invariance, which also yielded a small decrease in the fit ($\Delta\text{CFI} = 0.008$, $\Delta\text{RMSEA} = 0.002$, $\Delta\text{SRMR} = 0.001$). As presented in Table 8, the comparison of the scalar versus residual invariance models did not suggest a meaningful decrease in fit ($\Delta\text{CFI} = 0.003$, $\Delta\text{RMSEA} = 0$, $\Delta\text{SRMR} = 0$). Given this empirical

evidence, configural, metric, and scalar and residual invariance for the six-factor SSMMQ was demonstrated.

4.3.4. Invariance across Gender

The configural model was assessed to establish if it was a good representation of the hypothesized relationships in the SSMMQ across gender. The results suggested evidence for a good model fit (χ^2 (1146) = 2085.271, CFI = 0.959, RMSEA = 0.030 [0.028, 0.032], SRMR = 0.041). The comparison between the configural and metric models showed a change in all studied indexes that met the cut-points (Δ CFI = -0.001 , Δ RMSEA = 0, Δ SRMR = 0.001). The decrease in fit between the metric and scalar was insignificant (Δ CFI = 0.009, Δ RMSEA = 0.002, Δ SRMR = 0.002). Comparing the residual invariance model against the scalar invariance model, we did not identify a decrease in fit indexes (Δ CFI = -0.003 , Δ RMSEA = 0, Δ SRMR = 0.001), as shown in Table 8.

4.4. Latent Mean Differences

Upon the establishment of full scalar invariance across gender and grade, and partial scalar invariance across languages, the latent means differences can be compared. In this analysis, the Russian and female groups were used as reference groups for languages and genders. However, when comparing the fifth vs. seventh and fifth vs. ninth grades, the fifth grade was constrained to zero, and when comparing the seventh and ninth grades, the seventh grade was defined as the reference group (Table 9).

Table 9. Latent mean differences for language, gender, and grade.

Groups	SSMMQ Scale	MD	CR	<i>d</i>
Gender ¹	Music	−0.609	−7.064 ***	0.488
	Art	−0.902	−10.531 ***	0.683
	English	−0.284	−4.544 ***	0.334
	Math	−0.082	−1.392	
	Science	−0.287	−4.360 ***	0.295
	Reading	−0.415	−7.756 ***	0.531
Languages ²	Music	−0.302	−2.992 *	0.175
	Art	−0.436	−4.273 ***	0.013
	English	−0.122	−1.802	
	Math	−0.261	−3.761 ***	0.196
	Science	−0.174	−2.124 *	0.129
	Reading	−0.086	−1.353	
5th grade vs. 7th grade ³	Music	−0.297	−2.819 *	0.229
	Art	−0.474	−4.668 ***	0.379
	English	0.049	0.681	
	Math	−0.295	−4.216 ***	0.329
	Science	−0.107	−1.348	
	Reading	−0.015	−0.231	
5th grade vs. 9th grade	Music	−0.398	−3.729 ***	0.285
	Art	−0.809	−7.542 ***	0.427
	English	−0.220	−2.794 *	0.205
	Math	−0.178	−2.484 *	0.190
	Science	−0.220	−2.714 *	0.231
	Reading	−0.062	−0.943	
7th grade vs. 9th grade	Music	−0.101	−0.914	
	Art	−0.335	−2.935 ***	0.213
	English	−0.269	−3.313 ***	0.258
	Math	0.116	1.527	
	Science	−0.112	−1.355	
	Reading	−0.047	−0.687	

Note: ¹ χ^2 (*df*) = 2219.189 (1206), CFI = 0.956, TLI = 0.954, RMSEA = 0.030 [0.028, 0.032], SRMR = 0.042.
² χ^2 (*df*) = 2016.882 (1205), CFI = 0.951, TLI = 0.949, RMSEA = 0.031 [0.029, 0.033], SRMR = 0.047.
³ χ^2 (*df*) = 3083.106 (1841), CFI = 0.948, TLI = 0.946, RMSEA = 0.027 [0.025, 0.028], SRMR = 0.047, * $p < 0.05$, *** $p < 0.001$.

The study of the latent mean differences by language demonstrated that the Russian group had lower means than the Romanian one on the Music, Math, and Science scales but the effect size of these mean differences was small, which can be neglected. The analysis of latent mean differences of the SSMMQ scales across gender showed that females had higher scores than males in all scales except for Math. The mean differences in Music, Art, and Reading had a medium effect size, whereas the rest had a small one. When comparing the means between the fifth and seventh grades, we found that these grades differed on Music, Art, and Math scales, the fifth grade having higher means with a small, even negligible, effect size, as shown in Table 9. Significant mean differences between the seventh and ninth grades were estimated in Art and English. The results of the latent mean differences between the fifth and the ninth grades revealed that the ninth graders reported lower levels of Music, Art, English, Math, and Science but with small effect size.

5. Discussion

The current study aimed to explore the factor structure of the Romanian and Russian versions of the SSMMQ in a sample of fifth, seventh, and ninth graders from the Republic of Moldova. For this purpose, we tested three models of the SSMMQ: the first one was the initial seven-factor model of the SSMMQ that was put forward by Józsa et al. [27]. It did not produce an acceptable fitness of good in both versions. Given the fact that the school mastery pleasure items had the lowest factor loadings and that each of its items measured the mastery pleasure in the specific subjects comprised in the SSMMQ, we included these items in the subject-specific scales for being the second tested model. The last model of the SSMMQ in Romanian and Russian included only the six subject-specific scales (six items per scale) and all the items assessing school mastery pleasure were excluded; it yielded the best goodness of fit indices and good internal consistency values across all samples.

The variables of school-specific mastery pleasure in the original study cross-loaded above 0.400 on the corresponding subject-specific mastery scale (English, Science, Art, and Music) and school-specific mastery pleasure scale [24]. We consider that an item of SMP can be dropped only if the whole related school domain scale is dropped. Otherwise, the drop of an SMP item related to a scale used in the questionnaire violates the construction of the construct of subject-specific mastery motivation. SMP is an affective scale that measures the expressive aspect during or right after mastering subject-specific tasks, which is similar to the Mastery Pleasure scale in the Dimension of Mastery Questionnaire 18 (DMQ 18). The items assessing mastery pleasure in the DMQ 18 are worded diversely while the items evaluating school subject mastery motivation in the SSMMQ are worded in parallel. Thus, in the DMQ 18, mastery pleasure is worded by a variety of phrases, e.g., "I smile when . . . ", "I get excited when . . . ", and "I am pleased . . . ", whereas in the SSMMQ, each item starts with "I am pleased when . . . ". Parallel wording in scales can cause misfits or inadequate fit and biased outcomes [68]. To our knowledge, there is no statistical solution for scales that are composed of items with parallel wording. We hypothesize that the subject-specific mastery pleasure items would be varied to express "smiling, laughing or other behavioral indicators of positive affect" during or after mastering tasks in the evaluated subjects.

One of the issues that we identified in this study is the presence of a ceiling effect in the English as a foreign language mastery pleasure scale. A ceiling effect occurs when the participants select the highest option on the Likert's scales, thus hampering the possibility of measuring the true extent of their subject-specific mastery motivation in our case. A ceiling effect can be a source of bias and it can limit the instrument's potential for differentiation among participants [68]. This is the first time a ceiling effect was discussed on the English scale of the SSMMQ [27,33].

Evidence for sufficient internal consistency was indicated by Cronbach's alpha and CR, which exceeded 0.700 in both the Romanian and Russian versions. One issue of some concern regarding the internal consistency is the alpha values of the Music, Art, and English scales in the Romanian version of the SSMMQ and Music and Art scales in the Russian version. The acceptable values of coefficient alpha range from 0.600 to 0.950 [66].

Nevertheless, there are some researchers who consider that values above 0.900 may point to a possible content overlap across items [69]. In the original research, higher values of coefficient alpha were computed in the Music scale in the Hungarian and Taiwanese samples and the English scale in the Taiwanese sample [24]. The results of the psychometric analyses exhibited adequate construct validity of the SSMMQ. The various psychometric analyses showed evidence of the convergent and discriminant validity of the Romanian and Russian versions of the SSMMQ. These findings provide initial psychometric evidence for the validity of the SSMMQ in the context of the Moldovan educational system where education is provided in the Romanian or Russian languages.

Another question that was investigated in this study is the differential distinctiveness of subject-specific mastery motivation by students of different grades (age levels). Following Marsh and Ayotte's (2003) train of thought, we assumed that there would be a declining trajectory of the correlations among mastery motivation factors in divergent subjects [39]. We identified that there was a systemic decrease of correlations among Reading, Math, and Science scales from the fifth to the ninth grade, which is in agreement with Józsa et al. [27] especially for the Taiwanese sample. This decreasing path suggested that the ninth-grade students perceived these scales as more distinctive, which can be explained by the fact that they have increased cognitive development and a more extensive academic experience, allowing them to better differentiate these subject domains. The rest of the correlations have either a negligible increasing or decreasing trajectory, which is in disagreement with a previous study. This path could be explained by the fact that some of the subjects included in the SSMMQ have common competences, for instance, Reading and English. These findings are congruent with Marsh and Ayotte [39] who constructed the differential distinctiveness hypothesis that stated that as children grew older, they were more likely to differentiate factors that are theoretically more distinctive. Nevertheless, there is a need for further analysis of differential distinctiveness of the SSMMQ, as the changes of the fifth and seventh grade and between the seventh and ninth grades have a different trajectory from those identified between the fifth and ninth graders.

The complexity of this study resides in the inclusion of three criteria in defining groups (language (Romanian and Russian), grade (five, seven and nine) and gender), resulting in the use of seven different groups in the statistical analysis. This complexity motivated the adoption of a sequential approach to defining the baseline model for further measurement invariance. The correlated errors imposed on the final baseline model were selected on the criteria of being present in all the groups to avoid accidental deflation or inflation of statistical outcomes.

On measurement invariance, the results supported the pattern structure, the factor loading, the item intercept, and the item residual variance across language, grade, and gender. The only partial scalar invariance that was established was across the ethnic groups where one intercept was freed. Partial scalar invariance points to the fact that a group can interpret the distances between points on the Likert scale shorter or longer on a particular item in comparison with the other groups [61]. The potential causes of these individual ethnic or cultural interpretations can be the propensity of a group to adhere to some social norms, the use of different criteria when evaluating themselves, or the overrating of a value or trait that is considered a weakness in their culture [56,70]. Importantly, this finding does not affect the validity and reliability of the Romanian and Russian versions of the SSMMQ that were fully demonstrated and discussed above.

In this study, we also aimed to assess group-level differences in subject-specific mastery motivation. In the studied sample, the means of girls were higher than those of boys. Thus, there is a statistically significant difference in means in Science and English mastery motivation, whereas in Art, Music, and Reading, the difference was a medium. There was no gender difference in the level of Math mastery motivation. Gender differences have rarely been examined within the theory of mastery motivation. The only study that focused on these differences used the Dimensions of Adult Mastery Motivation Questionnaire that investigated mastery motivation levels in university students [4]. This study

found that there was a lack of gender differences in Hungarian students, but the Australian, Bangladeshi, and Iranian female students reported significantly lower levels of mastery motivation.

What is more, the lack of gender differences in Math mastery motivation is in disagreement with studies that investigated motivation at school and concluded that secondary school girls (as compared with boys) have lower mastery motivation in Western countries [71]. At the same time, there are several studies that have identified that boys reported lower academic or domain-specific motivation than girls in Belgium, Russia, Azerbaijan, Australia, and the US [72–75]. In light of the new emergent gender roles, the gender differences in subject-specific mastery motivation can explain the academic fluctuations of the students. Nevertheless, the gender differences may be age- or grade- related as, at the university level, there are no differences between males and females on the total mastery motivation and on the scales of Dimensions of Adult Mastery Motivation Questionnaire College [76].

Although the students studying in the Romanian language had higher latent means of Music, Science, Art, and Science mastery motivation, the size effect of these differences are below 0.200, therefore they are negligible. Thus, there was no statistically significant difference between the latent means of the students receiving education in the Romanian language and those studying in Russian.

Findings also showed latent mean difference across seventh graders had a lower Music, Art, and Math mastery motivation in comparison with fifth graders. Moreover, the ninth graders exhibited statistically and significantly lower mastery motivation in Art and English, whereas the latent mean comparison of fifth- and ninth-grade students revealed more differences, namely in Music, Art, English, Math, and Science mastery motivation, with the ninth graders having lower latent means. All identified latent differences had a small effect. One subject-specific mastery motivation level that remained stable across the grades was Reading. Art mastery motivation constantly decreased across the grades. English is the subject-specific mastery motivation that starts decreasing more significantly in the seventh grade, continuing towards the ninth grade. Music, Math, and Science mastery motivation decrease gradually but it is identified only in ninth graders and not in seventh graders. Some of the grade level changes found in this study correspond with the previous studies examining subject mastery motivation in Hungary and Taiwan. The Art, Science, and Math mastery motivation of the students from Hungary are similar with the ones from the Republic of Moldova and decreased across the grades with a similarly small effect size. English as a foreign language did not decrease in either Hungary or Taiwan at the secondary school level, whereas it did in Moldova, just like mastery motivation in all other subjects under investigation. Only in the Republic of Moldova was Reading mastery motivation level stable across the grades, which is opposite to the findings of the previous research. In Hungary, the English mastery motivation level tends to drop from the fourth to the sixth grade, but later on it becomes stabilized. Furthermore, the outcomes of the current study support the conclusions that the cognitive persistence domain of mastery motivation tends to decline in students from grade four to grade eight [5].

6. Limitations and Future Directions

The present study has several limitations. One of them is the cross-sectional design adopted for investigating the subject-specific mastery motivation across grades. A longitudinal study can reflect the students' true personal changes over time. A further direction in the research on subject-specific motivation would be the analysis of the degree of independence of development of its constructs over time, its predictive power, and further development of the school-specific mastery pleasure domain.

