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ACHIEVEMENT EMOTIONS AND MOTIVATION TOWARDS MATHEMATICS IN PRIMARY SCHOOL STUDENTS – THE PORTUGUESE AND SERBIAN REALITY

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Resumo

As emoções e a motivação são relevantes para o desempenho dos alunos, e indissociáveis do contexto académico, sofrendo influências de características individuais dos alunos, como idade, género ou cultura. Assim, este estudo teve como primeiro objetivo compreender como o país e o ano de escolaridade influenciam as emoções e a motivação na matemática. Em segundo lugar, visou-se identificar diferentes perfis relativos às emoções de realização dos alunos e compreender como estes se relacionam com o desempenho e a motivação dos alunos para a matemática. Procurou estudar-se as diferenças na distribuição dos alunos nos diferentes clusters, com base no país, género e ano de escolaridade.

Participaram neste estudo 1632 alunos sérvios e portugueses, que frequentavam entre o 3º e o 6º ano do ensino básico, e responderam ao Achievement Emotions Questionnaire - Elementary School e à Math Motivation Scale. Os resultados mostraram diferenças significativas nas emoções e motivação dos alunos, com base no país e ano de escolaridade.

A análise de clusters diferenciou vários clusters relativos às emoções académicas dos alunos. O Grupo de Alunos com Prazer parece ser o mais adaptativo, com níveis mais elevados de motivação e desempenho. Inversamente, o Grupo de Estudantes Aborrecidos e Ansiosos exibiu os níveis mais baixos de motivação e desempenho a matemática. A distribuição dos alunos nos clusters mostrou depender do sexo, do ano escolar e do país dos alunos.

Os resultados são discutidos dentro das teorias de expectativa-valor e controlo-valor. Implicações práticas e limitações do estudo são consideradas, e direções futuras são sugeridas.

Palavras-chave: Matemática, emoções, motivação.

Abstract

Emotions and motivation are important variables that are indissociable from the academic environment, and suffer an influence from students' characteristics, such as age, gender or culture. Firstly, this study aimed at understanding how country and school grade influence emotions and motivation in mathematics. Secondly, it aimed at identifying different profiles pertaining to students' emotions, understand they relate to achievement and motivation, and study differences in the distribution of students across the different clusters, based on country, gender and school grade.

Participants were 1632 Serbian and Portuguese students from grades 3 to 6, who responded to the Achievement Emotions Questionnaire – Elementary School, and the Math Motivation Scale. Results showed significant differences on both students' emotions and motivation, based on their country and school grade

Cluster analysis differentiated various clusters pertaining to students' achievement emotions. The Joyous Students Group seems to be the most adaptive, obtaining higher scored on motivation and achievement. Inversely, the Bored and Anxious Students group displayed the lowest levels motivation and achievement. Students distribution across the clusters showed to be dependent of students' gender, school grade and country.

Results are discussed within the expectancy-value and control-value theories. Practical implications as well and limitations of the study are considered, and some future directions are provided.

Keywords: Mathematics, emotions, motivation.

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Mathematics continues to emerge as one of the subjects in which students, at a global level, present greater difficulties – specifically, it has been estimated that about 20% of the student population presents some type of difficulty in learning the subjects taught in mathematics (Aunio, Mononen, & Laine, 2015).

Regarding the Portuguese reality, according to the report of the Directorate General of Statistics of Education and Science (DGEEC, 2017) mathematics shows the highest percentage of student failure during middle school. More recently, the OECD report (2016) pointed out that Portuguese students did not show significant improvements in math results, compared to the results obtained in 2012, remaining below the average of the other countries. A similar pattern is presented in Serbia, where students present a significantly lower performance, when compared to the average OECD performance (OECD, 2016).

In fact, a number of difficulties have been identified in mathematics, such as difficulties relating to number sense (Baroody 2009), visual-spatial and information skills (Tambychika, & Meerah, 2010). Moreover, many difficulties are revealed not only by students with low academic performance, but also by students who present a medium or high academic performance in the other school disciplines (González-Pienda et al., 2002, as cited in González-Pienda et al., 2006). Various authors (e.g., Wu, Willcutt, Escovar, & Menon, 2014) have demonstrated that students generally perceive math as a complex subject, reporting feelings of anxiety during math-related tasks.

Considering, on the one hand, the above described difficulties and, on the other, the importance attributed to mathematics in developing students' decision-making and judgment-making powers (OECD, 2016), understanding the various variables that may be related to the failure of this discipline plays an important role in developing better intervention programmes (Schukajlow, Rakoczy & Pekrun, 2017). Indeed, authors such as Aunio and collaborators (2015) point out that there are several dimensions related to mathematical skills and performance that begin to be developed as early as the first years of school, making it essential to understand the variables involved in poor academic performance to mathematics. In this study, we aimed to understand, specifically, the affective-motivational variables involved in the learning of mathematics, in both Portugal and Serbia.

Emotions

Emotions represent a central dimension of the human being, and affective experiences are a constant in an individual's life. According to Schutz, Hong, Cross and Osbon (2006), emotions are built socially and contextually, representing ways of being in the world. Emotions

have been defined as a subjective state of discrete nature, which arise in response to a specific event or object (Frijda, Kuipers, & ter Schure, 1989), and which tend to be accompanied by a physiological response and an evaluative judgment, before a given event. The authors have also added that emotions tend to influence or produce some action or behavior.

In addition, some investigations have also shown that emotions play an important role in areas such as motivation, cognition and learning (e.g., Izard, Stark, Trentacosta, & Schultz, 2008). Emotions thus appear to be a variable of interest in educational contexts, as these appear to be contexts that trigger various emotions (Meyer, & Turner, 2006) and that emotions arise as a variable involved in most teaching and learning processes (Schutz, & Lanehart, 2002).

Moreover, the various emotions experienced influence the way the students live their school life, since the learning environment experienced by a student who is in a positive affective state is substantially different from that experienced by a student who is in a negative affective state (e.g., Pekrun, 2009). Hence, it becomes fundamental to understand the nature of emotions in the school context, since this understanding can also prove to be helpful in the development of different teaching methods, targeting students with specific mathematics difficulties (Wu et al., 2014).

However, despite the variety of emotions experienced in these contexts, most of the research carried out in the context of the emotions associated with mathematics has been focused on anxiety and its impact on student performance, leaving aside the remaining emotions experienced by the students (Peixoto, Sanches, Mata, & Monteiro, 2017; Pekrun, 2006, 2009). In part, the absence of a greater focus may be due to the fact that positive emotions exist in fewer number, while being more difficult to observe and differentiate (Valiente, Swanson, & Eisenberg, 2012).

In recent years, the importance of studying the emotions experienced by students in the academic context, as well as the relationship they have with other variables, such as student motivation (Pekrun, Elliot, & Maier, 2009) has increased. Authors such as Pekrun, Frenzel, Goetz and Perry (2007) argued that, according to literature on motivation, pleasure for learning would arise associated with the students' intrinsic and extrinsic motivation. Pekrun et al. (2006) reported that there is an association between the perceptions of competence and the different emotions experienced by a student, thus demonstrating the importance of studying other emotions besides anxiety. Also, Lichtenfeld, Pekrun, Stupnisky, Reiss and Murayama (2012) argue that emotions play an important role in motivation, learning, performance and even the well-being of students.

In addition, gender and grade differences have been studied in relation to the emotions experienced in an educational context. As for gender differences, boys tend to have more positive emotions than girls, while girls have higher levels of negative emotions (Frenzel, Pekrun, & Goetz, 2007). As far as school grade is concerned, it has been possible to observe that positive emotions tend to decrease as students progress in schooling (Mata, Peixoto, Monteiro, & Sanches, 2017). A particularly steep decline has been reported in the transition from primary to secondary school (e.g., Hagenauer, & Hascher, 2010). When trying to understand these results, Pekrun, Frenzel et al. (2007) suggest that students might perceive school as allowing for less autonomy, which, in turn, reduces positive emotions.

Finally, since, as mentioned by Pekrun (2006), emotions arise in a specific context, differences in the different learning contexts have also been studied - for example, it has been noticed that tests tend to triggering more negative emotions such as anxiety (Goetz, Frenzel, Pekrun, Hall, & Ludtke, 2007), when compared to performing homework, or with the classroom context.

As far as academic achievement is concerned, research has shown that positive emotions, such as pleasure, tend to have a positive association with performance levels, while negative emotions, such as anxiety, arise associated with levels of negative performance (e.g., Pekrun, 2009). However, not all emotions establish similar relationships with academic achievement, nor for the same reasons, therefore, in order to understand how emotions reflect in student performance, specific definitions of positive and negative emotions are needed (Valiente et al., 2012).

