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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

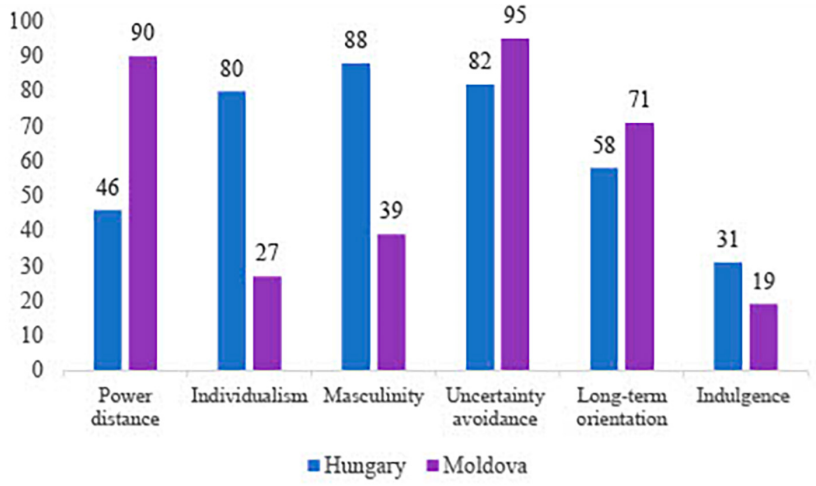

FIGURE 1
Cultural comparison of Hungary and the Moldova according to Hofstede's 6-D model of cultural values (Hofstede, 2018).

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% nineth 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 ΔCFI < 0.01, ΔRMSEA < 0.015, and ΔSRMR < 0.03 (metric MI) or ΔSRMR < 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 standardizes 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