7. Conclusions

The present study contributes to the empirical literature of subject-specific mastery motivation by translating the SSMMQ into Romanian and Russian and validating them in

the context of the Republic of Moldova. As a point of psychometric properties measurement, the last SSMMQ model of both the Romanian and Russian versions was well-fitted after excluding all items assessing students' school mastery pleasure, and it could prove that the SSMMQ was reliable and valid for measuring the subject-specific mastery motivation in Moldovan middle-school students. It was also identified that the SSMMQ of the students studying in the Romanian language does not differ significantly from the students having Russian as the language of instruction. Investigating age-related (grade levels) differential distinctiveness of the SSMMQ, a systematic decrease of correlation was found among the scales of Reading, Math, and Science from the fifth to the ninth grades. This decreasing correlation means that ninth graders are more distinctive in these subjects due to their increased cognitive development and extended academic experience. In the measurement invariance of the SSMMQ across language, grade, and gender, our study could demonstrate the residual measurement invariance across language, grade level, and gender. In addition, we identified that gender differences in the SSMMQ were significant, especially in Reading, Music, and Art; boys were less motivated to master a skill in these domains. Comparing the latent mean difference also gave a first insight into the domain-specific mastery motivation, showing no significant difference between the Romanian and Russian samples (with very low effect sizes across languages, grade levels, and genders).

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Article 3

Article 3



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Comparing subject-specific mastery motivation in Hungary and the Republic of Moldova

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Research on mastery motivation has documented its importance in personality development and school achievement, yet there is little research that examines school subject-specific motivation, specifically cross-cultural research. The objective of this study was to investigate the school subject-specific nature of mastery motivation in the context of middle and secondary school grades 5, 7, and 9 in Hungary ($N = 1121$) and Moldova ($N = 939$) in Reading, Math, Science, English as a foreign language, Music, and Art. The findings indicated that subject-specific mastery motivation (SSMM) domains in Hungary and Moldova have different paths across grade levels. In Hungary, there was a constant decreasing trajectory across all grades in all domains with the exception of English, whereas in Moldova, the decrease was identified in Math, English, Music, and Art between the fifth and the seventh grades but not between the seventh and the ninth grades, while Reading mastery motivation levels remained stable. Upon conducting a cross-cultural comparison of SSMM levels across the countries and grades, we identified only one statistically significant difference in science mastery motivation. The study attempts to explain the absence of cross-cultural differences not only through a conventional lens focusing on the unique characteristics of individual educational systems but also by considering the cultural values associated with each country.

KEYWORDS

subject-specific motivation, mastery motivation, cross-cultural studies, middle school, school learning, Hungary, Moldova

1 Introduction

A vast majority of research studies have concluded that motivation is a pivotal component of the learning process, academic success (Guay and Bureau, 2018; Liu et al., 2020), and wellbeing in formal and informal contexts (Howard et al., 2021). The wide range of individual differences that influence students' motivation throughout their academic experience form a very complicated set of variables that make teaching in specific academic contexts difficult. As a motivation theory, mastery motivation can provide valuable insight into students' motivation to overcome obstacles while acquiring new skills and tackling challenging tasks in specific school subjects (Józsa et al., 2020). Investigations of subject-specific mastery motivation have been conducted using several samples from Hungary,

Taiwan, and Moldova with the aim of elucidating the influence of culture on mastery motivation in the academic context (Józsa, 2014; Józsa et al., 2017; Calchei et al., 2023) and the culturally universal or culturally specific nature of this construct (Xu et al., 2021).

The small but growing body of variable-centered research on subject-specific mastery motivation has focused on psychometric analyses of the instrument and mean differences between different groups of students (Józsa et al., 2017; Calchei et al., 2023). While the role of mastery motivation in acquiring specific skills in specific subjects has been established, there is a lack of knowledge about the specific configurations of mastery motivation that students exhibit in specific subjects (Józsa et al., 2020).

1.1 The concept of mastery motivation

Comprehending motivation within the educational context has been identified as one of the critical elements in elucidating students' cognitions, emotions, and achievement-related behaviors (Covington, 1992). Numerous theories have emerged to account for the differences in students' levels of curiosity, persistence, and academic success (Collie and Martin, 2019). Such theories have established that motivation in the academic context is correlated with academic outcomes (Guay et al., 2008; De Naeghel et al., 2012; Cerasoli et al., 2014; Lazowski and Hulleman, 2016; Camacho et al., 2021).

Mastery motivation is a complex concept that centers around the ongoing process of accomplishing a task, irrespective of potential obstacles (Barrett and Morgan, 1995; Wang et al., 2021). Moreover, it is a drive that stimulates an individual to sustain a goal-oriented behavior (Gilmore and Cuskelly, 2017). What sets mastery motivation apart from other motivational concepts is its emphasis on cognitive, object-related, or social persistence during the pursuit of a specific domain, alongside the emotions that arise during the journey of mastering endeavors (Barrett and Morgan, 2018; Morgan et al., 2020a). Hence, mastery motivation represents a process aimed at achieving a task that is challenging but not the final outcome. The theory of mastery motivation is built upon a two-aspect framework, encompassing instrumental and affective aspects. The instrumental aspect includes four domains: cognitive/object persistence, gross motor persistence, social persistence with adults, and social persistence with children. On the other hand, the affective aspect refers to the positive or negative reactions experienced by an individual while mastering a task or acquiring a skill, manifested as feelings of mastery pleasure or negative responses to challenging domains (Doherty-Bigara and Gilmore, 2016; Gilmore et al., 2017).

Mastery motivation shares some features with other motivational theories. The distinction between intrinsic and extrinsic motivation is a traditional dichotomy. They are often described as the opposite poles of the motivation spectrum. However, proponents of other theories of motivation have stated that this division fails to explain fully the origins of human motives (Barrett and Morgan, 2018; Ryan and Deci, 2020). The mastery motivation framework considers that the motives of achieving a task can be simultaneously intrinsic and extrinsic and considers an array of factors that influence mastery motives, such as socialization contexts that affect motivation and emotions that are generated during mastery-motivated behavior.

1.2 Subject-specific mastery motivation

The domain specificity of mastery motivation has received attention alongside its multifaceted nature. Students' mastery motivation can exhibit heterogeneity across subjects according to strength, grade, and cultural context (Józsa et al., 2017; Calchei et al., 2023). The specificity of mastery motivation can be significantly influenced by the nature of students' school experiences. The curriculum approach adopted by schools in particular and educational systems in general can influence the extent to which children's motivation is specific to a particular subject (Wigfield et al., 2014). Thus, educational systems that teach each subject separately tend to foster subject-specific mastery motivations in students for each subject area, while in systems where subjects are more integrated, students tend to develop mastery motivation within domains.

Mastery motivation instruments measure a person's own general perception of one's level of mastery motivation (Huang et al., 2020). However, in this study, we focus on the specific level of mastery motivation that refers to the mastery motivation of an individual in relation to a particular performance that occurs in a particular school subject. Typically, mastery motivation questionnaires, such as the Dimensions of Mastery Questionnaire (DMQ 18), primarily center their assessment on the broad construct of general mastery motivation, which encompasses individuals' drive to achieve and enhance their own skills irrespective of the obstacles they face, while intentionally omitting explicit reference to any particular contextual setting in which these motivations are expressed. For example, items in DMQ 18 such as "I work on a new problem until I can do it; I try hard to get adults to understand me" are not specific (Peura et al., 2019; Morgan et al., 2020b). Meanwhile, when assessing the subject-specific mastery motivation, both the specific context and subject-related task or competencies are integrated: e.g., "If I do not understand a sentence, I read it again; If I make a mistake in my calculation, I start it again" (Józsa et al., 2017).

All the empirical studies conducted on subject-specific mastery motivation have focused predominantly on elementary and middle school students, employing a cross-cultural methodology investigating the psychometric properties of subject-specific mastery motivation (SSMM), differential distinctiveness across grades, and mean differences across languages, grade levels, and gender. The studies are based on two factorial models of SSMMQ. The original one included seven factors: Reading mastery motivation (Reading), Mathematics mastery motivation (Math), Science mastery motivation (Science), Music mastery motivation (Music), Art mastery motivation (Art), English as a foreign language mastery motivation (English), German as a foreign language mastery motivation (German), and school mastery pleasure (SMP); the next model included only the six subject-specific scales of Reading, Math, Science, Music, Art, and English (Józsa et al., 2017; Calchei et al., 2023). Moreover, it was established that ninth graders compared to fifth and seventh graders exhibited a greater perception of distinctiveness of Reading, Math, and Science scales due to heightened cognitive development and academic exposure (Calchei et al., 2023).

Józsa et al. (2020) found that though there is an established decreasing trend in subject-specific mastery motivation as the

students advance in their education on most scales (Reading, Science, Math, Art, and Music), there are some exceptions, i.e., the level of perceived mastery motivation of English as a foreign language in Hungary and Taiwan did not decline. On the contrary, Moldovan students who study either in Romanian or Russian exhibited a decline in English mastery motivation, while Reading mastery motivation remained stable among middle school students (Józsa et al., 2020).

1.3 Cultural context of subject-specific mastery motivation

In the areas of both education and psychology, there is a need to investigate how cultural factors relate to motivational constructs (Zusho and Clayton, 2011). This need stems from the need to understand the degree of the universality of motivation (Artelt, 2010) and the need to identify the factors that vary across cultures and subsequently influence certain educational outcomes (Elliot and Resing, 2012). In line with this, culture has an impact on motivation in the educational context and consequently triggers cultural differences and variations (within and between countries) in motivation. As Deci and Ryan posited, human beings possess an inherent disposition toward incorporating cultural behaviors and values encountered during their development (Ryan and Deci, 2009). This implies that individuals fully internalize their inherited culture.

Students at any stage of their educational path are influenced by sociocultural and contextual factors such as behavior norms, internal and external or social expectations, and attitude, which in their turn can serve as explanations of the variations in motivation across cultures (Te Wang et al., 2020). Cross-cultural research has indicated that culture influences motivation in various subjects and domains such as mathematics (Chiu and Klassen, 2010), reading (Artelt, 2010), creativity (Zhang et al., 2021), and physical education (Shen et al., 2022). Furthermore, empirical evidence has revealed that the culture factor leads to differences in mastery motivation and subject-specific mastery motivation (Morgan et al., 2013, 2017; Józsa et al., 2017). Therefore, exploring subject-specific mastery motivation across cultures has guided the attempt to determine the role of mastery motivation in specific school domains.

Some studies state that our comprehension of the relationships between culture and motivation is limited due to various factors, one of them being the inclusion of the dimension of individual/collectivism in research (Te Wang et al., 2020). Due to the fact that Hungary and Moldova are closely located and can be classified as Western or non-Western countries, we have to tackle this issue using a theory of cultural dimensions. Scholars have utilized different typologies to classify cultures. There are three classical studies of cultural dimensions: Hofstede's 6-D model of cultural values, Schwartz's cultural value orientations, and House et al. (2004) GLOBE (Smith and Bond, 2019). Schwartz's classification, which is based primarily on the normative aspect of culture, includes harmony, egalitarianism, intellectual autonomy, affective, autonomy, mastery, hierarchy, and embeddedness (Schwartz, 2009). Schwartz grouped 77 investigated societies into eight transnational cultural regions, delineating

the boundaries based on shared cultural characteristics, values, and norms that traverse national boundaries. This project had data on Hungary, which was included in the East Central European group, but to our knowledge, there were no published data on Moldova; therefore, it could not be used in that study. GLOBE's cultural attributes are performance orientation, assertiveness, future orientation, humane orientation, institutional collectivism, in-group collectivism, gender egalitarianism, power distance, and uncertainty avoidance (House et al., 2004). This project researched 62 cultures, including both Hungary and Moldova, and this is the main reason for using it in the present cross-cultural study. Hofstede (2001) described culture using six dimensions: power distance, uncertainty avoidance, individualism/collectivism, masculinity/femininity, long-/short-term orientation, and indulgence/restraint (Hofstede, 2001).

In the few studies that used Hofstede's classification of values, it was concluded that the masculinity/femininity, uncertainty avoidance, and power distance dimensions were essential for explaining the correlations between mathematics motivation and mathematics achievement. Thus, they concluded that in countries where gender roles were not so rigid, students had less power distance and were more inclined to accept uncertainty; moreover, the correlation between math motivation and achievement was positive (Chiu and Klassen, 2010). Culture values (according to Schwartz's classification) were also found to explain the level of academic motivation goals; specifically, mastery goals were positively correlated with egalitarian countries (Dekker and Fischer, 2008). At the same time, no support for the connection between egalitarian societies and extrinsic motivation was found in the reading domain (Chiu and Klassen, 2010).

1.4 The cultural context of the study

Cross-cultural studies examining various motivation theories have often had as their primary focus the comparison of collective and individual societies or Western (Western European) and non-Western nations as these contexts are divergent milieus (Józsa et al., 2014; Cheng et al., 2020; Korpershoek et al., 2021). Contrasting mastery motivation in educational settings within culturally closer societies yields valuable insights for the studied contexts (Elliot and Resing, 2012; Józsa et al., 2014). The identified differences could contribute to a more comprehensive theoretical understanding of the constructs and factors and their implications for certain educational systems. Therefore, the comparison of subject-specific mastery motivation in Hungary and Moldova is significant. It can shed light on whether mastery motives operate similarly or not in these cultures and the role of culture in this process.