Considering the variety and specificity of emotions experienced in contexts of achievement, such as in the educational context, Pekrun (2006) proposed a theoretical model that sought to understand the role of emotions in the educational context. Control-value theory of emotions (CVT) considers emotions as multidimensional, suffering influences from affective, cognitive, motivational, expressive and physiological variables simultaneously. It also argues that learning contexts influence two components of cognitive appreciation – subjective control and subjective value – that contribute to the development of achievement emotions.

Subjective control seeks to encompass cognitive aspects related to control, such as expectations for self-efficacy and causal attributions of outcomes. The subjective value refers to the perceived value of the actions performed and their results. In this way, the model refers to the beliefs that an individual has about his or her competence in a given task and to the intrinsic and extrinsic value that the task has for itself, indicating that the emotions are a product of the two components explained.

Additionally, the theory classifies emotions according to three axes. Object focus refers to the fact that the focus of the emotion experienced may be on the activity performed or on the subsequent result that may result from the activity; valence, which refers to the fact that the emotions may be negative or positive; and degree of activation, with emotions being classified as activating or deactivating.

Positive activating emotions (e.g., enjoyment, pride) could thus foster interest and motivation for learning, making cognitive resources necessary to succeed in a task more accessible to students. Negative deactivating emotions (e.g., annoyance, discouragement) will diminish the interest and motivation of a student. Negative activating emotions (e.g., anxiety), on the other hand, tend to be pointed out as being negatively associated with student performance, for example, reducing intrinsic motivation.

Motivation

Motivation has often been pointed out as a variable associated with learning and overall school performance (Broussard, & Garrison, 2004) and specifically with student performance in mathematics (e.g., Pintrich, Smith, García, & McKeachie, 1993; Skaalvik, Federici, & Klassen, 2015). However, the relationships established between this variable and variables such as performance or emotions are not yet clear. In the case of performance, some studies suggest that motivation and academic performance have a two-way relationship (Ryan, & Deci, 2000), while others demonstrate that performance predicts student motivation (e.g., Garon-Carrier et al., 2015).

When investigating achievement, some studies suggest that motivation and academic performance have a two-way relationship (Ryan & Deci, 2000), while others demonstrate that performance predicts student motivation (e.g., Garon-Carrier et al., 2015).

The impact of gender and school grade has also been studied in the area of motivation for mathematics. Thus, authors such as Eccles, Wigfield, Harold and Blumenfeld (1993) report that the boys' competence perception regarding math is superior to that of girls, and therefore their expectation of success in math-related tasks is also superior. Girls, on the other hand, tend to report more concern about having worse math results. Regarding school year, literature has shown that the motivation for mathematics tends to decrease as students' progress in their schooling (e.g., Chouinard & Roy, 2008).

Given the importance of motivation in the educational context, theories have emerged that seek to explain the factors that influence a person's involvement in a given task. One of these theories is the expectancy-value theory (Eccles, 2006; Wigfield, & Eccles, 2000), which

theorizes that the performance, choices and involvement of an individual in a particular activity are influenced by their beliefs about how successful they believe they can be in the task (expectancy) and how they value this same activity (Wigfield, & Eccles, 2000). In turn, these expectancy beliefs are influenced by various factors, including parents' and teachers' beliefs and behaviors, previous experiences or the cultural background in which the student was raised (Wigfield, Tonks, & Lutz Klauda, 2009). More specifically, the value of the task can be conceptualized according to four axes - achievement value, intrinsic value, utility value and cost.

Achievement values refer to the subjective and personal importance of obtaining a good result in a given task, with the same task as an opportunity to express aspects of the real self, as is the case of competence in the task domain. Intrinsic value or interest, on the other hand, relates to the enjoyment or satisfaction that the individual obtains from accomplishing a certain task; it may also refer to the subjective interest that the individual experiences regarding a specific subject. Utility value, in turn, is determined by how the task relates to current and future goals, such as career-related goals. A task can have a positive value for someone because it brings a great insight on important future goals, even if the person is not interested in the task itself (Eccles, 2006; Eccles, & Wigfield, 2002). Finally, cost is conceptualized in terms of the negative aspects related to task involvement, such as performance-related anxiety and fear of both success and failure, as well as the amount of effort required to be successful and the lost opportunities that result from one choice over another (Eccles, & Wigfield, 2002).

Thus, in the present study, motivation will be conceptualized according to the theoretical framework described above. The dimensions related to the perceived competence in mathematics, the utility attributed to it, the perceived costs and the intrinsic interest in mathematics will, therefore, be taken into account.

The present study

Research has revealed that there are several variables in action in the educational context. Authors such as Singh, Granville, and Dika (2002) have demonstrated, for the specific case of mathematics, that there are several factors that influence student performance. The same authors also emphasize that these factors might not even be directly related to the students, but to the family or to the school context. Given the importance of studying these variables in a specific context, several studies have investigated the affective-motivational variables related to learning mathematics (e.g., Pekrun, 2006; Wigfield, & Eccles, 2000).

Most studies, however, have only considered a variable-centered approach by studying associations between the variables considered (i.e., achievement emotions, motivation, and

mathematics achievement). Moreover, although some studies in the area of motivation have assumed a person-centered approach (e.g., Hayenga, & Henderlong Corpus, 2010), research applying this approach to the study of achievement emotions is still scarce. Thus, the present study aims at using both a variable and a person-centered approach in order to understand how emotions relate to other variables in an academic context.

This would allow to understand which profiles of academic emotions are more adaptive in an academic context. In addition, authors such as Roeser, Eccles, and Sameroff (1998) point out that a person-centered approach offers the opportunity to outline future interventions that take into account the individual needs of groups of individuals with different psychological profiles.

In addition, since cultural context has also been shown to influence students' achievement emotions (e.g., Frenzel, Thrash, Pekrun, & Goetz, 2007), and some motivation goals (e.g., Dekker, & Fischer, 2008), this study intends to investigate differences between students from two different countries, Portugal and Serbia.

More specifically, the main objectives of this study are to (a) understand how country and school grade influence achievement emotions and motivation towards mathematics, (b) identify different profiles pertaining to students' achievement emotions, (c) understand how the different students profiles relate to math achievement and motivation, (d) study differences in the distribution of students across the different clusters, based on their country, gender and school grade.

Thus, in line with the main goals, the following hypotheses are put forward:

Hypothesis 1: We expect to find a negative effect of school grade on students' positive emotions, and a positive effect of school grade on negative emotions, which would be in line with the fact that positive emotions tend to decrease, as the opposite tends to happen with negative emotions, as students grow older (e.g., Mata et al., 2017; Hagenauer & Hascer, 2010).

Hypothesis 2: It is also expected that school grade will present a negative effect on students' motivation. Specifically, competence self-beliefs would decrease, as well as intrinsic and extrinsic motivation (González-Pienda et al., 2006; Wigfield et al., 2009). When it comes to costs, however, a prediction regarding the direction of this effect is harder to make, since cost has been the least studied motivation component (Eccles, & Wigfield, 2002).

Hypothesis 3: Considering the aforementioned cultural differences, regarding emotions (e.g., Frenzel, Thrash et al., 2007), it is also expectable to find some differences between the

two countries, although the direction of those differences is uncertain, especially because literature on cultural differences on achievement emotions is still scarce.

Hypothesis 4: Similarly, since cultural differences have also been raised regarding students' motivation (Dekker, & Fischer, 2008), differences are expected to show up between Portugal and Serbia. Again, since literature still lacks studies on cultural differences regarding students' motivation (Flake, Kenneth, Hulleman, McCoach, & Welsh, 2015; Wigfield et al., 2009), the direction of these effects is hard to predict.

Hypothesis 5: We expect to find different profiles, in which positive emotions show up in an opposite direction to negative emotions. This results would be in line with previousstudies from authors such as Pekrun et al. (2009), or Goetz et al. (2006) who report a negative correlation between positive and negative emotions.

Hypothesis 6: Cluster membership is expected to produce an effect on students' motivation, with clusters presenting high levels of positive emotions presenting higher levels of motivation, and clusters with high levels of boredom presenting low levels of motivation. This would be in line with the work of authors such as Lichtenfeld et al. (2012), who have reported a positive correlation between motivation and positive emotions, and a negative correlation between motivation and negative emotions.