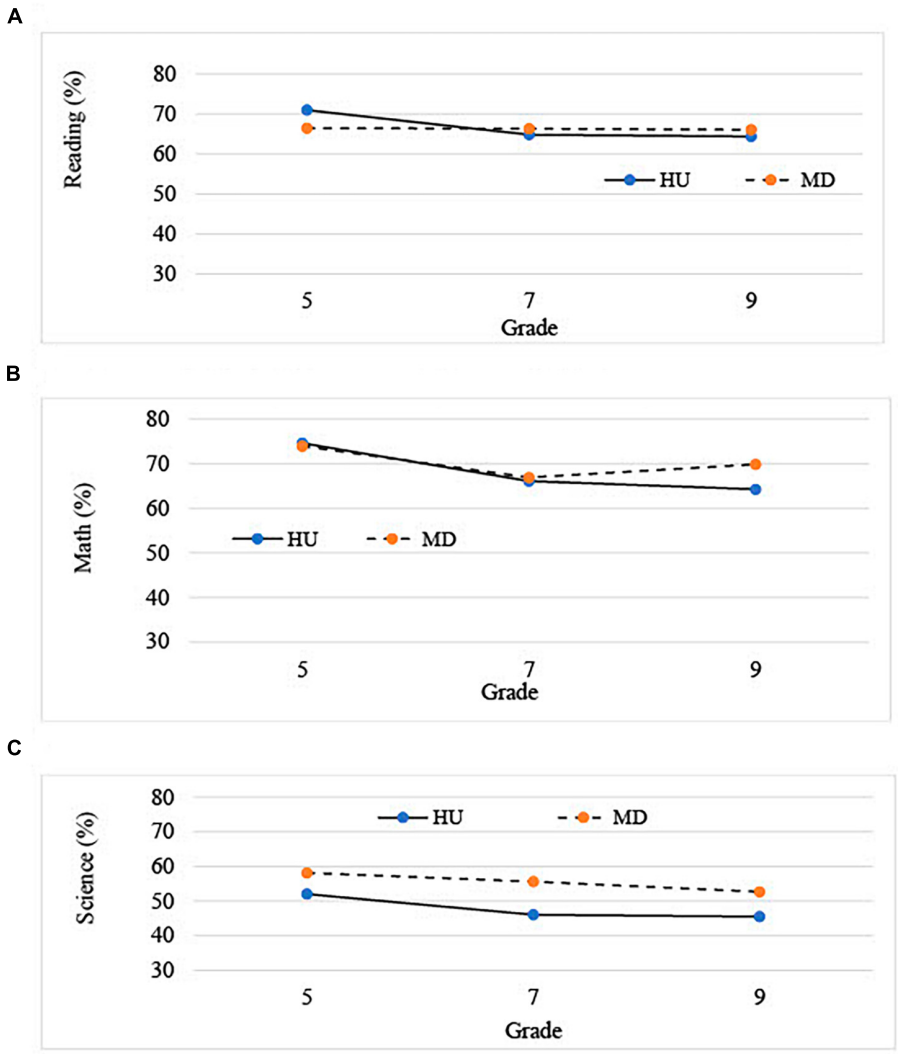

FIGURE 2
Age changes in SSMM for Hungarian and Moldovan students. **(A)** Age changes curves in reading for Hungarian and Moldovan students. **(B)** Age Changes in math for Hungarian and Moldovan students. **(C)** Age changes in science for Hungarian and Moldovan students.

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

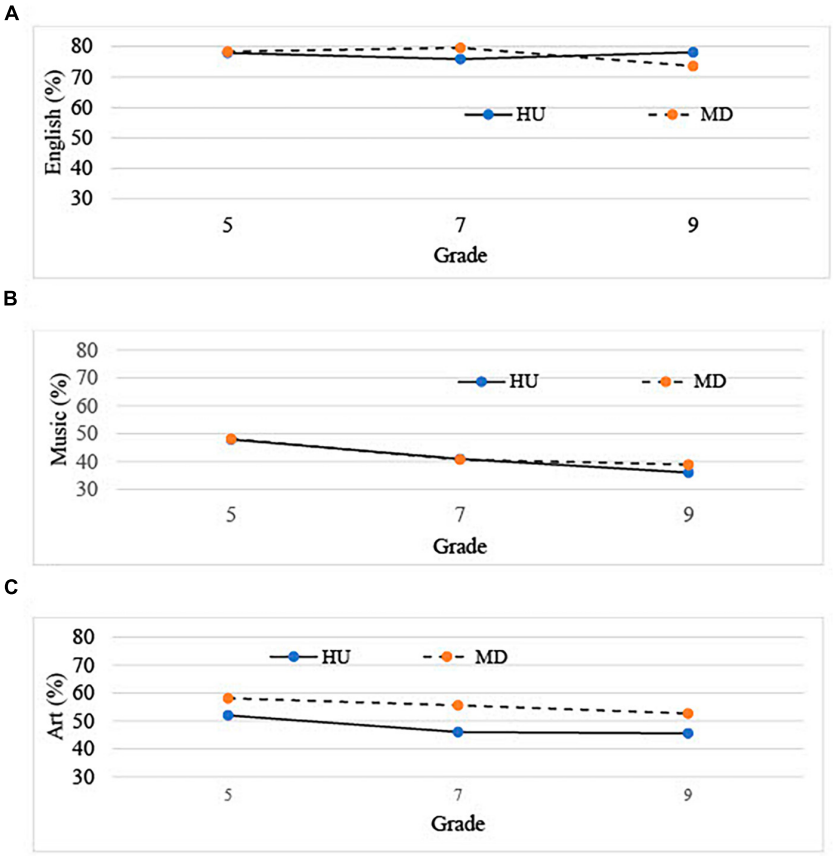

FIGURE 3
Age changes in SSMM for Hungarian and Moldovan Students. **(A)** Age changes in English for Hungarian and Moldovan students. **(B)** Age changes in music for Hungarian and Moldovan students. **(C)** Age changes in art for Hungarian and Moldovan students.

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 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.

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**	

**$p = 0.01$.

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, jozsa@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.

Publisher's note

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