The cultural aspect is also important as we are attempting to conduct cross-cultural research between two countries, and the variability of cultural values can explain the results of this study. In this section, Hungary and Moldova will be compared from the perspective of cultural values based on Hofstede's 6-D. According to Hofstede and as shown in Figure 1, the Hungarian and Moldovan societies differ on all indexes to varying degrees. Hungarian culture tends to be more individualistic, valuing individual accomplishments, enterprise, and personal rights. Meanwhile, Moldovan society has collectivist values, prioritizing the needs

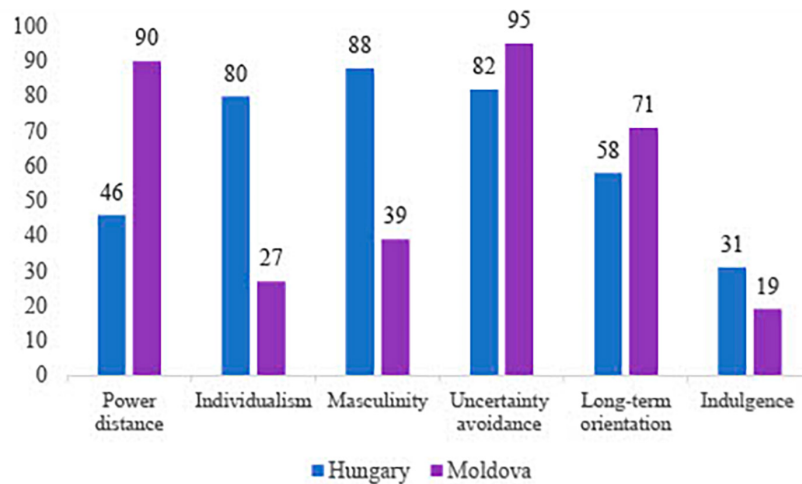


FIGURE 1
Cultural comparison of Hungary and the Moldova according to Hofstede's 6-D model of cultural values (Hofstede, 2018).

and goals of a group over an individual (Hofstede, 2001, 2018). Next, on the power distance dimension, Hungary scores low, deemphasizing the role of hierarchy and placing emphasis on an independent cultural style. Regarding the masculinity dimension, Hungarian society has a high consideration for masculinity, which can lead to an assumption that Hungarian students are more competitive and achievement and performance driven than Moldovan ones. Moreover, in the uncertainty avoidance and long-/short-term normative orientation dimensions, the two countries are quite close, with Hungary having a slight advantage. Thus, members of both societies are more anxious and uncomfortable with uncertainty and change, which could influence the motivation of the students and the way they handle stress. Furthermore, Hungarian society balances between preserving long-established customs and conventions and tackling the transformation of norms and values in the present and future. Finally, both countries scored low on the indulgence dimension, with Moldovan society being more pessimistic and guiding itself according to social norms. Thus, Hungary and Moldova differ primarily in the power distance, individualism, and masculinity dimensions, while in the rest of dimensions, these societies are quite close.

1.5 The Hungarian education system

Hungary is a country in Central Europe with a population of about 9,7 million people and with a GDP per capita in 2021 of 18,728.1 (current US\$) (World Bank, 2022). The country exhibits a relatively homogeneous ethnic composition, with minorities constituting less than 10% of the population (Józsa et al., 2018).

According to the Hungarian National Public Education law, the compulsory school age is six (Act CXC of 2011 on National Public Education, 2011) after attending 3 years of kindergarten (ISCED 020), which is also a compulsory level. Primary education, which encompasses a total of eight grades, typically provides ISCED 1 education, including the initial four grades, and ISCED 2, covering grades 5–8; the latter corresponds to lower secondary education. This level of education is designed to equip pupils with the

necessary skills, knowledge, and aptitude tailored to their individual interests, abilities, and talents, thereby laying a solid foundation for their future pursuits in secondary education (Act CXC of 2011 on National Public Education, 2011). Upon completing primary school, students progress to one of the secondary schools (ISCED 3) to continue their studies. Nevertheless, some students are required to undergo an entrance examination as a means of determining their eligibility for admission to the respective secondary schools. Students accessing ISCED3 can opt among vocational schools (ISCED 353), vocational secondary schools (ISCED 354), and academic secondary schools (ISCED 344). As part of the ISCED3 trajectory, students pursuing the academic path undergo an Upper Secondary School Leaving Examination at the end of the 12th grade. Thus, students are assessed in at least five subjects: Hungarian language and literature, history, mathematics, foreign language or native minority language and literature, and a subject of the student's choice. Successful performance in this examination serves as a prerequisite for admission to higher education institutions (Eurydice. National Education Systems, 2021). Besides this major exam, the National Assessment of Basic Competencies (NABC) is conducted annually. NABS is a system that assesses the extent to which students in grades 4–11 are able to apply their mathematical and reading comprehension competencies in their studies and in their everyday lives (Tóth and Csapó, 2022). In grades 7, 9, and 11, the students' level of science literacy is measured (Eurydice. National Education Systems, 2021).

1.6 The education system in Moldova

Moldova is a country situated in Eastern Europe with a population of 2.6 million people and a GDP per capita in 2021 of 5,230 (current US\$) (World Bank, 2022). In terms of ethnicity, Moldova is diverse, with minorities constituting more than 25% of its population (Goreainov, 2019). Due to the pluricultural characteristics of Moldovan society, there are schools that offer instruction in the Romanian language and schools that offer instruction in the Russian language. In all, 80.6% of the students

enrolled in primary and secondary schools study in Romanian, and 19.3% receive instruction in Russian ([Educația în Republica Moldova \[Education in the Republic of Moldova\], 2022](#)).

According to the Education Code of the Republic of Moldova, mandatory education starts in kindergarten, where children are required to attend a year of preschool education—a preparatory group that corresponds to ISCED 0 level ([Education Code of the Republic of Moldova, 2014](#)). In Moldova, the beginning of formal education starts at the age of seven ([Metodologia De Înscriere A Copiilor În Clasa I \[The Methodology for Enrolling Children in the First Grade\], 2016](#)). The first level of education, ISCED 1, covering first to fourth grades, is provided by either primary schools or integrated in gymnasiums or lyceums. Upon completing primary level, the students proceed to lower secondary education (ISCED 2), which includes grades 4–9. The main objective of primary and gymnasium education in Moldova is to foster a free and creative personality by ensuring the development of the necessary competencies for the student's continuation of their studies ([Education Code of the Republic of Moldova, 2014](#)). Gymnasium education concludes with the ninth-grade National Graduation Exams (NGE). The results of the NGE determine access to further education. The upper secondary education trajectory (ISCED 3) includes an academic track, comprising lyceum education (covering grades 10–12), and a vocational track, comprising technical and vocational education (which can last up to 5 years depending on the program). Students pursuing an academic path sit the National Baccalaureate Exam (NBE), which is compulsory for enrollment in a higher education program (ISCED 6). The NBE consists of two compulsory exams, native language and literature and a foreign language, and two optional exams, history or mathematics and a subject of the student's choice. All students who take the NBE in the Russian language must take a Romanian language and literature exam, and minorities take another exam in their native language and literature. Students in Moldova take two compulsory national tests: (a) the national examination for primary education (NEPE) and the above-mentioned NGE. The NEPE includes tests in mathematics, the language of instruction, and, for minorities, their native language, and it is not a high-stakes assessment, as the results of this exam are not a prerequisite for access to secondary education. In the NGE, students take exams in the language and literature of the language of instruction, mathematics, world and Romanian history, and Romanian language for students that study in Russian.

1.7 National curriculum in Hungary and Moldova

As subject-specific mastery motivation is measured in the educational context, it is important to address the role of motivation in the governing documents of the national education system, specifically in the national curricula. A curriculum is structured to present the expected educational outcomes for students in a certain grade level and academic subject ([Little, 2012](#)). Both the Hungarian Core Curriculum and the Moldovan National Curriculum are competence based rather than content based ([Tahirsylaj and Fazliu, 2021](#)). Moreover, both countries are regulated at the state level by national curricula and by

local curricula. The latter are designed by the local educational institutions and are approved by national accreditation bodies. In Hungarian secondary schools, 10% of the total academic hours allocated for compulsory classes must constitute the local curriculum (optional classes), whereas in Moldova, this allocation is only 5%. The presence of optional courses that have a local curriculum can be considered a motivational element of the curriculum. These courses are designed based on the principle of individualization, which entails the consideration of students' ages, interests, and motivations ([Guțu et al., 2017](#)).

Since the curricula in both countries are competence based, they contain a set of objectives and competencies that regulate the educational processes. Notably, the Moldovan curriculum includes recommended topics teachers can use in class, allowing them the flexibility to opt for alternative topics that best fit their students' needs. Moreover, motivation as a special section does not have a place in either of the curricula. However, in both countries, the curricula specify that instruction should be designed to foster student motivation.

Though, in both countries, the national curricula serve as the highest-level regulatory document in the educational context, their influence on the day-to-day teaching and learning process within the classroom is indirect. The national curricula act as the highest level in a hierarchy of planning, followed by a teaching package in the case of Hungary and a textbook in the Moldovan one. Ultimately, these guidelines are reflected in the teachers' annual long-term planning. Thus, the main role of the curriculum in both countries is to underpin some theoretical and conceptual foundations of public education in a country ([Szabó, 2007](#)).

1.8 Research questions

Considering the cultural differences between the Hungarian and Moldovan societies and the structural characteristics of their educational systems, we expect them to be reflected in this study. Furthermore, despite the reasonable validity and reliability demonstrated by the SSMMQ, there remains a lack of consensus on a universally accepted version, and comprehensive cross-cultural psychometric evaluations of the instrument are lacking. To achieve this, we set several research questions:

- RQ1. What are the underlying dimensions and factor structure of the Hungarian version of the Subject-Specific Mastery Motivation Questionnaire (SSMMQ)?
- RQ2. Does middle school students' SSMM decrease significantly over grade levels in Hungary and Moldova?
- RQ3. Are there SSMM mean-level differences between Hungarian and Moldovan middle school students and grades?

2 Materials and methods

2.1 Participants

The researchers employed a convenience sampling approach to select participants for this empirical study. The sample of 2060

students comprised 1121 Hungarian and 939 Moldovan students drawn from grades five, seven, and nine. Across the Hungarian sample, 43.175% were fifth graders, 33.452% were seventh graders, and 23.371% were ninth graders, with a quite balanced sex distribution of 49.995% female and 50.044% male (Table 1). The Moldovan sample, on the other hand, consisted of 36.848% fifth graders, 32.375% seventh graders, and 30.777% ninth graders, of whom 50.373% were female and 49.6273% were male (Table 2).

2.2 Procedure

The investigators obtained ethical approval from the Institutional Research Board of the University of Szeged, ensuring compliance with all prescribed protocols mandated by the educational institutions from which the data were gathered. Prior to the data collection, the participants or/and parents were informed regarding the aims of the study, and they provided written consent. The researchers administered the questionnaire using the paper–pencil mode in both countries. All the questions concerning the questionnaire and, specifically, the meaning of some words (in the case of lower-grade students) were addressed by the researchers.

2.3 Instrument

The Subject-Specific Mastery Motivation Questionnaire (SSMMQ) was employed (Józsa, 2014; Józsa et al., 2017). Specifically, the Hungarian (HU), Romanian (RO), and Russian (RU) versions of the SSMMQ with 42 items were used. Each of the scales, comprising Reading, Math, Science, English, Art, Music, and SMP, contained six five-point Likert scale items ranging from 1 = not at all like me to 5 = exactly like me. The subject-specific scales showed good internal consistencies in these versions ($\alpha > 0.80$), while the SMP scale yielded values below 0.80.

The sample items of the SSMMQ were as follows (with the corresponding scale):

- I want to master reading even if it takes a long time (Reading).
- I do my best to solve a math problem (Math).
- I do experiments to get answers to my nature-related questions (Science).
- I do my best to be a better and better speaker of English (English).
- I would like to get better and better at painting and drawing (Art).
- I keep on learning a song until it goes perfectly (Music).
- I am pleased when I solve a math problem (School-Specific Mastery Pleasure).

2.4 Analytical approach

First, confirmatory factor analysis (CFA) and measurement invariance (MI) were used to validate the SSMMQ factor structure within the Hungarian sample. Three measurement models were

run: (a) the original model of SSMMQ that contains seven factors with 42 items (Józsa et al., 2017), (b) the six-factor model with 42 items that integrates school mastery pleasure items into the subject-specific factors, and (c) the six-factor model with 36 items that contains only subject-specific factors and items (Calchei et al., 2023). Decisions regarding goodness of fit were taken based on χ^2 difference tests using the following cut-offs: $\chi^2/df \leq 3$, TLI and CFI ≥ 0.95 , RMSEA ≤ 0.06 , and SRMR ≤ 0.08 (Hu and Bentler, 1999; Marsh et al., 2004). Moreover, Cronbach's alpha and McDonald's omega were computed to report reliability (McDonald, 1999). The validation and analysis of the Moldovan sample were performed by Calchei et al. (2023). In this study, the partial scalar invariance with one covariance across students instructed in Romanian and Russian was reached. For the present study, the Romanian and Russian samples were merged.

To analyze the latent mean differences between the Hungarian and Moldovan samples, we adopted MI as a standard analytical procedure for mean comparison across cultures or any other groups as it assesses whether the participants from different observed groups perceive the meaning of the SSMMQ items equally (Little, 1997; Steenkamp and Baumgartner, 1998; Vandenberg and Lance, 2000; Brown, 2015). Thus, using CFA with maximum likelihood estimation, a baseline model that would fit both samples was determined. A number of parameters were hierarchically constrained across the samples (Thompson and Green, 2013). The first level was configural invariance, in which the identified baseline model was not constrained, but all the items were expected to load on the designated latent factor (Meredith, 1993; Cheung and Rensvold, 2009). Next, metric or factorial invariance was tested as a procedure to demonstrate that factor loadings can be compared across samples. Finally, the third level was the scalar invariance that assesses uniform item bias and allows latent mean differences between samples to be interpreted (Byrne et al., 1989; Putnick and Bornstein, 2016). MI was assessed based on the changes in the fit indexes between the MI models with the cut-offs of $\Delta CFI < 0.01$, $\Delta RMSEA < 0.015$, and $\Delta SRMR < 0.03$ (metric MI) or $\Delta SRMR < 0.015$ (scalar and strict MI) (Chen, 2007, 2008; Chen et al., 2008).