Hypothesis 7: Considering that authors such as Mega, Ronconi and De Beni (2014), and Pekrun et al. (2009) reported a positive association between positive emotions and student performance, and that Ganotice, Datu and King (2016) have found students in clusters presenting higher levels of positive emotions to present higher mathematics achievement, cluster membership is expected to produce an effect on students achievement.

Lastly, as mentioned above, this study also aims at studying differences regarding gender, country and school grade in the clusters constitution. However, since there isn't a clear indication on what clusters might emerge, this study aim will remain as an open question.

Method

Sample

This study comprised 1632 students (810 boys, 811 girls) from grade 3 to 6, from Portuguese and Serbian schools. The students were selected following a convenience sampling method. The Portuguese sample included both public (52.6%) and private (47.4%) institutions, whereas the Serbian sample contemplated students from the public school. Students' age ranged from 8 to 14 years (M_{age}=10.62, SD=1.33). The distribution of students' grade and gender across the two countries is presented in Table 1.

Table 1

Students' distribution by grade and gender across Serbia and Portugal.

	Portugal		Serbia		Total	
	Girls	Boys	Girls	Boys	Girls	Boys
Grade 3	76	98	78	85	154	183
Grade 4	95	93	72	82	167	175
Grade 5	95	106	123	127	218	233
Grade 6	147	105	125	114	272	219

Procedure

After obtaining the authorization from the Directorate-General for Education – in Portugal –, the schools were contacted, in order to obtain the authorization of the educational institutions to carry out the study. Letters of informed consent were also sent to the students' tutors, in order to obtain permission for their children to take part in the research. Through this process, the objectives of the study were further clarified and the voluntary nature of participation in the research was assured.

Instruments were applied to each class individually, and all data was collected by a trained researcher inside the classroom, and the questionnaires were delivered on paper. This application was carried out only once, during the 3rd term. The application of the two questionnaires lasted approximately 40 minutes. All the participants were informed of the volunteer nature of their involvement. Confidentiality and anonymity were assured.

Although the questionnaires must be carried out individually by each student, whenever it was considered necessary, the items were read aloud, to the class or to some students

individually. Whenever possible, the teachers were also requested not to be present, so that they would influence the students' responses as little as possible.

The two questionnaires were applied alternately among the different classes, in order to counterbalance eventual order effects. Finally, data were analyzed using the SPSS Statistics software (v.25 SPSS, Chicago IL), as well as the MPLUS (v.8.2).

Measures

Motivation. In order to assess students' motivation towards mathematics, *Math Motivation Scale* (MMS; Peixoto, Mata, Radisic, Baucal, Laine, & Mononen, 2017) was used. This scale comprises 33 items, organized in four separate factors: (a) Intrinsic value, composed by 7 items (e.g. "I like doing math"); (b) Utility value, composed by 6 items (e.g., "I really want to do well in math. Math is important"); (c) Competence Self-Beliefs, composed by 6 items (e.g., "I am no good in math.") and (d) Costs, composed by 5 items (e.g., "I have to give up too much to do well in math.").

The MMS is 4-point scale (1 = *Many times*, 4 = *Never*); some of the items are, however, negatively-worded. The results are computed separately for each dimension and should be reported as a mean or a sum. Higher values indicate higher levels of motivation, with the exception of the Costs dimension, where higher scores would indicate lower levels of motivation. This scale has also presented acceptable reliability values (Guilford; Nunnally, as cited in Kline, 2000), with Cronbach's alpha ranging from .72 to .90.

Emotions. In order to assess students' achievement emotions, *Achievement Emotions Questionnaire - Elementary School* (AEQ-ES; Lichtenfeld et al., 2012) will be used. This 5-point Likert-type scale (1= Not at all, 5=Very much) comprises 28 items, organized in 3 separate dimensions, Enjoyment, Boredom and Anxiety. Enjoyment comprises 8 items (e.g., "Math is fun for me"), Boredom comprises 7 items (e.g., "Math homework bores me to death") and Anxiety comprises 13 items (e.g., "I am so nervous during a math test that I cannot remember properly what I have learned."). This scale has also reported good reliability indexes, with Cronbach's alpha ranging from .75 to .95 (Pekrun, Lichtenfeld, Killi, & Reiss, 2007).

The scale applied to the students from grade 3 and 4 included a graphical representation of the emotions they intend to evaluate, together with the items. The results of this scale can be calculated for each of the emotions using a mean or a sum – in this case, higher values in each dimension reveal that this emotion is experienced in a greater degree.

Achievement. Math performance was evaluated using the grades assigned by the teachers at the end of the 2nd term. Students attending grade 5 and 6 were asked to complete a field related to their performance in mathematics, with the mark obtained in mathematics. In the case of students attending grade 3 and 4, this field was completed by the teachers at the end of the application of the questionnaires. It should also be clarified that the mark of each school grade was transformed into a z-score, based on the mean and standard deviation referenced to each class.

Additionally, a socio-demographic questionnaire was paired with the scales, requiring students' age, gender, school and school grade of each child (Appendix B).

Data analysis

Firstly, in order to validate the AEQ-ES structure, a cross-validation analysis was carried out. The total sample was randomly split in two (50% of the participants in each part), while assuring that each part had a similar number of participants from each country. Comparison analysis were also run, in order to certify that no significant differences existed between the two samples, regarding gender, age and math achievement.

An exploratory factor analysis was then carried out in the first half, with maximum likelihood as an extraction method, and direct oblimin rotation. Using the obtained scale structure, a confirmatory factor analysis was conducted in the second half.

Goodness of fit was evaluated recurring to the comparative fit index (CFI), the Tucker-Lewis index (TLI), the model chi-square (χ^2), as well and the root mean square error of approximation (RMSEA). A value of .90 was considered as the threshold for CFI and TLI (Kline, 2011), and $\leq$.08 was used for RMSEA (Brown, & Cudeck, 1993).

Additionally, invariance analysis for both country and grade were run. In this way, we tested whether different factors were measured similarly for both Portuguese and Serbian students, and for students from all four grades. When testing for measurement invariance, a similar procedure to the one described by Putnick and Bornstein (2016) was followed.

Therefore, we firstly calculated the equivalence of the model form (configural invariance), followed by the equivalence of factor loadings (metric invariance) and, lastly, the equivalence of item intercepts (scalar invariance). The WLSMV estimator was used, in view of the fact that ML isn't considered appropriate for ordinally scaled variables (Bollen, 1989), while MLSMV is designed to specifically address ordinal data (Li, 2016). Furthermore, WLSMV computes structural coefficients, robust standard errors and factor loadings in a more accurate

way, generally yielding a better fit for most indices, when compared to WLSM (DiStefano, & Morgan, 2014).

Invariance was first tested with the χ^2 difference. However, it has been pointed that, due to a sensitivity to sample size, when testing for invariance in large samples, the χ^2 difference can yield significant results, even if that's not the case (e.g., Bentler, & Bonett, 1980). Therefore, as proposed by Cheung and Rensvold (2002), the CFI and TLI differences were used to evaluate the decrease of model fit; similarly, RMSEA differences were also used (Chen, 2007). In this regard, RMSEA differences ≤.015, CFI differences ≤.010, and TLI differences ≤.010 were considered acceptable (Chen, 2007)

The invariance analysis, as well as sensibility and reliability analyses (i.e., Cronbach's alpha) were run with the total sample.

After the structure of the scale was set, a multivariate analysis of variance (MANOVA) was used to investigate the country and grade main effects on emotion and motivational dimensions, as well as an interaction effect of country and grade on the same variables. Subsequently, to ascertain which means vary across the four grades, a post-hoc test (i.e., Tukey LSD) was used. Effect sizes were found using partial eta squared (η^2_p).

The data were also analyzed using a cluster analysis, so as to obtain students' profiles regarding the emotional variables. The different student profiles were determined based on the levels of each emotion. Prior to the cluster analysis, emotion scores were standardized.

The methodology followed in the cluster analysis was in line with the one proposed by Hair, Black, Babin and Anderson (2010). Firstly, with a hierarchical classification being followed by a non-hierarchical classification method, in order to decide the number of clusters to retain. Therefore, firstly, the squared Euclidean distance was used as a dissimilarity index, and Ward's method was used as an agglomerative hierarchical clustering method. Secondly, an analysis was carried out, using K-means. In order to decide the number of clusters to retain, both the dendogram and the coefficient scree plot, obtained from the agglomeration schedule, were analyzed.