In order to conduct a comparison of means involving multiple groups, it is necessary to establish MI at a particular level. Conventionally, full MI must be achieved before scalar invariance is tested, and factor means can be analyzed only after full scalar invariance is confirmed (Bollen, 1989; Horn and McArdle, 1992). However, alternative perspectives on this issue contend that partial invariance is sufficient for making valid inferences about latent means as long as it meets the conditions stated by Byrne et al. (1989), Meredith (1993), Steenkamp and Baumgartner (1998), Meredith and Teresi (2006), Millsap (2011), and Rudnev et al. (2018).

To compare the means across countries and grades and their interaction, the variables underwent an analysis of variance (ANOVA) and a multivariate analysis of variance (MANOVA). We ran several tests to determine whether the data met the assumption of univariate and multivariate analysis, namely, the assumption of normality, homogeneity of variance, and absence of high correlation between dependent variables. As some of the assumptions were not met, we set the significance level (α) to 0.01. The use of a stringent alpha value was guided by the presence of violations in the assumptions of ANOVA, which

would also help to mitigate the increased risk of type 1 error appearance (Lee et al., 2016). To check the results of the ANOVA test and the decision to use the stringent alpha, we investigated latent mean differences via structural equation modeling (Aiken et al., 1994). In this analysis, the reference group (constrained to zero) was set to the Hungarian sample. The critical ratio (CR) index above or below 1.96 was judged to be significant, and the magnitude of difference was assessed with Cohen's d (Teo, 2014; Hair et al., 2018).

To calculate the significant difference for grade levels, we employed both eta squared (η^2) and omega squared (ω^2). Omega squared serves as an estimation of the level of variance within a population, whereas eta squared is employed within a sample (Olejnik and Algina, 2003). Before proceeding with the MANOVA analysis for the SSMM scales, it was necessary to evaluate the assumption of a moderate correlation between the dependent variables on the merged samples (Hungarian and Moldovan) (Meyers et al., 2016). Thus, a set of Pearson correlation analyses were run to examine the associations between all the dependent SSMM variables.

3 Results

3.1 Descriptive analysis

Tables 1, 2 present the means and the standard deviations for each scale in each group (grade and sex). The highest total means in both samples were computed for the English scale, whereas the lowest means were identified on the Music scale. Moreover, we determined that the data followed a normal distribution by applying Kline's (2016) standards, which specify that the skewness should be ≤ 3.0 and the kurtosis should be ≤ 10.0 for the Hungarian

sample and the Moldovan sample (Kline, 2016). In both samples, the English scale was the most negatively skewed.

RQ1. What are the underlying dimensions and factor structure of the Hungarian version of the Subject-Specific Mastery Motivation Questionnaire (SSMMQ)?

The seven- and the six-factor solutions were fitted onto the Hungarian responses (Józsa et al., 2017; Calchei et al., 2023). The seven-factor solution produced an inadequate model fit based on all the indexes [$\chi^2(798) = 3524.469$, $p < 0.001$, CFI = 0.905, TLI = 0.898, RMSEA = 0.055 [0.053, 0.057], SRMR = 0.0596]. The model fit of the six-factor solution demonstrated improvement [$\chi^2(579) = 1941.298$, $p < 0.001$, CFI = 0.947, TLI = 0.942, RMSEA = 0.046 [0.044, 0.048], SRMR = 0.0391]. The examination of the factor loadings of both models revealed that in the seven-factor solution, four out of the six SMP items loaded below 0.600, and the standardized residual covariances that were higher than 2.00 included an SMP item (e.g., I am pleased when I understand the text; I am pleased when I solve a math problem). Therefore, the SMP scale was deleted, a procedure that was also used in the validation of the Romanian and Russian versions of SMP (Calchei et al., 2023). Having analyzed the modification indexes and standardized residual covariances of the six-factor solution, we added five covariances of item errors, resulting in good model fit indices [$\chi^2(573) = 1416.565$, $p < 0.001$, CFI = 0.967, TLI = 0.964, RMSEA = 0.036 [0.034, 0.039], SRMR = 0.0349].

Internal consistency reliability analysis of all the scales in the six-factor model resulted in acceptable values. Music ($\alpha = 0.945$; $\omega = 0.946$), English ($\alpha = 0.902$, $\omega = 0.903$), and Art ($\alpha = 0.926$, $\omega = 0.927$) were above the level of acceptability, while the Cronbach's alpha and omega coefficients for Reading were lowest ($\alpha = 0.839$; $\omega = 0.842$) (Streiner, 2003). The rest of the scales indicated acceptable values: Math ($\alpha = 0.869$; $\omega = 0.901$) and Science ($\alpha = 0.871$, $\omega = 0.873$).

TABLE 1 Descriptive statistics (Hungarian sample): means, standard deviations (SD), skewness, kurtosis.

	Total (N = 1121)			Grade			Sex	
	Mean (SD)	Skewness	Kurtosis	5 (N = 484)	7 (N = 375)	9 (N = 262)	Female (N = 560)	Male (N = 561)
Reading	3.693 (0.799)	-0.513	-0.176	3.837 (0.769)	3.592 (0.801)	3.573 (0.812)	3.752 (0.820)	3.635 (0.774)
Math	3.773 (0.866)	-0.659	-0.113	3.983 (0.794)	3.643 (0.882)	3.570 (0.887)	3.690 (0.895)	3.856 (0.828)
Science	2.939 (0.957)	0.019	-0.646	3.080 (0.933)	2.840 (0.981)	2.820 (0.934)	2.810 (0.935)	3.067 (0.962)
Music	2.712 (1.293)	0.285	-1.157	2.917 (1.249)	2.637 (1.313)	2.442 (1.287)	2.957 (1.320)	2.467 (1.219)
English	4.090 (0.847)	-0.941	0.446	4.116 (0.845)	4.034 (0.864)	4.124 (0.824)	4.122 (0.833)	4.059 (0.859)
Art	3.298 (1.181)	-0.337	-0.976	3.639 (1.033)	3.229 (1.215)	2.769 (1.181)	3.608 (1.100)	2.989 (1.180)

TABLE 2 Descriptive statistics (Moldovan sample): means, standard deviations (SD), skewness, kurtosis.

	Total (N = 939)			Grade [Mean (SD)]			Sex [Mean (SD)]	
	Mean (SD)	Skewness	Kurtosis	5 (N = 346)	7 (N = 304)	9 (N = 289)	Female (N = 473)	Male (N = 466)
Reading	3.651 (0.846)	-0.406	-0.226	3.657 (0.833)	3.652 (0.855)	3.641 (0.856)	3.865 (0.805)	3.433 (0.832)
Math	3.814 (0.878)	-0.600	-0.104	3.956 (0.824)	3.675 (0.887)	3.792 (0.907)	3.858 (0.883)	3.770 (0.871)
Science	3.224 (0.952)	-0.165	-0.619	3.325 (0.961)	3.223 (0.943)	3.106 (0.940)	3.361 (0.948)	3.085 (0.937)
Music	2.716 (1.310)	0.269	-1.213	2.926 (1.291)	2.629 (1.307)	2.557 (1.308)	3.025 (1.315)	2.402 (1.230)
English	4.091 (0.912)	-1.185	1.141	4.133 (0.873)	4.182 (0.875)	3.943 (0.978)	4.238 (0.869)	3.941 (0.930)
Art	3.311 (1.266)	-0.358	-1.041	3.677 (1.126)	3.231 (1.237)	2.957 (1.340)	3.716 (1.114)	2.899 (1.251)

The first step was to determine a common baseline model that could be retained for the Hungarian and Moldovan samples. The original models of both samples produced an acceptable fit model, with the Moldovan sample having lower indexes (Table 3). The six covariances, added in the baseline model, were established according to the common covariance that was identified in the Hungarian and Moldovan modified models.

RQ2. Does middle school students' SSMM decrease significantly over grade levels in Hungary and Moldova?

The next step in the variable-oriented statistical analysis involved testing for factorial invariance by constraining the factor loadings and intercepts to be equal across the Hungarian and Moldovan samples. The low decrease in model fit indexes from configural to metric proved that each item of the SSMMQ loaded similarly and with the same magnitude across both samples, as presented in Table 4. The next test in this sequential analysis was to test for scalar invariance. This test did not support full scalar invariance due to the CFI difference. To identify the non-invariant items, a test for partial scalar invariance was carried out by systematically removing the constraint on the intercept of each item, one at a time (Byrne, 2013).

Grade differences in the subject-specific mastery motivation scales were observed in both countries, indicating notable variations across different grade groups (Figures 2, 3). To examine the distinctions among the grade levels for each country and their interaction, one-way ANOVA and MANOVA were conducted as part of the statistical analysis in this study.

Before proceeding with univariate and multivariate analyses for the SSMM scales, it was necessary to evaluate the assumption normality. In this context, the Kolmogorov–Smirnov test was applied to assess the distributional differences in each sample across the subjects. For the Hungarian sample, the Kolmogorov–Smirnov test yielded a $D_{(1121)} = 0.089$, $p > 0.05$ for Reading; $D_{(1121)} = 0.096$, $p < 0.001$ for Math; $D_{(1121)} = 0.096$, $p < 0.001$ for Science; $D_{(1121)} = 0.141$, $p < 0.001$ for English; $D_{(1121)} = 0.094$, $p < 0.001$ for Music; and $D_{(1121)} = 0.093$, $p < 0.001$ for Art.

Similar findings were obtained for the Moldovan sample: Reading: $D_{(939)} = 0.065$, $p < 0.001$; Math: $D_{(939)} = 0.089$, $p < 0.001$; Science: $D_{(939)} = 0.054$, $p < 0.001$; English: $D_{(939)} = 0.159$, $p < 0.001$; Music: $D_{(939)} = 0.104$, $p < 0.001$; and Art: $D_{(939)} = 0.095$, $p < 0.001$. These outcomes provided evidence for rejecting the null hypothesis of no distributional differences. To conduct MANOVA analysis for the SSMM scales, it was necessary to evaluate the assumption of moderate associations between the SSMMQ variable (Meyers et al., 2016). Most of the correlations demonstrated moderate values, with all of them falling in the moderate-to-low positive range, and none of them rose above 0.600, which is appropriate (Table 5). Finally, the multivariate equality of covariance matrices was assessed using Box's M test, which was significant ($p < 0.001$) with a Box's M-value of 304.808. Since the assumption of homogeneity was not satisfied, Pillai's trace would be a suitable test to interpret in this context.

For the Hungarian sample, we identified a decrease of mastery motivation from grade five to grade seven and a stability between grade seven and nine in Reading [$F_{(2,1118)} = 14.085$, $p < 0.001$, $\eta^2 = 0.21$, $\omega^2 = 0.023$, grade levels $5 > 7 = 9$], Math [$F_{(2,1118)} = 26.833$, $p < 0.001$, $\eta^2 = 0.046$, $\omega^2 = 0.044$, grade levels $5 > 7 = 9$], Science [$F_{(2,1118)} = 9.421$, $p < 0.001$, $\eta^2 = 0.017$, $\omega^2 = 0.015$, grade levels $5 > 7 = 9$], and Music [$F_{(2,1118)} = 12.661$, $p < 0.001$, $\eta^2 = 0.022$, $\omega^2 = 0.020$, grade levels $5 > 7 = 9$]. For the Art scale, ANOVA revealed a constant decrease [$F_{(2,1118)} = 51.263$, $p < 0.001$, $\eta^2 = 0.084$, $\omega^2 = 0.082$, grade levels $5 > 7 > 9$]. The analysis of variance did not yield a significant result when evaluating the mean differences for the English subscale [$F_{(2,1118)} = 1.249$, $p = 0.287$].

The variances in grade levels within the context of Moldova exhibited the following significant mean differences: Math [$F_{(2,936)} = 8.566$, $p < 0.001$, $\eta^2 = 0.018$, $\omega^2 = 0.016$, grade levels $5 > 7 = 9$], Music [$F_{(2,936)} = 7.349$, $p < 0.001$, $\eta^2 = 0.015$, $\omega^2 = 0.013$, grade levels $5 > 7 = 9$], and Art [$F_{(2,936)} = 27.921$, $p < 0.001$, $\eta^2 = 0.056$, $\omega^2 = 0.054$, grade levels $5 > 7 > 9$]. The rest of the changes were not statistically significant as we used the stringent alpha: English [$F_{(2,936)} = 5.748$, $p = 0.003$, $\eta^2 = 0.012$, $\omega^2 = 0.010$, grade levels $5 > 7 = 9$], Science [$F_{(2,936)} = 4.195$, $p = 0.003$, $\eta^2 = 0.009$, $\omega^2 = 0.007$, grade levels $5 = 7, 7 = 9, 5 > 9$], and

TABLE 3 Goodness-of-fit statistics: baseline models (Hungarian and Moldovan samples).

Groups	Model	χ^2 (df)	TLI	CFI	RMSEA [90% CI]	SRMR
HU	Original model	1941.298 (579)	0.942	0.947	0.046 [0.044, 0.048]	0.0391
	Modified model	1416.565 (573)	0.964	0.967	0.036 [0.034, 0.039]	0.0349
	Baseline model	1470.480 (573)	0.962	0.965	0.037 [0.035, 0.040]	0.0356
MD	Original model	1974.913 (579)	0.935	0.940	0.051 [0.048, 0.053]	0.0382
	Modified model	1472.594 (573)	0.958	0.961	0.041 [0.038, 0.043]	0.0386
	Baseline model	1540.377 (573)	0.954	0.958	0.042 [0.040, 0.045]	0.0391

TABLE 4 Measurement invariance models by sample.

Models	χ^2	CFI	RMSEA [90% CI]	SRMR	Δ CFI	Δ RMSEA	Δ SRMR	Decision
Configural	3010.892	0.962	0.028 [0.027, 0.029]	0.0356				
Metric	3218.245	0.958	0.029 [0.028, 0.030]	0.0369	-0.004	0.001	0.0013	Accept
Scalar	4342.926	0.936	0.035 [0.034, 0.037]	0.037	-0.022	0.006	0.000	Reject
Scalar partial	3763.073	0.948	0.032 [0.031, 0.033]	0.037	-0.010	-0.003	0.000	Accept

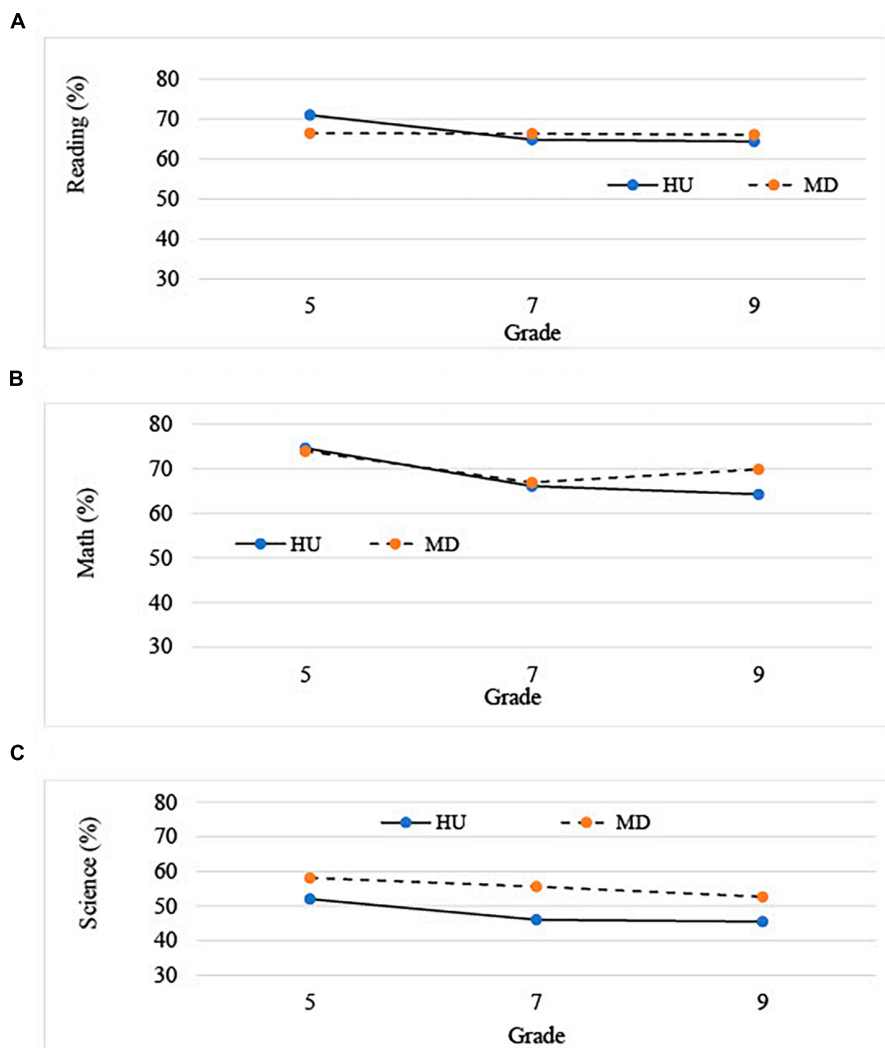


FIGURE 2

Age changes in SSMM for Hungarian and Moldovan students. (A) Age changes curves in reading for Hungarian and Moldovan students. (B) Age changes in math for Hungarian and Moldovan students. (C) Age changes in science for Hungarian and Moldovan students.

Reading [$F_{(2,936)} = 0.030, p = 0.970, \eta^2 = 0.000, \omega^2 = -0.002$, grade levels 5 = 7 = 9].

RQ3. Are there SSMM mean-level differences between Hungarian and Moldovan middle school students and grades?

The MANOVA test demonstrated that there was a statistically significant difference across the country and grade variables on a linear combination of the SSMMQ scales, $V = 0.022$; $F_{(12,4100)} = 3.887, p < 0.001, \eta^2 = 0.011$, and across the countries, $V = 0.033$; $F_{(6,2049)} = 11.814, p < 0.001, \eta^2 = 0.033$. As presented in Table 6, there was one significant country difference, i.e., on the Science scale, although for the interactions (grade X country) of the Reading, Math, and English scales, the statistical significance level was set to < 0.001 .

Moreover, when comparing the latent means of the Hungarian and Moldovan students using the SEM framework, we obtained similar results. Thus, the investigation of latent means showed that the most significant difference was in the Science scale. The

Moldovan middle school students scored higher on this scale than the Hungarian ones. Another difference that was registered was on the Reading Scale, where the Hungarian sample scored higher, but the magnitude of this difference (d) of latent means can be ignored. This repetitive analysis demonstrated that setting the p -value to < 0.001 was an acceptable approach to univariate and multivariate analysis in the present study (Table 7).

4 Discussion

The present quantitative study sought to explore subject-specific mastery motivation as perceived by middle school students in two countries. In order to facilitate this aim, we attempted to assess the measurement invariance for subject-specific mastery motivation among the examined samples by country, followed by the interpretation of statistically significant latent mean differences. Finally, several tests were carried out to identify the clusters in each sample, thus determining the SSMM profiles in each

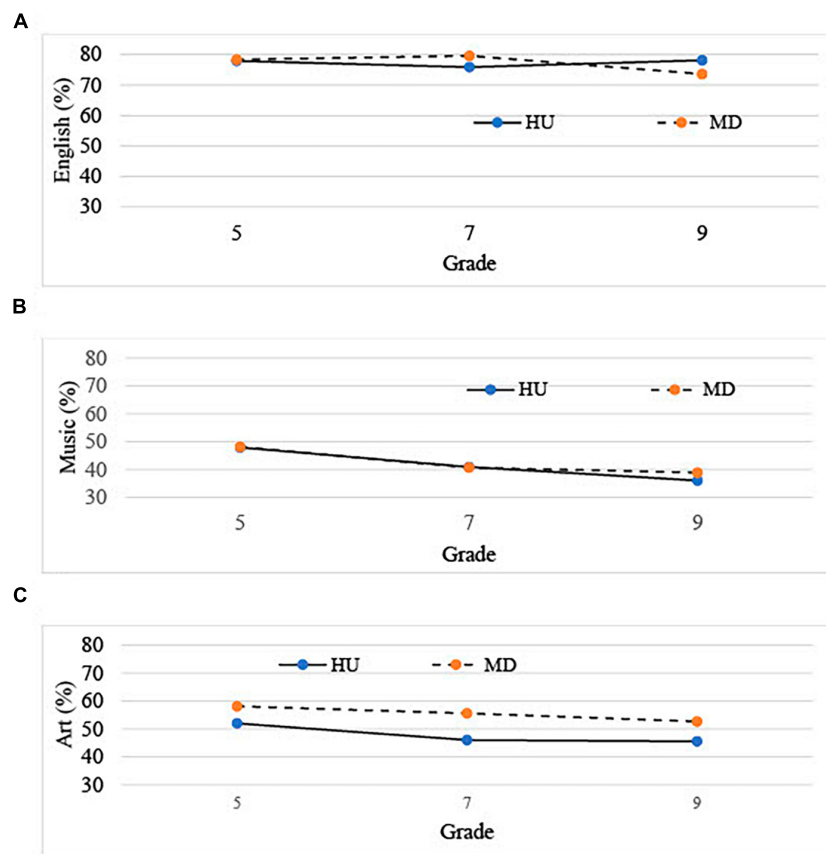


FIGURE 3 Age changes in SSMM for Hungarian and Moldovan Students. (A) Age changes in English for Hungarian and Moldovan students. (B) Age changes in music for Hungarian and Moldovan students. (C) Age changes in art for Hungarian and Moldovan students.

country. Hungarian students were divided into three clusters and Moldovan into two. Furthermore, the findings of the present investigation contribute to the comprehension of the relationship between demographic factors and SSMM profiles in both countries and set the context for further cross-cultural studies on SSMM cluster analysis with the purpose of establishing more stable cluster patterns.

Due to the fact that previous studies on the SSMMQ resulted in inconclusive factor models, the Hungarian data were tested to determine what proposed factor structure it held (Józsa et al., 2017; Calchei et al., 2023). The six-factor model with 36 items met the expected goodness-of-fit indicators: this included Reading, Math, Science, English, Music, and Art. The school mastery pleasure scale did not fit this data, similarly to Calchei et al.'s (2023) research, which also used CFA (Hu and Bentler, 1999; van Laar and Braeken, 2021). This finding supports the research on the SSMMQ as a valid instrument for measuring perceived mastery motivation in specific subjects and has laid the foundation for cross-cultural comparison.

At the same time, the fact that the school mastery pleasure scale has the tendency of not fitting the subject-specific mastery motivation model contradicts the theory of mastery motivation, which specifically states that positive emotions encourage attempts at mastering moderately challenging tasks in any context and persistence (Pekrun, 2006; Józsa and Barrett, 2018). Therefore, the present model measures the instrumental aspect of mastery

TABLE 5 Correlation between SSMMQ scales.

	Reading	Math	Music	Science	English	Art
Reading						
Math	0.521**					
Music	0.317**	0.162**				
Science	0.455**	0.399**	0.309**			
English	0.453**	0.444**	0.200**	0.292**		
Art	0.381**	0.237**	0.396**	0.336**	0.177**	

**p = 0.01.

motivation and not the affective one that includes both pleasant emotions and negative emotions (Wang and Barrett, 2013). A future direction in the field of subject-specific mastery motivation is to identify a measuring instrument for measuring school mastery pleasure.

4.1 Within-countries comparison of subject-specific mastery motivation

Regarding the mean difference within the grades in each country, we found that in Hungary, Reading, Math, Science, Art,

TABLE 6 Multivariate analyses of variance for SSMM scales as a function of grade level and country.

SSMMQ scales		F	p	η^2
MANOVA	Grade level	11.814	<0.001	0.033
	Country	17.495	<0.001	0.049
	Grade × Country	3.887	<0.001	0.011
Reading	Grade level	6.369	0.002	0.006
	Country	0.217	0.642	0.000
	Grade × Country	5.380	0.005	0.005
Math	Grade level	29.937	<0.001	0.028
	Country	3.816	0.051	0.002
	Grade × Country	3.573	0.028	0.003
Science	Grade level	11.785	<0.001	0.011
	Country	50.852	<0.001	0.024
	Grade × Country	0.976	0.377	0.001
English	Grade level	1.881	0.153	0.002
	Country	0.016	0.898	0.000
	Grade × Country	5.373	0.005	0.005
Music	Grade level	19.360	<0.001	0.019
	Country	0.440	0.507	0.000
	Grade × Country	0.394	0.674	0.000
Art	Grade level	76.300	<0.001	0.069
	Country	2.056	0.152	0.001
	Grade × Country	1.036	0.355	0.001

TABLE 7 Latent mean differences for sample (Hungarian and Moldovan).

SSMMQ Scale	MD	CR	d
Music	-0.057	-0.963	0.003
Art	0.114	1.948	0.010
English	-0.042	-1.053	0.000
Math	-0.020	-0.473	0.048
Science	0.245	5.263***	0.300
Reading	-0.110	-3.097*	0.052

χ^2 (df) = 3689.774 (1201), CFI = 0.949, TLI = 0.947, RMSEA = 0.032 [0.031, 0.033], SRMR = 0.037. *p < 0.05, ***p < 0.001.

and Music decreased significantly between grades five and seven. These findings are consistent with a previous study of SSMM in this country that concluded that these levels decreased between grades four and eight. The findings are corroborated by a body of empirical evidence derived from cross-sectional investigations on mastery motivation among school students in Hungary (Józsa and Molnár, 2013; Józsa et al., 2014, 2020). As for the trajectory of the SSMM between grades seven and nine in the Hungarian sample, the data showed that the levels remained significantly stable, which is in line with a previous empirical study, with the exception of the Art and Music scales, where the students' mastery motivation constantly increased from grades four to ten (Józsa et al., 2017). As for English, the result of the present study differed as we did not find the change to be significant,

whereas previous studies determined a decrease in the level of English SSMM from grades four to six and then a stagnation up to grade 10.

In the Moldovan sample, significant differences were registered on the Math, Music, and Art scales. As in the Hungarian sample, the levels in these subjects declined from the fifth to the seventh grade, but in the ninth grade, the Math and Music SSMM remained stable, while Art continued declining. Since we decided on the use of stringent alpha in the analysis of variance between grades as a result of the violations of the assumption of this statistical test, the changes in Science and English are not considered significant. As for the domain of Reading, students' subject-specific mastery motivation level in this particular subject remained relatively consistent and was not found to undergo significant fluctuations during the middle school years in Moldova.

It is crucial to emphasize that the magnitude of effect sizes for the Hungarian sample, which estimates both the extent of variability within a population (ω) and a sample (η^2), was substantial for all the statistically significant alterations, mirroring the findings observed in the Moldovan sample (Cohen, 1965).

When making a comparison of the means between the two countries, our conclusion was that, solely on the Science scale, the Moldovan students consistently rated themselves higher than their Hungarian counterparts. Moreover, it was specifically this scale that exhibited a significant difference between the countries, whereas the remaining scales did not register any statistically significant variations. Thus, the Moldovan students displayed a higher motivation to study Science.