An analysis of variance (ANOVA) was then run, to study the effect of the obtained profiles on mathematics achievement and motivation. A post hoc test (Tukey) was afterwards performed, to determine the clusters involved in statistically significant differences. Finally, a chi-squared (χ^2) test was used, in order to analyze differences in the students' distribution across the different clusters.

The data analyses were run using the SPSS statistical package (v.25; IBM SPSS, Chicago IL), as well as MPlus (v.8.2, Muthén, & Muthén, 1998-2012).

Results

Validation of the AEQ-ES

As mentioned above, in order to validate the structure of the AEQ-ES, a cross-validation procedure was followed. Firstly, the sensitivity of the items was analyzed. All the items had answers in every category, and the asymmetry index was lower than the module of 3 and the kurtosis index was lower than the module of 7 – therefore, it is possible to state that the items present a normal distribution (Kline, 2011).

Table 2

EFA (Direct Oblimin rotation) factor loadings of AEQ-ES items.

	Fact. 1	Fact. 2	Fact. 3	Fact. 4
Aeq21 – Math homework bores me to death.	,877		-,626	
Aeq15 – I find Math Class so boring I'd rather do something else.	,871		-,636	
Aeq24 – Math homework bores me so much that I don't want to keep doing it.	,869		-,594	
Aeq12 – I find doing math boring.	,858		-,673	
Aeq2 – Math class bores me.	,843		-,671	,408
Aeq8 – Math class annoys me.	,825		-,589	,491
Aeq29 – When I do math homework, I get tired quickly because I am bored.	,784	,429	-,553	
Aeq40 – I get very nervous during math tests.		,839		,550
Aeq41 – When I take a math test, I am afraid of doing poorly.		,806		,476
Aeq38 – I am so nervous during a math test that I cannot concentrate properly.	,426	,798	-,416	,557
Aeq34 – I am so nervous during a math test that I cannot remember properly what I have learned.	,425	,777		,547
Aeq42 – When I take a math test, I am afraid of getting a bad grade.		,755		,417
Aeq37 – Math tests scare me so much that I would rather not take them.	,494	,706	-,452	,567
Aeq25 – When I do math homework, I worry if I will ever understand it		,584		,555
Aeq17 – I enjoy doing math.	-,684		,865	
Aeq5 – I look forward to math class.	-,701		,856	
Aeq10 – Math is fun for me.	-,708		,851	
Aeq1 – I enjoy math class.	-,666		,829	
Aeq20 - When I do math homework, I am in a good mood.	-,643		,790	
Aeq26 – I enjoy math homework so much that I don't want to stop.	-,567		,782	
Aeq35 – I look forward to math tests.	-,504		,761	
Aeq32 – During a math test, I think "This is going great!"		-,469	,580	
Aeq6 – When I think about math class, I get nervous.		,493		,782
Aeq3 – Math scares me.		,509		,743
Aeq13 – During math class, I worry that everything is too difficult for me.		,643		,658
Aeq9 – When I think about math class, my stomach feels upset.				,643
Aeq22 – I worry so much about not finishing my math homework that I start sweating.		,428		,480

Considering that the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) presented a value of .97 (≥.7) and that Bartlett's Test of Sphericity presented a significance value ≤.05, an exploratory factor analysis was then run (Appendix C). According to the eigenvalue rule and the analysis of the scree plot, it was possible to conclude the existence of four different factors, explaining 69,5% of the total variance.

Factor 1 mostly grouped the items relating to boredom, factor 2 grouped the items related to test anxiety factor 3 groups the items related to enjoyment; and factor 4 groups all the items related to anxiety in the classroom and during homework tasks. Item 28, however, showed similar factor loadings in factors 1, 2 and 4, so it was decided to exclude it. The results of the EFA on the remaining items are presented in Table 2.

Additionally, descriptive statistics and reliability analysis were also run on the obtained scale results (Appendix D). Skewness and kurtosis suggest that all the dimensions are normally distributed. Reliability analysis also produced acceptable results, with Cronbach's Alpha ranging from .829 to .948 (Table 3).

Considering that the factor loadings could be considered somehow ambiguous, two separate confirmatory factor analysis were then run on the second half on the sample – the first confirmatory factor analysis was run on a four emotions model, considering the 4 factors proposed by the exploratory factor analysis, and the second confirmatory factor analysis, considering two separate factors: one factor that grouped the items loading in both factors 1 and 3, and the other joining the items that loaded in factors 2 and 4. As presented in Table 4, all goodness-of-fit indexes suggest a better fit in the four emotions model.

Table 3

Descriptive statistics and reliability of the AEQ-ES dimensions.

	M	*SD*	*Med*	Skewness	Kurtosis	α
Boredom	2.317	1.179	2.00	.783	-.516	.948
Enjoyment	2.886	1.104	2.875	.165	-.953	.933
Test Anxiety	2.496	1.151	2.333	.535	-.806	.912
Anxiety	1.821	.783	1.667	1.421	2.067	.829

Table 4

Goodness-of-Fit Indexes for the Models Tested.

	χ^2	*df*	*p*	TLI	CFI	RMSEA
2 Emotions Model	5391.589	323	≤.001	.95	.95	.1
4 Emotions Model	2122.198	318	≤.001	.96	.97	.08

As aforementioned, when measuring invariance in the four emotions model, Chen (2007) recommendations were followed. Hence, a RMSEA differences ≤ .015, and CFI differences ≤ .010 were considered as thresholds (Chen, 2007). As showed in table 5, regarding country invariance, the tests of the configural, metric and scalar model suggest a good fit, with TLI, CFI and RMSEA showing acceptable values; additionally, the differences between the values of RMSEA and CFI support scalar invariance.

Table 5

Three levels of invariance measurement regarding country.

	χ^2	*df*	*p*	TLI	CFI	ΔCFI	RMSEA	ΔRMSEA
Configural	1493.784	636	≤.001	.980	.982	-	.057	-
Metric	1529.157	659	≤.001	.980	.982	.000	.057	.000
Scalar	1622.863	736	≤.001	.982	.981	.001	.054	.003

Regarding school grade invariance, as showed in table 6, the tests of the configural, metric and scalar model all suggest a good fit, with TLI, CFI and RMSEA showing values within the acceptable range; RMSEA, and CFI differences also fall in the acceptable value, therefore supporting scalar invariance.

Table 6

Three levels of invariance measurement regarding school grade.

	χ^2	*df*	*p*	TLI	CFI	ΔCFI	RMSEA	ΔRMSEA
Configural	2234.369	1290	≤.001	.98	.99	-	.04	-
Metric	2347.992	1359	≤.001	.99	.99	.00	.04	.00
Scalar	2535.320	1590	≤.001	.99	.99	.00	.04	.00

Effect of school grade and country on students' achievement emotions and motivation

MANOVAs were used to analyse the effects of school grade and country over the different motivation and emotion dimensions, followed by a *post-hoc* test (i.e., Tukey HSD). The analysis revealed a statistically significant interaction effect of country and grade on both students' achievement emotions (Figure 1), Pillai's Trace=.060; $F(12,4818)=8.126$; $p\leq.001$, $\eta^2_p=0.020$, as well as on students' motivation, Pillai's Trace=.034; $F(12,4869)=24.668$; $p\leq.001$, $\eta^2_p=0.092$ (Figure 2; Appendix F).

Interaction effects between country and grade were significant for enjoyment, $F(3,1607)= 8.841$; $p\leq.001$, $\eta^2_p=0.016$, for boredom, $F(3,1607)= 6.869$; $p\leq.001$, $\eta^2_p=0.013$, for anxiety, $F(3,1624)= 4.775$, $p=.003$, $\eta^2_p=0.009$, and for test-anxiety, $F(3,1624)= 3.804$, $p=.010$, $\eta^2_p=0.007$. Regarding motivation, the interaction effects between country and grade was significant for utility value, $F(3,1624)= 3.131$, $p=.025$, $\eta^2_p=0.006$, competence self-beliefs, $F(3,1624)= 4.463$, $p=.004$, $\eta^2_p=0.008$, and costs, $F(3,1624)= 2.091$, $p=.006$, $\eta^2_p=0.008$