There were no significant multivariate effects for students from all the grades in both countries on the Science, Music, and Art scales. However, the interaction effect between grade and country was significant on the Reading, Math, and English scales; it seems that the Hungarian students' means in Reading and Math dropped between fifth and seventh grade, whereas the Moldovan students tended to have a stable mastery motivation in Reading between these grades, while their trend in motivation in respect to obstacles in Math followed the Hungarian one.

When embarking on this study, we anticipated that the overall trajectory of the levels of mastery motivation in particular disciplines would exhibit a downward trend. This decline in motivation and subject/domain-specific motivation over ages/grades was empirically established by a range of motivation frameworks (Jacobs et al., 2002; Lepper et al., 2005; Yeung et al., 2011; Potvin and Hasni, 2014; Gensowski et al., 2021; Liou et al., 2021). This trajectory has been explained through developmental and educational settings and curriculum perspectives. Hence, in approaching it from a developmental standpoint, this decline can be attributed to the optimistic orientation of younger students who perceive their own motivation as high (Bouffard et al., 1998). Moreover, the older students become, the more opportunities for social comparison they get, and therefore, students' self-rating of the mastery motive becomes more objective and thus falls. In addition, another fact that can influence this progression of motivation is change in the educational setting, such as change of schools (elementary school to middle school) or teachers (Wigfield et al., 2004). Yet, in the present study, we determined a decline even though there was no change in the schools, which is in line with the findings of Gensowski et al. (2021). Students in

higher grades pursue academic achievement, thus deemphasizing learning, which may have adverse effects on student motivation (Jacobs et al., 2002). Furthermore, as students make headway through their educational path, the curriculum gradually becomes more challenging and less relevant to real-world contexts, which can negatively impact motivation (Lepper et al., 2005). The cultural aspects of students are mainly identified in studies that compare the motivation of students from Asian countries with students from Western countries (Gilmore et al., 2017; Morgan et al., 2017).

Our study concludes that subject-specific mastery motivation tends to decline until grade seven and becomes stable at grade nine. The lack of change in the trajectory between these two grades can be explained in Moldova by the high-stakes compulsory exams in native language and literature and mathematics at the end of the ninth grade. Students are not assessed in science at this point, and therefore, we see a downfall trajectory in Science mastery motivation.

4.2 Cross-cultural aspects of subject-specific mastery motivation in Hungary and Moldova

Given the cultural differences identified between the Hungarian and Moldovan cultures on Hofstede's cultural dimensions, we expected more significant mean differences between middle school students in these countries. Nonetheless, this empirical investigation did not identify major differences. In order to elucidate the absence of variations within the realm of SSMM in the specific context of Hungary and Moldova, it is imperative to ascertain the specific domains encompassed by the cultural frameworks employed in this study that encompass the concept of persistence, which serves as the fundamental cornerstone underpinning the theoretical framework of mastery motivation theory. Hofstede's cultural dimensions do not explicitly incorporate persistence as a distinct cultural domain or include it within its predefined domains. Nevertheless, we consider that two dimensions in Hofstede's 6-D model of cultural values, namely, long-term orientation and uncertainty avoidance, might be indirectly related to the motivational concept of persistence. Thus, the tendency to display uncertainty avoidance indicates a society's preference for rules and predictability. Consequently, this cultural domain can support persistence when facing challenges. The long-term orientation dimension reflects a society's orientation toward either short-term or long-term goals, thus emphasizing persistence and perseverance as means of mastering goals. In these two domains, the observed differences between Hungary and Moldova are minimal, including in the indulgence cultural domain. One plausible hypothesis could be posited to explain the absence of significant mean differences in subject-specific mastery motivation (SSMM) between Hungary and Moldova based on their proximity in the dimensions of long-term orientation and uncertainty avoidance. The relatively similar positions of these two countries along these cultural dimensions may contribute to the observed lack of divergence in SSMM scores.

The present cross-cultural study contributes to the debate on measuring motivation in various cultures or ethnic groups. This issue is prompted by the cultural meanings associated with the motivational construct, which can lead to difficulties in comparing means (Pintrich, 2003). Researchers tend to consider that within-country comparisons are more reliable as the potential differences are less influenced by cultural, social, and educational system structural aspects (Artelt, 2010). The study of subject-specific mastery motivation across two cultures that are geographically closely situated and share some political characteristics in their history is important for practitioners as it can highlight the potential differences between cultures that contribute to the achievement of academic success. Moreover, it can elucidate the role of culture in the variation of mastery motivation in cultures that share values. However, there is a need to concurrently assess the predictive power of the achievement of its domains and other school related-outcomes (such as time spent on mastering a challenging task or competence), for it can be a subject of cultural variations.

4.3 Limitations and direction for future studies

Despite the several strengths of the study, we acknowledge the presence of certain limitations. First, the study used convenient sampling rather than random sampling due to the privacy laws imposed in both countries. Next, the cross-sectional study design did not allow to study the individual changes in SSMM. Therefore, it is important to adopt a longitudinal design for researching the developmental trajectories and individual dynamics of SSMM. Third, the students rated themselves, and most students prefer to rate themselves higher, especially in the case of younger students. Therefore, further examinations of measurement and structural equivalence across additional grade cohorts and cultures are required. Moreover, we compared students from similar grades assuming that they would fall in the same grade and were in the same age bracket of above or under 3 years.

5 Conclusion

Multidimensional measures of SSMM were employed in this developmental research, contributing to a comprehensive understanding of this construct. The present cross-cultural study established that, in Hungary, there was a decrease of SSMM over grade levels in Reading, Science, Math, Music, and Art and a stable level in English, while in Moldova, Reading mastery motivation had a stable trajectory, whereas the SSMM in the rest of the scales decreased from fifth to seventh grade but remained stable from the seventh to ninth grade. While Hungary and Moldova exhibit socio-cultural disparities across several cultural domains, it is noteworthy that only one distinction was observed between these two countries, specifically in the Science mastery motivation domain.

Data availability statement

The datasets presented in this article are not readily available because this research is based on human participants, and thus data availability is impossible due to their privacy. Requests to access the datasets should be directed to KJ, jozs@sol.cc.u-szeged.hu.

Ethics statement

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board of University of Szeged Doctoral School of Education. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

Author contributions

MC: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review and editing. SA: Writing – original draft, Writing – review and editing. KJ: Conceptualization, Funding acquisition, Supervision, Writing – original draft, Writing – review and editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Conclusion

The thesis project was focused on the study of mastery motivation and subject specific mastery motivation in the context of the Republic of Moldova and on a cross-cultural study of subject-specific mastery motivation in Hungary and Moldova. The results of the first three stages of the research project were published in three articles.

The first article entitled “Comparative Study of Russian-and Romanian-Speaking Students’ Mastery Motivation in the Republic of Moldova” was based on our pilot study and included a sample of 275 fifth grade students from schools with Romanian ($N=162$) and Russian language of instruction ($N = 113$). The main aim of this part of our study project was to validate the Romanian and Russian versions of the DMQ18 using confirmatory factor analysis. Additionally, it aimed to conduct a meaningful comparison of the mastery motivation levels between these two group through measurement invariance procedures and latent means comparison.

The second article “Subject Specific Mastery Motivation in Moldovan Middle School Students” was part of our study project. This study project represented a novel empirical analysis on the role of subject-specific mastery motivation among middle-school students in the Republic of Moldova. Prior research on subject-specific mastery motivation used utilized exploratory factor analysis and correlations to explore the domain specificity of mastery motivation constructs within a school context (Józsa et al., 2017). The primary research objectives of this section of our study project were to confirm the domain specificity of mastery motion and validate the Romanian and Russian versions of SSMMQ. Besides this part of the study project focused on the analysis of age-related differential distinctiveness of the instrument and the latent mean differences and their magnitudes across languages, grade levels, and gender. The investigation was based on a sample of 939 students ($N_{\text{Romanian}} = 586$, ($N_{\text{Russian}} = 353$) from fifth, seventh and ninth grades.

The next article was focused on the exploration of subject-specific mastery motivation from a cross-cultural perspective and was part of our main study project. The research examined subject-specific mastery motivation in Reading, Math, Science, English as a foreign language, Music, and Art based on students in Hungary ($N = 1121$) and Moldova ($N = 939$) across grades five, seven, and nine. This research aimed to confirm the factor structure of the Hungarian version of the SSMMQ. It is important to mention that the validity of the versions used in Moldova was studied in a previously published study that used the same sample (Calchei et al., 2023). Additionally, the article presented the changes in SSMM levels both

across grade levels and Hungarian and Moldovan middle school students were assessed. Hence, this study project addressed the gap in cross-cultural psychometric evaluations of SSMMQ.

This empirical investigation led to some preliminary conclusions that needed to be deepened and explored by verifying the predictive value of mastery motivation and subject-specific mastery motivation in relation to general or subject-specific academic achievement. Thus, the first step in the study project was to validate the two measurement instruments that were adapted into Romanian and Russian languages within the educational context of the Republic of Moldova. The initial findings from the pilot study revealed that the Negative Reaction to Challenges scale of school-aged version of the DMQ18 did not fit the Romanian as well as the Russian data, contradicting findings from earlier studies of the DMQ18 (Józsa et al., 2020). The main investigation that was carried out on a larger sample reaffirmed the misfit of the Negative Reaction to Challenges scale in both language versions. It can be assumed that this was either a problem of translation or a cultural issue present in school where students were not encouraged or allowed to demonstrate their negative emotions. At the same time mastery motivation's expressive dimension was conceptualized a binary construct and further research on this scale is required particularly in light of findings indicating that the negative reaction dimension was a negative predictor of domain specific academic achievement in elementary school students (Józsa et al., 2020; Józsa & Barrett, 2018)

When validating the Romanian and Russian versions of SSMMQ within the main study sample, it was concluded that not all the School Mastery Pleasure items representing the expressive aspect of subject-specific mastery motivation that fit the data in both versions therefore it was discarded which contracted the results obtained from the first validation of SSMMQ in Hungarian and Chinese versions (Józsa et al., 2017). The rest of the scales: Reading, Math, Science, English as a foreign language, Art and Music mastery motivation fit the first-order six-factor model. Besides, the study proved that the multidimensionality of subject-specific mastery motivation becomes more distinct with age based on the declining correlations among the latent factors of the instrument. Yet, the issue of School Mastery Pleasure scale might be the result of parallel wording of items which potentially led to biased outcomes. The fact that in our studies some of the scales of expressive dimensions did not fit the observed data must be empirically investigated in the context of Moldova.

Another issue researched in our articles was the differences in self-rated levels of mastery motivation and subject-specific mastery motivation across grades, gender, and languages. Thus this study project made a valuable contribution in exploring the differences between mastery motivation and subject-specific mastery motivation levels with a previously unstudied

population, middle schools students in the Republic of Moldova. To ensure comparability of measurement across groups, measurement invariance was used as a fundamental prerequisite for assessing differences or changes between these groups. Thus, having achieved scalar invariance of the DMQ18 in students studying in Romanian and Russian languages I explored a meaningful cross-ethnic comparison of latent means between Romanian-speaking and Russian-speaking middle school student groups. The analytical study revealed that students instructed in Romanian language rated themselves statistically significantly higher than Russian-speaking students on the Gross Motor Persistence scale indicating a greater tendency of Romanian-speaking children to persist in challenging physical activities, in comparison to Russian-speaking children. However, no significant differences were observed on the other scales (Cognitive/Object Persistence, Social Persistence with Children, Social Persistence with Adults and Mastery Pleasure), thus it suggested an overall similarity in perceived mastery motivation across the studied groups. This finding is a step forward to understanding the ethnic, cognitive and affective differences between the students studying in school with Romanian or Russian language of instruction in the Republic of Moldova, using the same curriculum documents.

Regarding the difference related to subject-specific mastery motivation domains between these groups, empirical findings showed that although the latent means of the students studying in Russian were statistically significantly lower in Math, Science, Music and Art, yet the effect size of these mean differences was small, suggesting that they can be considered negligible. Consequently, these results indicate that though there are some differences between the students receiving instruction in Romanian and Russian languages, the data collected in schools using different languages of instruction and using the Russian and Romanian versions of the DMQ18 and SSMMQ could be merged. This integration facilitated further exploration into the levels of mastery motivation and domain-specific mastery motivation of Moldovan students in cross-cultural studies (Calchei et al., 2023).

In terms of the differences across grades, it was studied just on subject-specific mastery motivation due to the fact that the data collected using DMQ18 was not yet published. Thus, one of the major findings in this study project was the Reading Mastery Motivation levels did not change significantly across fifth, seventh and ninth grades. This stability of Reading mastery motivation levels in Moldova stood in contrast to earlier findings in Hungary and Taiwan where these levels decreased from grade four to eight, and only after grade eight it became stable (Hungary), or it increased (Taiwan). This result is important for the Moldovan educational system as the stability of Reading mastery motivation should be capitalized

effectively by curriculum, teachers and parents as reading achievement can impact achievement in other subjects (Grimm, 2008; Hübner et al., 2022).

Next, Science, Art, and Music mastery motivation declined across the grades. Science mastery motivation levels have a declining trajectory, but it is statistically significant only when comparing the fifth and the ninth grades. Math mastery motivation also declines but it seems that the declining that takes place between grades five and seven is important as it affects the decline from across grades five to nine with a small size effect. No significant differences were found in Math mastery motivation between grades seven and nine, which can be explained by the first high-stake exam in Mathematics that students take in their academic path at the end of the ninth grade. English mastery motivation began its decline from grade seven onwards, maintaining stability between fifth and seventh grades. Music and Art mastery motivation domains were the only ones to exhibit a consistently significant downward trajectory across all grade levels, and this can be explained by the fact that students are evaluated in these subjects and not assessed.

As for latent mean differences of the SSMMQ scales across gender, the empirical data indicated that females had higher levels of subject - specific mastery motivation levels in all domains except Math. However, the studies on mastery motivation and other motivation frameworks did not identify any gender differences (Gilmore et al., 2017; Martin, 2004). The differences between girls and boys in this study project can be explained by cultural perspective on gender orientation, which entails that boys, compared to girls, are less academic- or study-oriented and by the fact that girls exhibit greater self-discipline (Bugler et al., 2015; Duckworth & Seligman, 2005; van Houtte, 2004).

In the article on the cross-cultural study of subject specific mastery motivation in Hungary and Moldova, the levels of SSMM in Hungary were compared. The results of that analysis were similar to the findings on SSMM in this country (Calchei et al., 2024). Thus, Reading, Math, Science, Art, and Music mastery motivation decreased significantly between grades five and seven, whereas between seven and nine these levels remained stable. In contrast, English mastery motivation remained stable across all the grades in Hungary.

When conducting a comparative analysis of the mean scores between the two countries, it was observed that it was observed that Moldovan students consistently self-rated higher than their Hungarian counterparts, but only in the domain of Science were these ratings were statistically significant. In contrast, other subject areas did not show any statistically significant differences.

No significant multivariate effects were observed across all grade levels in both countries for the subjects of Science, Music, and Art. However, the interaction effect between grade and country was significant on the Reading, Math, and English scales; a decline in the mean scores of Hungarian students in Reading and Math from the fifth to the seventh grade. In contrast, Moldovan students exhibited consistent levels of mastery motivation in Reading across these grades. Their trajectory in Math mastery motivation, particularly concerning challenges, mirrored that of the Hungarian students.

When examining the means of SSMM levels, we identified that the highest levels of mastery motivation were in English mastery motivation and this can be explained by the future and even momentary professional, social and entertainment utility of learning this language in both countries. As for the declining mastery motivation in the majority of specific subjects, it can be explained by the cognitive changes within middle school students. As they develop and acquire academic experience in schools often focused more on achievement and less on mastery, they become more aware and objective about their mastery motivation levels. (Calchei et al., 2024; Wigfield & Eccles, 2002).

In our third study, we attempted to explain the trajectories of subject specific mastery motivation across grades and countries from a cultural perspective. For this purpose, we employed Hofstede's 6-D model of cultural value who conceptualized culture in six dimensions: power distance, uncertainty avoidance, individualism/collectivism, masculinity/femininity, long-/short term orientation, and indulgence/restraint (Hofstede, 2001). And though according to Hofstede's model, Hungary and Moldova differ on all dimensions with the largest difference on individualism, masculinity and power distance, our study project found few differences in SSMM between Hungarian and Moldovan students. As it has been hypothesized this outcome may be attributed to the countries' similar positions in Hofstede's dimensions of long-term orientation and uncertainty avoidance, which indirectly relate to the motivational concept of persistence and in which these two countries are close to each other. The long-term orientation dimension mirrors society's orientation toward goal attainment be they short-term or long-term; thus. I consider that it reflects persistence and perseverance as means of mastering goals. Uncertainty avoidance reflects societal preference for rules and predictability. Therefore persistence, as a key component in mastery motivation theory, can be supported by societal preference for rules and predictability (uncertainty avoidance) and a focus on long-term goals (long-term orientation). Additionally, Hungary and the Republic of Moldova are similarly distant from both the United States (cultural fixation index = .102 and .100, respectively) and China (cultural fixation index scores = .125, and .133, respectively)

(Muthukrishna et al., 2020). According to the app Cultural Distance 0.9.5beta (<http://culturaldistance.com/>; see Muthukrishna et al., 2020), which uses data from the World Values Survey to compute the statistical distance between the cultures of different countries, the cultural distance index between Hungary and Moldova using 2005-2009 data was .073[.0715; .0774]; this index can range between 0 and 1, however in Muthukrishna's seminal study the values do not exceed .300 (Muthukrishna et al., 2020). In conclusion, if we return to the research gap of this project study, and address the issue of whether cultures with small cultural distances can be included in cross-cultural studies, our perspective is that in education research these comparisons can offer insight into the differences that are paramount for a process, construct, etc.

If we compare the results delivered by DMQ18 and SSMMQ, we can state that it is SSMMQ that delivered more differences between students receiving instruction in Romanian and students receiving instruction in the Russian language, mostly since it measures mastery motivation in a narrow educational context.

A series of studies demonstrated the role of teachers and parents in motivating students and increasing it and even improving students' academic achievement (Brandmiller et al., 2020; Friedrich et al., 2015; Givvin et al., 2001; Liu, 2021; Peng, 2021; Rogers et al., 2009; Tandler & Dalbert, 2020). Therefore, one of the future directions that is important to adopt in research on mastery motivation is examining the agreement and consistency of teachers' and parents' perception of students' levels of mastery motivation, understanding how these perceptions correlate and assessing their power to predict academic achievement, especially in comparison with student's self-assessment of their mastery motivation levels. Such studies can explain the assistance teachers require to enhance their diagnostic skills in mastery motivation and subjects-specific mastery motion and what is more teachers' role in fostering persistence in educational settings is significant (Bureau et al., 2022; Hashmi et al., 2017).

Furthermore, in all research on mastery motivation and subject-specific mastery motivation the scholars adopted the variable-centered approach that focused on studying the relations among variables. We consider that adopting person-centered approach could bring new insights into the theory of mastery motivation and, importantly, enhance its applicability for educators and parents.

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Appendices
Appendix A
Dimensions of Mastery Questionnaire in Romanian and Russian

Chestionar: motivația copiilor de vârstă școlară

Numele, prenumele: _____ Vârsta _____ (ani)

Încercuți: fată băiat Data: _____

Încercuiește cifra care te caracterizează cel mai exact, bazându-te pe experiența recentă. Toți copiii sunt diferiți; majoritatea sunt motivați să facă unele lucruri și demotivați să facă alte lucruri. Unele întrebări nu sunt tipice pentru vârsta ta - în acest caz, încercuiește varianta "nu sunt deloc așa". Încearcă să răspunzi la toate întrebările, chiar dacă nu ești sigur în privința unora dintre ele.

	nu sunt deloc așa					sunt exact așa
1. Lucrez asupra unei probleme până îmi reușește.	1	2	3	4	5	
2. Simt satisfacție când termin cu bine să fac ceva complicat.	1	2	3	4	5	
3. Încerc să fiu bun la jocurile sportive.	1	2	3	4	5	
4. Rezolv problemele repede.	1	2	3	4	5	
5. Simt tristețe sau rușine când nu-mi ating scopul.	1	2	3	4	5	
6. Încerc din greu să-i înveselesc pe ceilalți copii când îmi par triști.	1	2	3	4	5	
7. Încerc să spun și să fac lucruri care să capteze interesul altor copii.	1	2	3	4	5	
8. Deseori discut cu adulții.	1	2	3	4	5	
9. Sunt frustrat/ă când nu reușesc să duc la bun sfârșit o sarcină dificilă.	1	2	3	4	5	
10. Sunt foarte bun/ă la majoritatea lucrurilor.	1	2	3	4	5	
11. Sunt foarte bucuros/ă când am parte de succes.	1	2	3	4	5	
12. Încerc să fiu bun/ă la activitățile fizice chiar dacă sunt complicate.	1	2	3	4	5	
13. Sunt frustrat/ă când nu sunt bun la ceva.	1	2	3	4	5	
14. Îmi fac toate temele, chiar dacă îmi ia mult timp.	1	2	3	4	5	
15. Încerc din greu să-i fac pe adulți să se intereseze de activitățile mele.	1	2	3	4	5	
16. Protestez când nu-mi reușește ceva, în pofida tuturor eforturilor.	1	2	3	4	5	
17. Încerc să identific toți pașii necesari pentru rezolvarea unei probleme.	1	2	3	4	5	
18. Sunt foarte bucuros/ă când reușesc să înțeleg ceva.	1	2	3	4	5	
19. Încerc să-i fac pe adulți să-mi înțeleagă punctul de vedere.	1	2	3	4	5	
20. Fac lucruri care sunt dificile pentru copiii de vârsta mea.	1	2	3	4	5	
21. Simt satisfacție când reușesc să rezolv o problemă după ce am muncit mult la ea.	1	2	3	4	5	
22. Încerc din greu să-i fac pe adulți să mă înțeleagă.	1	2	3	4	5	

	nu sunt deloc așa					sunt exact așa				
23. Persist mult timp când încerc să fac ceva complicat.	1	2	3	4	5	1	2	3	4	5
24. Nu-i privesc pe oameni în ochi când încerc să fac ceva, dar nu-mi reușește.	1	2	3	4	5	1	2	3	4	5
25. Încerc din greu să-i înțeleg pe alți copii.	1	2	3	4	5	1	2	3	4	5
26. Persist în lucrul asupra abilităților sportive până îmi reușește mai bine.	1	2	3	4	5	1	2	3	4	5
27. În majoritatea cazurilor, sunt mai bun decât alți copii de vârsta mea.	1	2	3	4	5	1	2	3	4	5
28. Încerc din greu să mă împrietenesc cu alți copii.	1	2	3	4	5	1	2	3	4	5
29. Persist mult timp când încerc să rezolv o problemă pentru școală.	1	2	3	4	5	1	2	3	4	5
30. Zâmbesc, când îmi reușește ceva la ce am muncit mult.	1	2	3	4	5	1	2	3	4	5
31. Înțeleg lucrurile bine.	1	2	3	4	5	1	2	3	4	5
32. Încerc să mă implic și eu când alți copii fac ceva.	1	2	3	4	5	1	2	3	4	5
33. Încerc să aflu ce le place și ce nu le place adulților.	1	2	3	4	5	1	2	3	4	5
34. Îmi ascund privirea când încerc să fac ceva, dar nu-mi reușește.	1	2	3	4	5	1	2	3	4	5
35. Când mă joc cu alți copii, încerc să fac astfel, încât jocul să continue.	1	2	3	4	5	1	2	3	4	5
36. Încerc din greu să devin un sportiv mai bun.	1	2	3	4	5	1	2	3	4	5
37. Încerc din greu să înțeleg sentimentele adulților.	1	2	3	4	5	1	2	3	4	5
38. Încerc din greu să devin mai bun la jocurile cu mingea.	1	2	3	4	5	1	2	3	4	5
39. Mă retrag după ce nu-mi reușește ceea ce am încercat să fac.	1	2	3	4	5	1	2	3	4	5
40. Prefer să încerc să rezolv probleme complicate, și nu cele ușoare.	1	2	3	4	5	1	2	3	4	5
41. Mă înfurii dacă încerc din greu să fac ceva și nu-mi reușește.	1	2	3	4	5	1	2	3	4	5

Анкета для оценки мотивации детей школьного возраста (заполняется взрослым)

Идентификационный номер ребенка Возраст лет

Обведите кружком пол ребенка: Мужской Женский

Сегодняшняя дата _____

Кем вы относитесь ребенку: мать отец учитель другое (укажите)

Пожалуйста, обведите кружками числа, которые лучше всего описывают то, какой ребенок в последнее время. Все дети - разные; большинство любят заниматься одними вещами и не любят - другими. Обратите внимание, что некоторые вопросы не относятся к типичным для детей возраста вашего ребенка, поэтому, отвечая на них, отметьте «это совсем не похоже на этого ребенка». Пожалуйста, постарайтесь ответить на все вопросы, даже если вы не уверены в своем ответе.

	ЭТО СОВСЕМ НЕ ПОХОЖЕ НА ЭТОГО РЕБЕНКА				ЭТОТ РЕБЕНОК ИМЕННО ТАКОЙ
1. Бьётся над новой задачей пока не справится с ней.	1	2	3	4	5
2. Доволен собой, когда доводит до конца что-то сложное.	1	2	3	4	5
3. Стараётся добиваться успехов в спортивных играх.	1	2	3	4	5
4. Решает задачи быстро.	1	2	3	4	5
5. Выглядит грустным или пристыженным, когда не достигает поставленной цели.	1	2	3	4	5
6. Очень старается сделать так, чтобы другие дети почувствовали себя лучше, если они кажутся грустными.	1	2	3	4	5
7. Пытается заинтересовать других детей своими словами или действиями.	1	2	3	4	5
8. Часто разговаривает на разные темы со взрослыми.	1	2	3	4	5
9. Расстраивается, когда не может выполнить сложную задачу.	1	2	3	4	5
10. Большинство вещей делает очень хорошо.	1	2	3	4	5
11. Он/она в восторге, когда добивается успеха.	1	2	3	4	5
12. Стараётся добиваться успехов в том, что касается физической активности, даже когда это сложно.	1	2	3	4	5
13. Расстраивается, когда у него что-то не получается.	1	2	3	4	5
14. Доводит до конца школьные задания, даже если это занимает много времени.	1	2	3	4	5
15. Очень старается заинтересовать взрослых тем, чем он занимается.	1	2	3	4	5
16. Возмущается если у него/нее ничего не получается, хотя он/она и очень старался.	1	2	3	4	5