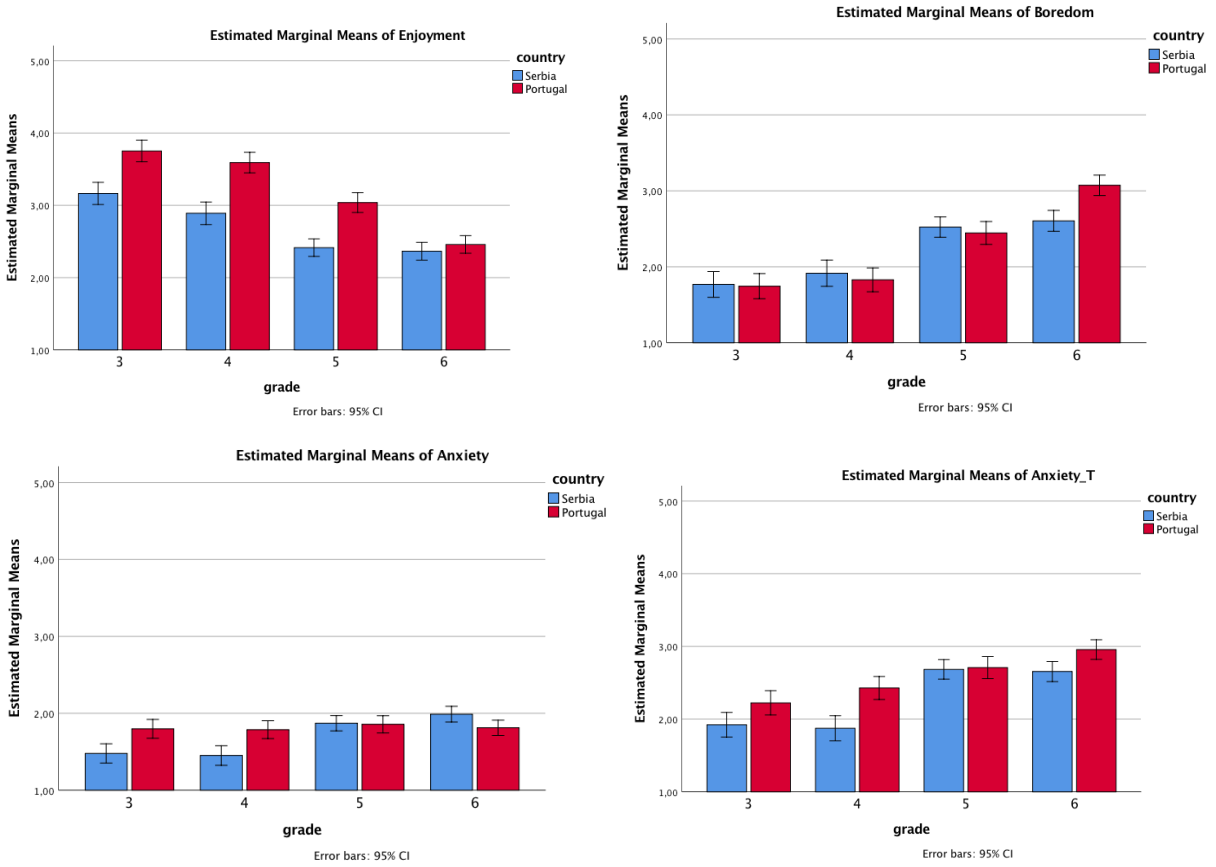

Figure 1. Interaction effect of country and grade on enjoyment, boredom, anxiety and test anxiety.

A main effect of both grade, Pillai's Trace=.177; $F(12,4818)=25.225$; $p\leq.001$, $\eta^2_p=0.059$, and country, Pillai's Trace=.198; $F(4,1604)=99.147$; $p\leq.001$, $\eta^2_p=0.198$, was also found on students' achievement emotions.

The effect of school grade affects all emotions, with a decrease in enjoyment as school grade increases, $F(3,1607)=93.198$, $p\leq.001$, $\eta^2_p=0.148$, and an increase in boredom, $F(3,1607)=88.934$, $p\leq.001$, $\eta^2_p=0.142$, although without differences between 3rd and 4th graders. Regarding anxiety, mean differences were statistically significant between primary and middle school students, with 5th and 6th graders showing higher levels of anxiety, when compared to 3rd and 4th graders, $F(3,1607)=31.969$, $p\leq.001$, $\eta^2_p=0.056$. Finally, test anxiety showed an identical pattern to anxiety, $F(3,811)=45.304$; $p\leq.001$, $\eta^2_p=0.078$.

Country, on the other hand, only presents a significant effect on enjoyment, $F(1,1607)=100.534$, $p\leq.001$, $\eta^2_p=0.059$, and on test anxiety, $F(1,1607)=28.243$, $p\leq.001$, $\eta^2_p=0.017$, with Portuguese students revealing higher levels of both emotions.

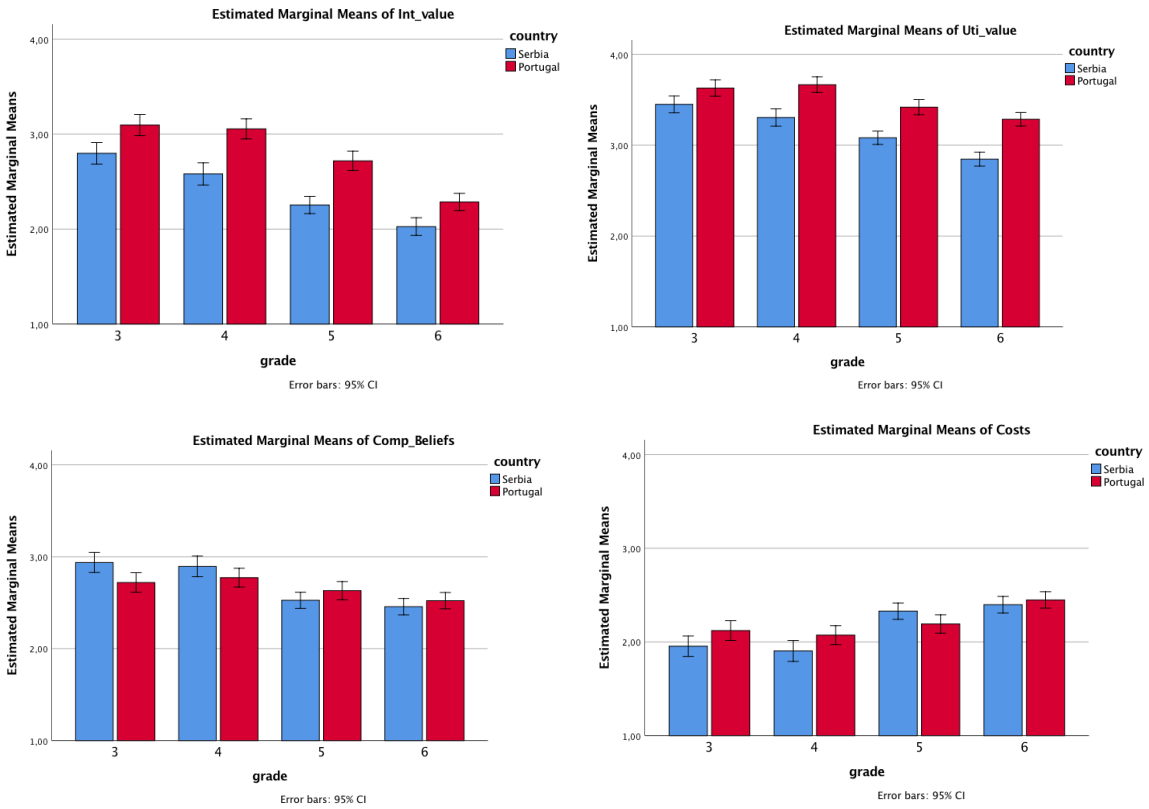

Figure 2. Interaction effect of country and grade on intrinsic value, utility value, competence self-beliefs and test costs.

As regard to students' motivation, a main effect of both grade, Pillai's Trace=.177; $F(12,4818)=25.225$; $p\leq.001$, $\eta^2_p=0.059$, and country, Pillai's Trace=.198; $F(4,1604)=99.147$; $p\leq.001$, $\eta^2_p=0.198$, was also found.

School grade produced a significant effect on all motivation dimensions. Specifically, intrinsic value decreases with school grade, $F(3,1624)=95.003$; $p<.001$, $\eta^2_p=0.149$, without differences between 3rd and 4th grade students; utility value presents a similar pattern to intrinsic value, $F(3,1624)=54.185$; $p<.001$, $\eta^2_p=0.091$. Competence self-beliefs also tended to decrease, with 3rd and 4th graders not presenting any significant differences between them, but presenting higher scores, compared to 5th and 6th graders, $F(3,1624)=12.385$; $p\leq.001$, $\eta^2_p=0.043$. Costs, on the other hand, tended to increase, although 3rd and 4th graders didn't show significant differences between them, $F(3,1624)=33.172$; $p\leq.001$, $\eta^2_p=0.058$.

Country, however, only produced a significant effect on intrinsic value, $F(3,811)=23.032$; $p<.001$, $\eta^2_p=0.079$, and utility value, $F(3,811)=23.032$; $p<.001$, $\eta^2_p=0.079$, with Portuguese students revealing higher levels of both intrinsic and utility values.

Achievement Emotions Clusters

Identifying achievement emotions profiles. The cluster analysis differentiated four different groups of students, based on the combinations of their achievement emotions (Figure 1). The first cluster groups 698 students (43.2%), who presented high levels of Enjoyment and low levels of all negative emotions. Therefore, this cluster can be nominated as the Joyous Students Group. The second cluster consisted of 215 students (13.3%), who displayed low levels of enjoyment, and high level of the three negative emotions, hence being nominated the Bored and Anxious Students Group. A third cluster showed up, comprising 319 students (19.8%), with low levels of enjoyment, average levels of both anxiety and test anxiety, and high levels of boredom, hence being nominated the Bored Students Group. Finally, a fourth cluster was identified, that comprehended 383 students (23.7%), who presented average levels of all emotions, except for test anxiety, where students presented slightly above average levels. This final cluster was called Anxious for Test Students Group (Appendix G).

Cluster differences in motivation and achievement. The results of the ANOVA performed on the four motivation dimensions and on mathematics achievement revealed statistically significant differences in all the evaluated variables, Pillai's Trace=.378;

$F(15,4755)=45.662$; $p\leq.001$, $\eta^2_p=0.126$. More specifically, the Joyous Students Group presented the highest levels of intrinsic and utility value, competence self-beliefs, a higher mathematics achievement, and the lowest levels regarding costs. On the other hand, the Bored and Anxious Students Group presented the lowest levels of intrinsic value, competence self-beliefs and achievement, and the highest level of costs. Finally, the Bored Students Group showed the lowest level of utility value.

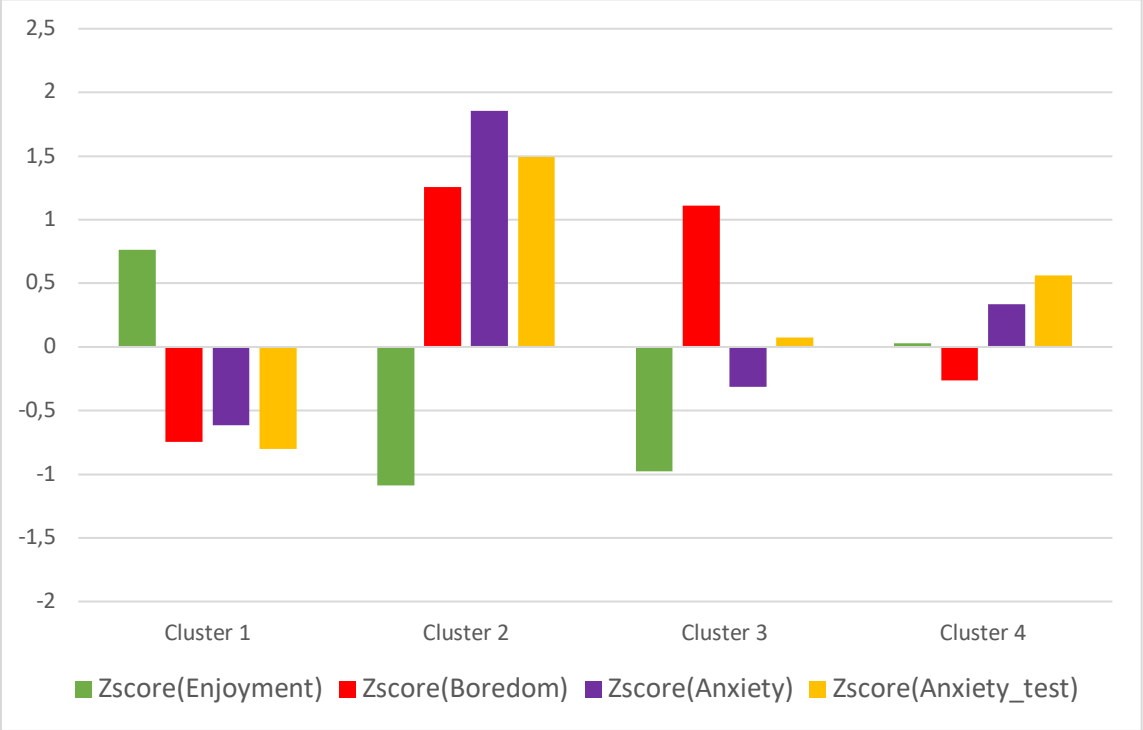

Figure 3. Achievement emotions profiles.

Subsequently, the post-hoc test (Table 7) revealed, regarding both intrinsic and utility value, statistically significant differences between all the clusters, except for the Bored Students Group and the Bored and Anxious Students Group, which showed no significant differences. Regarding competence self-beliefs, statistically significant differences were found between all the clusters, except for the Bored Students Group and the Anxious for Test Students Group, where no significant differences were found. Lastly, as to costs and mathematics achievement, statistically significant differences were found between all the clusters.

Students' distribution in the clusters. It was possible to see that a higher number of students from Serbia were included in Joyous Students Group (50.7%), Bored and Anxious Students Group (58.1%) and Bored Students Group (51.1%), and that a higher amount of students from Portugal (56.1%) were grouped in the Anxious for Test Students Group. Inferential

statistical analysis report that students' distribution across the four clusters is dependent of the students' country ($\chi^2(3) = 11.747$; p=0.008), although significant differences were only present, at the 0.05 level, in the Bored and Anxious Students Group, and in the Anxious for Test Students Group. Similarly, it was found that students' distribution across the four clusters is dependent on the students' gender ($\chi^2(3) = 10.642$; p=0.014), with significant differences being present, at the 0.05 level, in the Joyous Students Group, with 53.4% of boys, as well as on the Anxious for Test Student Group, where 55% of the students were girls.

Table 7

Motivation and achievement mean scores on the four AEQ-ES clusters.

	Joyous Students Group	Bored and Anxious Students Group	Bored Students Group	Anxious for Test Students Group	Statistical significance	
					F (3,1587)	η^2
IV	0.4524	-0.5980	-0.6299	-0.0183	143.257*	0.213
UV	0.2717	-0.4062	-0.3922	-0.0675	45.233*	0.086
CSB	0.3713	-0.6837	-0.1603	-0.1422	80.161*	0.132
C	-0.4162	0.7226	0.3338	0.0748	106.445*	0.168
A	0.3692	-0.5276	-0.0560	-0.3067	75.540*	0.125

Note. IV=Intrinsic Value; UV=Utility Value; CSB= Competence Self-Beliefs; C=Costs; A=Achievement; *$p \leq .001$.

Finally, students' distribution across the clusters is also dependent on student's school grade ($\chi^2(9) = 185.780$; $p \leq 0.001$). More specifically, in the Joyous Students Group, significant differences were found between all school grade, except for the 3rd and the 4th grade. Regarding the Bored and Anxious Students Group, differences were found between in all grades, except between 3rd and 4th grade, and between the 5th and 6th grade. In the Bored Students Group, statistically significant differences showed up between all school grades. No significant differences were present in the Anxious for Test Students Group. Percentage of students from each school grade in the four cluster is presented in Table 8.

Table 8

Percentage of students of each school grade present in the four AEQ-ES clusters.

	3rd grade	4th grade	5th grade	6th grade
JSG	28.8%	28.7%	24.1%	18.5%
BASG	9.3%	11.2%	38.1%	41.4%
BSG	8.2%	13.5%	30.4%	48%
ATSG	20.6%	18.8%	28.5%	32.1%

Note. JSG=Joyous Students Group; BASG=Bored and Anxious Students Group; BSG=Bored Students Group; ATSG=Anxious for Test Students Group.

Discussion and conclusions

The present study aimed at studying the relations established between achievement emotions, motivation and math achievement, and variables such as students' school grade and country, through both a variable and a person-centered approach.

A first goal of this study was to understand the differences in students' achievement emotions and motivation, according to their school grade. It was possible to see that school grade produced a negative effect on enjoyment and a positive effect on boredom, anxiety and test-anxiety, hence supporting the first hypothesis. It seems that the higher the school grade, the higher students' levels of negative emotions are, and the lowest the levels of enjoyment.