	ЭТО СОВСЕМ НЕ ПОХОЖЕ НА ЭТОГО РЕБЕНКА					ЭТОТ РЕБЕНОК ИМЕННО ТАКОЙ				
17.	Пытается выяснить все шаги, необходимые для решения задачи.					1	2	3	4	5
18.	Радуется, когда ему/ей удается что-то понять.					1	2	3	4	5
19.	Пытается донести до взрослых свою точку зрения.					1	2	3	4	5
20.	Делает вещи, которые с трудом даются другим детям его возраста.					1	2	3	4	5
21.	Бывает доволен, когда ему/ ей удастся, после многих усилий, решить поставленную задачу.					1	2	3	4	5
22.	Очень старается, чтобы взрослые его/ ее поняли.					1	2	3	4	5
23.	Работает долгое время, когда пытается сделать что-то сложное.					1	2	3	4	5
24.	Не смотрит людям в глаза, когда пытается что-то сделать, но у него не получается.					1	2	3	4	5
25.	Очень старается понять других детей.					1	2	3	4	5
26.	Работает над своими спортивными навыками, пока у него/нее не начинает получаться хорошо.					1	2	3	4	5
27.	Справляется с задачами лучше, чем большинство других детей его возраста.					1	2	3	4	5
28.	Очень старается подружиться с другими детьми.					1	2	3	4	5
29.	Долго бьётся над школьными задачами, пытаясь их решить.					1	2	3	4	5
30.	Улыбается, когда у него получается что-то, над чем он/ она много работал/а.					1	2	3	4	5
31.	Хорошо понимает разные вещи.					1	2	3	4	5
32.	Пытается присоединиться к другим детям, когда они что-то делают.					1	2	3	4	5
33.	Пытается выяснить, что нравится и не нравится взрослым.					1	2	3	4	5
34.	Не смотрит в глаза, когда пытается что-то сделать, но у него не получается.					1	2	3	4	5
35.	Старается поддержать игру, когда играет с другими детьми.					1	2	3	4	5
36.	Старается стать лучше в спорте.					1	2	3	4	5
37.	Очень старается понять чувства взрослых.					1	2	3	4	5
38.	Старается улучшить свои навыки игры в мяч.					1	2	3	4	5
39.	Отстраняется, если его попытки безуспешны.					1	2	3	4	5
40.	Предпочитает решать сложные задачи, а не простые.					1	2	3	4	5
41.	Злится, если у него/неё что-то не получается, хотя он/она и очень старается.					1	2	3	4	5

Appendix B

Subject-Specific Mastery Motivation Questionnaire in Romanian and Russian

Chestionar: Motivație pentru însușirea abilității/obiectului de studii

Numele, prenumele: _____ Vârsta _____ ani _____

Încercuțiți: fată băiat

Data: _____

Încercuiește cifra care te caracterizează cel mai exact, bazându-te pe experiența recentă. Toți copiii sunt diferiți; majoritatea sunt motivați să facă unele lucruri și ne motivați să facă alte lucruri. Unele întrebări nu sunt tipice pentru vârsta ta - în acest caz, încercuiește varianta "nu sunt deloc așa". Încearcă să răspunzi la toate întrebările, chiar dacă nu ești sigur în privința unora dintre ele.

	nu sunt deloc așa				sunt exact așa
Motivația de măiestrie/învățare pentru citire/lectură					
1. Dacă nu înțeleg o propoziție, o recitesc.	1	2	3	4	5
2. Mă strădui cât de bine pot să devin un bun cititor.	1	2	3	4	5
3. Exersez ca să mă învăț să citesc bine.	1	2	3	4	5
4. Citesc cât este nevoie pentru ca să înțeleg totul.	1	2	3	4	5
5. Vreau să devin un cititor bun, chiar dacă îmi va lua mult timp.	1	2	3	4	5
6. Recitesc textele de mai multe ori, ca să le înțeleg mai profund.	1	2	3	4	5
Motivația de măiestrie/învățare pentru matematică					
1. Exersez ca să mă învăț să fac calcule bine.	1	2	3	4	5
2. Dacă nu înțeleg o sarcină matematică, fac o nouă încercare.	1	2	3	4	5
3. Dacă fac o greșeală în calcule, fac o nouă încercare.	1	2	3	4	5
4. Persist în lucrul la o sarcină de matematică până când o înțeleg pe deplin.	1	2	3	4	5
5. Vreau să mă învăț să fac calcule chiar dacă trebuie să exersez mult.	1	2	3	4	5
6. Mă strădui cât de bine pot să rezolv o problemă de matematică.	1	2	3	4	5
Motivația de măiestrie/învățare pentru muzică					
1. Dacă nu am cântat bine, fac o nouă încercare.	1	2	3	4	5
2. Dacă nu cânt clar și precis, exersez până îmi reușește mai bine.	1	2	3	4	5
3. Mă strădui cât de bine pot să devin un cântăreț bun.	1	2	3	4	5
4. Exersez ca să mă învăț să cânt bine.	1	2	3	4	5
5. Continui să învăț cântecul până când îmi iese perfect.	1	2	3	4	5
6. Vreau să devin un cântăreț bun, chiar dacă îmi va lua mult timp.	1	2	3	4	5

CONTINUARE PE VERSO

	nu sunt deloc așa				sunt exact așa
Motivație de măiestrie/învățare pentru științe					
1. Persist în a observa lucruri și fenomene în natură.	1	2	3	4	5
2. Dacă mă interesează un fenomen natural, pun întrebări și investighez până aflu totul despre el.	1	2	3	4	5
3. Vreau să înțeleg totul ce ține de natură, chiar dacă îmi va lua mult timp.	1	2	3	4	5
4. M-am întrebat cum dintr-o sămânță îngropată în pământ crește o plantă.	1	2	3	4	5
5. Fac experimente pentru a obține răspunsuri la întrebările mele legate de natură.	1	2	3	4	5
6. Observ cum se schimbă vremea.	1	2	3	4	5
Motivația de măiestrie/învățare pentru limba engleză ca limbă străină					
1. Dacă nu înțeleg o propoziție în limba engleză, o recitesc.	1	2	3	4	5
2. Dacă nu pot scrie ceva în limba engleză, exersez până îmi reușește bine.	1	2	3	4	5
3. Mă strădui cât de bine pot să învăț limba engleză bine.	1	2	3	4	5
4. Exersez ca să cunosc limba engleză mai bine.	1	2	3	4	5
5. Repet cuvintele în limba engleză până le cunosc bine.	1	2	3	4	5
6. Mă strădui cât de bine pot să învăț să vorbesc limba engleză mai bine.	1	2	3	4	5
7. Simt satisfacție când pot spune ceva în limba engleză.	1	2	3	4	5
Motivația de măiestrie/învățare pentru arte					
1. Dacă nu-mi place desenul meu, fac o nouă încercare.	1	2	3	4	5
2. Aș vrea să desenez și să pictez tot mai bine și mai bine.	1	2	3	4	5
3. Exersez ca să mă învăț să desenez bine.	1	2	3	4	5
4. Continui să desenez până ce desenul meu devine frumos.	1	2	3	4	5
5. Vreau să devin un pictor bun, chiar dacă îmi va lua mult timp.	1	2	3	4	5
6. Mă strădui cât de bine pot să învăț să pictez frumos.	1	2	3	4	5
Plăcerea de obținere a măiestriei specifice disciplinelor școlare					
1. Simt satisfacție când înțeleg textul.	1	2	3	4	5
2. Simt satisfacție când reușesc să rezolv o problemă de matematică.	1	2	3	4	5
3. Simt satisfacție când pot să cânt frumos un cântec.	1	2	3	4	5
4. Simt satisfacție când înțeleg un fenomen natural.	1	2	3	4	5
5. Simt satisfacție când pot spune ceva în limba engleză.	1	2	3	4	5
6. Simt satisfacție când desenul meu arată frumos.	1	2	3	4	5

Анкета для оценки мотивации по отношению к предмету/умению

Имя _____ Возраст_ _____ лет

Обведи кружком твой пол: Мужской / Женский

Сегодняшняя дата__

Пожалуйста, обведи кружками числа, которые лучше всего описывают то, какой ты в последнее время. Все дети – разные; большинство любят заниматься одними вещами и не любят – другими. Обрати внимание, что некоторые вопросы не относятся к типичным для детей твоего возраста, поэтому, отвечая на них, отметь «это совсем не похоже на меня». Пожалуйста, постарайся ответить на все вопросы, даже если ты не уверен в своем ответе.

		ЭТО СОВСЕ М НЕ ПОХОЖ Е НА МЕНЯ				Я ИМЕННО ТАКОЙ/ ТАКАЯ
Мотивация мастерства к чтению						
1.	Если я не понимаю предложения, я перечитываю его.	1	2	3	4	5
2.	Я прилагаю все усилия, чтобы стать хорошим читателем.	1	2	3	4	5
3.	Я занимаюсь чтением, чтобы научиться читать хорошо.	1	2	3	4	5
4.	Я перечитываю текст, пока не пойму его.	1	2	3	4	5
5.	Я хочу научиться читать хорошо, даже если для этого потребуется много времени.	1	2	3	4	5
6.	Я перечитываю тексты снова и снова, чтобы понять их лучше.	1	2	3	4	5
Мотивация мастерства к музыке						
1.	Если я спою плохо, то я попробую еще раз.	1	2	3	4	5
2.	Если я не спою четко и точно, то я буду петь еще и еще, пока у меня не получится лучше.	1	2	3	4	5
3.	Я прилагаю все усилия, чтобы стать хорошим певцом.	1	2	3	4	5
4.	Я занимаюсь пением, чтобы научиться это делать хорошо.	1	2	3	4	5
5.	Я учу песню, пока не спою ее идеально.	1	2	3	4	5
6.	Я хочу научиться петь хорошо, даже если для этого потребуется много времени.	1	2	3	4	5

		ЭТО СОВСЕ М НЕ ПОХОЖ Е НА МЕНЯ				Я ИМЕННО ТАКОЙ/ ТАКАЯ
	Мотивация мастерства к математике					
1.	Я упражняюсь в вычислениях, чтобы научиться это делать хорошо.	1	2	3	4	5
2.	Если я не понимаю математическую задачу, то я повторяю свою попытку.	1	2	3	4	5
3.	Если я делаю ошибку в расчетах, я начинаю заново.	1	2	3	4	5
4.	Я бьюсь над математической задачей, пока не пойму ее полностью.	1	2	3	4	5
5.	Я хочу научиться делать вычисления, даже если мне нужно будет много заниматься.	1	2	3	4	5
6.	Я прилагаю все усилия, чтобы решить математическую задачу.	1	2	3	4	5
	Мотивация мастерства к естественным наукам					
1.	Я много наблюдаю за разными вещами и природными явлениями.	1	2	3	4	5
2.	Если меня интересует какое-то природное явление, я задаю себе вопросы и расспрашиваю других, пока не узнаю все о нем.	1	2	3	4	5
3.	Я хочу научиться понимать природу, даже если для этого потребуется много времени.	1	2	3	4	5
4.	Мне интересно, почему день превращается в ночь и наоборот.	1	2	3	4	5
5.	Я ставлю эксперименты, чтобы получить ответы на мои вопросы, связанные с природой.	1	2	3	4	5
6.	Я наблюдаю, как меняется погода.	1	2	3	4	5

		ЭТО СОВСЕ М НЕ ПОХОЖ Е НА МЕНЯ				Я ИМЕННО ТАКОЙ/ ТАКАЯ
	Мотивация мастерства к английскому языку как иностранный язык					
1.	Если я не понимаю предложения на английском, я перечитываю его.	1	2	3	4	5
2.	Если я не могу что-то написать правильно по-английски, я повторяю попытки еще и еще, пока не выучусь.	1	2	3	4	5
3.	Я прилагаю все усилия, чтобы выучить хорошо английский язык.	1	2	3	4	5
4.	Я занимаюсь английским, чтобы выучить его лучше.	1	2	3	4	5
5.	Я повторяю английские слова, пока я их не выучу.	1	2	3	4	5
6.	Я прилагаю все усилия, чтобы говорить по-английски все лучше и лучше.	1	2	3	4	5
	Мотивация мастерства к искусству					
1.	Если мне не нравится мой рисунок, я начинаю заново.	1	2	3	4	5
2.	Хотелось бы рисовать все лучше и лучше.	1	2	3	4	5
3.	Я много занимаюсь рисованием, чтобы научиться это делать	1	2	3	4	5
4.	Я продолжаю рисовать, пока мой рисунок не выглядит красивым.	1	2	3	4	5
5.	Я хочу научиться рисовать хорошо, даже если для этого потребуется много времени.	1	2	3	4	5
6.	Я прилагаю все усилия, чтобы научиться рисовать красиво.	1	2	3	4	5
	Удовольствие от мастерства в школьных предметах					
1.	Я доволен, когда понимаю текст.	1	2	3	4	5
2.	Я доволен, когда у меня получается хорошо спеть песню.	1	2	3	4	5
3.	Я доволен, когда решаю математическую задачу.	1	2	3	4	5
4.	Я доволен, когда понимаю какое-то природное явление.	1	2	3	4	5
5.	Я доволен, когда могу что-то сказать по-английски.	1	2	3	4	5
6.	Я доволен, когда мой рисунок выглядит красиво.	1	2	3	4	5



Appendix C

Ethical Approval

Institutional Review Board
 Doctoral School of Education

6722 Szeged, 30-34 Petőfi S. Av., Hungary
 Phone/fax: +36 62 544-032

Calchei Marcela
 PhD Student: Doctoral School of Education
 Reference number: 19/2018
 Subject: Ethical evaluation of a research project

ETHICAL APPROVAL

The Institutional Review Board (IRB) of the Doctoral School of Education, University of Szeged has recently reviewed your application for an ethical approval (Title of the Research Project: “A study of Mastery Motivation on Moldovan Students”, senior researcher: Prof. Dr. Krisztián Józsa).

This proposal is deemed to meet the requirements of the ethical conducts on social research with human subjects of the Doctoral School of Education, University of Szeged.

IRB decision: approved

Justification: The research project meets the requirements of the professional-ethical criteria of the social research including human subjects within the field of educational science. Participation in data collection is voluntary, the identification of the students is not possible to this research. The students and their parents will be informed about the main goals of the research project. Procedure of the data collection does not harm their privacy law, it does not have an impact on the students' mental or physical health. Data cannot be handled by persons to whom they are not concerned.

In a summary, full ethical approval has been granted.

We wish you all the best for the conduct of the project.

Date: 16th December, 2018



Prof. Dr. Bettina Pikó
 IRB coordinator