As for motivation, a similar pattern was observed, with intrinsic value, utility value and competence self-beliefs decreasing upon an increase in school grade. Costs, on the other hand, presented an increase in relation to school grade. Thus, it's possible to conclude that students in higher school grades feel less interested and see less value in mathematics, while also feeling less competent in this particular subject and perceiving it as being more costly, which corroborates the second hypothesis.

When analyzing these results together, further insight can be shed on the relation between motivational and affective variables, and school grade. For instance, the found decrease enjoyment can be clarified when taking into account the decrease in competence self-beliefs, intrinsic value and utility value. As postulated in the CVT (Pekrun, 2006, 2009), emotions are the result of students' beliefs about their own competence and the intrinsic and extrinsic value they perceive in the activity. If one does not feel competent at a given activity, then it's expectable that they don't feel enjoyment while performing that task. Inversely, when looking at the increase in boredom, it is possible to see it as being related to a lack of interest, mirrored by the

decrease in intrinsic value and a lack of value/utility accredited to mathematics. Additionally, it has also been stated that perceived competence appears together with anxiety (e.g., Kvedere, 2014), which can explain the inverse pattern found between anxiety, test anxiety, and competence self-beliefs. Feeling less competent may then cause students to feel more anxious when doing math activities. Finally, an increase was found in Costs, which may be related to the increasing level of complexity involved in the process of learning mathematics.

Another interesting finding was that all emotions, except for enjoyment, and all motivation dimensions presented no significant differences between the 3rd and 4th grade, hence suggesting that the first cycle of primary education is stable in terms of affective motivational variables, and that major differences emerge in the transition from the first to the second cycle of primary education. This was particularly evident for competence self-beliefs, anxiety and test anxiety, that showed differences between the first cycle and the second cycle of primary education, but not within each cycle.

The observed difference may be due to the change from a class teacher to a subject teacher, occurring in both Portugal and Serbia, from grade 4 to grade 5. For example, since variable such as class and teacher support have been identified as being associated with higher levels of positive emotions (e.g., Lei, Cui, & Chiu, 2018) and motivation (Skaalvik et al., 2015), it could be that students perceive teacher support as less sufficient when transitioning from a teacher who accompanies them in every subject to one who they see only in math class. It may also be that, since, as students progress in school, the subjects become more complex and less related to the students' reality, which is reflected in the curriculum, the reasons for learning a particular subject become less evident. Hence, if students can't attribute any practical value to the subject, they may be less interested and feel less enjoyment in it (Pekrun, 2006, 2009).

On the other hand, it has also been stated that younger children tend to be less rigorous when evaluating themselves and comparing themselves to others, demonstrating a more optimistic outlook (Wigfield et al., 2009). This less rigorous take on competence self-beliefs, as shown above, can relate to intrinsic and utility value, as well as enjoyment.

These results then come in line with previous results found regarding the relationship between emotions and motivation (e.g., Goetz, Frenzel, Pekrun, & Hall, 2006) and the effect of school grade on both variables (e.g., Raccanello, Brondino, & Bernardi, 2013; Mata et al., 2017).

As expected (Hypothesis 3 and 4), effects of students' country were also found, both on emotions and motivation. More specifically, it was found that Portuguese students presented higher levels of enjoyment, test anxiety, intrinsic value and utility value. While these results are

less immediate to explain, particularly so since few studies have been conducted on non-western Europe countries (Wigfield et al., 2009), CVT assumes that emotions represent not only a physiological response, but rather a multidimensional construct that suffers social and learning influences (Pekrun, 2006). Expectancy-value also posits an influence of students' background (e.g., culture) on their motivation. Hence, cultural differences, although harder to explain, are in line with both considered theoretical frameworks.

On the one hand, it has been theorized that some constructs might have different meaning in different cultures (e.g., Van de Vijver, & Leung, 2001). Therefore, it could be that the differences between the two countries are due to the fact that the constructs being measured have different meanings.

Moreover, it has been shown that teacher support, for instance, shows a greater correlation with positive emotions among Western Europe countries than on East Asia (Lei et al., 2018). Although Eastern Europe wasn't included in this review, it could be that students from Serbia react differently from the Portuguese ones. This could eventually make sense, considering the interaction effects present, where differences between the two countries in enjoyment are progressively lower; it could also explain why differences were found for enjoyment but not for boredom. Teachers might play a bigger role on enhancing students' emotions in Portugal, with that role fading with the transition from the 1st to the 2nd cycle of primary education.

On the other hand, it may also be the case that these results reflect not country differences, but rather socio-economical differences, since as stated above, the Portuguese sample contemplated both public and private institutions, whereas the Serbian sample contemplated only public-school students. Since students' socio-economic status has been pointed as a relevant variable in students' motivation, predicting higher levels of motivation (Kriegbaum, & Spinath, 2016;), and considering its relation to students' achievement emotions, it's possible that the Portuguese sample presents higher levels of intrinsic value, utility value and enjoyment simply because it contemplated more students from a higher socio-economic status.

Since no country differences were found for competence self-beliefs, differences regarding test anxiety may be due to a discrepancy between the two educational systems, where a higher pression might be put on tests or specific evaluation moments in Portugal.

Further investigation on this subject, controlling for socio-economic status and taking other variables, such as teacher support, into account could be needed, in order to better understand the differences found. Qualitative studies, researching students' perception on the measured variables, could also be useful, in order to ensure that they mean the same to every student.

Another curious finding in the fact that results in Serbia tend to become more stable from the 5th to 6th grade, whereas Portuguese students generally maintain a similar pattern to the one found from 4th to 5th grade. Some research has shown that anxiety, for one, seems to have a tendency to increase during the first years, and stabilize afterwards (Raccanello et al., 2013). It could be that Serbia students reach this level of stabilization earlier, when compared to Portuguese students.

Another goal of this study was to identify different student profiles, based on their achievement emotions. Four different clusters of achievement emotions emerged from the analysis: Joyous Students Group, Bored and Anxious Students Group, Bored Students Group and Anxious for Test Students Group.

These finding came to confirm the idea that students' emotional experience can be idiosyncratic, with students revealing different emotional patterns. Moreover, although some studies have suggested that students who feel bored also feel that they're skills for that task are high, which would mean they wouldn't feel worried about their performance (Csikszentmihalyi, 1975), a cluster was found where students present high levels of boredom, anxiety and test anxiety, and one where only boredom is experienced in high levels. This comes to demonstrate that students may experience the different degrees of different emotions, or experience different emotions in co-occurrence, which is consistent with the findings of Goetz, Sticca, Pekrun, Murayama and Elliot (2016). As expected (hypothesis 5), these clusters showed positive and negative emotions in opposite directions.

After identifying the different profiles, two additional aims were to study the effect of the profiles on motivation and math achievement, and to characterize and analyze the differences in the clusters composition, taking students' gender, country and school grade into account. Results here corroborated both hypothesis 7 and 8.

Firstly, it was possible to understand that the Joyous Students Group showed to be the most adaptive cluster, presenting higher levels of intrinsic and extrinsic motivation (i.e., intrinsic and utility value) and math achievement. This result shows that students who perceive high levels of enjoyment and lows levels of negative emotions are also the same students who have the highest levels of motivation and math achievement, which is in line with previous research on the correlations between achievement emotions, motivation and achievement (e.g., Peixoto et al., 2017; Shukajlow et al., 2017).

Furthermore, these findings are also congruent with CVT's claims regarding control and value (Pekrun, 2006), since students who report higher levels of enjoyment do perceive themselves as being more in control (higher levels of competence self-beliefs) and value

mathematics to a greater degree (they are more interested and perceive it as being more useful). It is also interpretable at the light of expectancy-value theory, considering that these students believe they can initiate and perform math tasks (action-control expectancies) and that engaging in these activities may be useful and produce the expected results (action outcome expectancies; Wigfield et al., 2009).

It would indeed seem that activities that evoke a greater interest in students, also hold for higher levels of positive emotions, resulting in a better achievement, probably because students are more involved in the said activity.

On the opposite end, the Bored and Anxious Students Group presents the lowest levels of utility value, competence self-beliefs and math achievement, and the highest perceived costs.

When comparing with students with about the same levels of boredom, but average levels of both anxiety and test anxiety (i.e., Bored Students Group), the Bored and Anxious Students Group still presents significant lower levels of competence self-beliefs and achievement, while presenting higher levels of costs. Notwithstanding, significant differences weren't found, between these two clusters, neither on intrinsic nor utility value. Thus, it would seem that boredom accounts for utility and intrinsic value, whereas anxiety accounts for competence self-beliefs and costs.

The low levels of intrinsic and utility value presented in both the Bored and Anxious Students Group, and the Bored Students Group is consistent with the reviewed literature, pertaining to the fact that students who experience boredom also see the activity as uninteresting and useless (Pekrun, 2006). When considering the Bored and Anxious Students Group, it's possible to state that anxiety, on the other hand, puts an extra pressure and tension over students, which can have an effect on their achievement and intrinsic motivation (Pekrun, 2009).

Test anxiety has also been pointed as a negative predictor of achievement in mathematics (Metallidou, &Vlachou, 2007), which is also in line with these results, and can account for the difference in achievement between the Bored and Anxious Study Group, and the Bored Study Group. Another possible explanation might lie in the differences in competence self-beliefs and costs – below average levels of competence self-beliefs and high levels of perceived costs might indicate that these students, because they don't feel competent in mathematics, put an extra effort into achieving good results (Brown, & Kanyongo, 2010). Additionally, anxiety has also been described as a psychological cost – this would mean that, while the Bored Students Group present relatively high levels of costs, they present low levels of psychological cost (Flake et al., 2015), which may also be accountant for the differences in achievement, and

might indicate that some students might present a better math achievement if the psychological cost related to anxiety isn't present.

Lastly, when looking at the Anxious for Test Students Group, it's possible to see that these students present only slight below average levels of intrinsic value, utility value, and perceived competence, and only slightly above average perceived costs. Achievement, however, is lower than the one presented by students in the Bored Students Group.

Low/average levels of costs might mean they are not investing enough time/effort in the said activity, hence justifying for the low achievement levels. Since their competence self-beliefs are below average, prospective failure (Pekrun, 2009) might be accounting for low achievement and low competence self-beliefs. Additionally, since tests constitute the major part of a student's assessment, students presenting higher levels of test anxiety but not class or homework-related anxiety. Anxiety has also been reported to have an effect on students' ability to concentrate on task-related information (Luttenberger, Wimmer, & Paetcher, 2018), which may also explain why these students present low levels of achievement.

These results are also consistent with the current view, claiming that students who present higher levels of positive emotions are the one who present higher levels of achievement (Pekrun et al., 2009).

Regarding students' distribution across the different identified clusters, which constituted a fourth goal of this study, statistically significant differences were found on students distribution across the different clusters, based on their country, their gender and their school grade.

In respect to country differences, Serbia presented a higher number of students on the Bored and Anxious Students Group, while Portugal grouped a higher number of students in the Anxious for Tests Students Group. Considering the aforementioned results regarding differences in achievement emotions and motivation, these results partly come as unsurprising. In fact, significant differences had been found on Test-Anxiety, with the results favoring Portugal, which is consistent with the fact that Portugal also presents a higher representation of students on the Anxious for Test Students Group. However, while no country differences were found on boredom or anxiety, when considering a variable centered-approach, country differences emerge in the Bored and Anxious Students Group, that contemplates both emotions – it is noteworthy, however, that this cluster also presented the lowest levels of enjoyment, which is, in itself, consistent with the previous findings.

As for students' distribution based on their gender, results indicated that boys mostly

constitute the Joyous Students Group, while a bigger amount of girl students was present in the Anxious for Test Students Group. This result is also in line with similar findings regarding gender differences on achievement emotions, demonstrating that, for test situations specifically, girls present higher scores on anxiety than boys (Monteiro, Peixoto, Mata, & Sanches, 2017), and that boys generally present higher levels of enjoyment (Pekrun et al., 2011).

Various possible explanation may be raised for this effect of gender – specifically, it might be that girls are suffering from a gender stereotype threat, resulting from the belief that girls have less ability on mathematics than boys (Spencer, Steele, & Quinn, 1999). The low self-competence beliefs also present in this cluster might indicate that girls generally feel less competent in mathematics, which may lead to an anxious emotional pattern (Frenzel, Pekrun et al., 2007). Lastly, McRae, Ochsner, Mauss, Gabrieli and Gross (2008) suggested males to be more efficient in reappraisal, meaning that they might need to put less effort into regulating emotions in a given situation. However, further investigations, for example, studies contemplating emotional regulation as a variable, would be needed in order to better understand this effect.

Finally, the analysis on school grade differences revealed a higher number of students from grades 3 and 4 in the Joyous Students Group, whereas the Bored and Anxious Students Group, and the Bored Students Group grouped a higher number of students from grade 5 and 6. This too is consistent with the results found when analyzing for the effect of school grade on achievement emotions. However, no significant differences were found on the Anxious for Test Students Group, despite found effect of school grade on Test Anxiety – this might indicate that some students will experience test anxiety, regardless of their school grade.

This study came to elaborate on previous research on achievement emotions and motivation, considering younger children and both a variable and a person-centered approach. Even when adopting a person-centered approach, allowing for clusters to freely form, results were consistent with the revised literature and interpretable at CVT and expectancy-value theory's light. Moreover, it was interesting to see that results from the variable-centered approach and the person-centered approach results were consistent with one another, with both pointing to cultural and school grade differences in emotional and motivational variables.

It also shed some light on a least studied component of motivation, demonstrating that school grade produces a significant effect on perceived costs in mathematics; the cluster analysis also showed that, while this dimension appeared in an opposite direction to intrinsic value, utility value and competence self-beliefs, representing a negative aspect of motivation, its

relationship to achievement wasn't clear. These results should be further investigated, to better comprehend the role costs play on students' achievement and on achievement emotions.

Looking for different profiles of achievement emotions also allowed for a better understanding of the contribution of each emotion to motivation and achievement. Joyous Students Group showed to be the most adaptive cluster, with higher levels of motivation and a better math achievement, while Bored and Anxious Students Group showed the least adaptive profile, achieving the lowest math performance and overall motivation levels. It was interesting to note that students could experience various emotions at the same time. Further analyzing these cluster results, recurring to the study of a bigger variety of emotions, could help enhance the knowledge on achievement emotions. This could be particularly interesting in older children, since they report and better understand the presence of mixed emotions in complex social situations (Larsen, To, & Fireman, 2007).

One last result that is noteworthy, although it wasn't a specific aim of this study, was the fact that

As such, these findings support the idea that interventions should be planned considering students' diversity, and emotional and motivational needs, in order to optimize all students' performance. Classroom practices should also put an emphasis on the development of academic activities that enhance positive emotions, that students can connect to and that contribute to students' interest and that may challenge students, while still sustaining their confidence in their own abilities. This should be particularly regarded when it comes to older students, since they show the lowest levels of motivation and positive emotions. Moreover, since country differences were found in regard to both emotions and motivation, these results further account for the importance of planning interventions with cultural diversity in mind.

Despite the found results, this study doesn't come without limitations. Firstly, this study focused only on mathematics, and emotions have proved to be context-specific (e.g., Goetz et al., 2007), so generalizations to other subjects are not possible. Additionally, differentiations between different types of tasks (i.e., classroom, test, homework) were only made for anxiety. Thirdly, this study relied on self-report measures, which are known to be susceptible to social desirability– future studies could, therefore, also rely on physiological indicators and classroom observation to evaluate students' emotions and motivation. The results were obtained from an evaluation that occurred at a single moment, so longitudinal studies would be needed to understand the evolution of motivation and emotions. Investigations accounting for what students felt before, during and after an achievement task could also be interesting. Finally, additional analysis, such as mediation and moderation effects, latent class analysis and structural equations

could be used in order to better understand the complex relations established between the variables at stake.

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Appendix

Appendix A – Extended literature review

Mathematics

Mathematics continues to emerge as one of the subjects in which students, at a global level, present greater difficulties – specifically, it has been estimated that about 20% of the student population presents some type of difficulty in learning the subjects taught in mathematics (Aunio, Mononen, & Laine, 2015).

Regarding the Portuguese reality, according to the report of the Directorate General of Statistics of Education and Science (DGEEC, 2017) mathematics shows the highest percentage of student failure during middle school, while 1/3 of high school students fail at that subject. More recently, the OECD report (2016) pointed out that Portuguese students did not show significant improvements in math results, compared to the results obtained in 2012, remaining below the average of the other countries. The persistence of high retention rates, despite the resources and measures developed within the scope of mathematics, led that a specific group be created with the purpose of developing a systematic analysis capable of sustaining better interventions that promote the learning of mathematics.

When it comes to Serbia's reality, previous PISA findings have also demonstrated a below average level in mathematics, with their results translating to approximately a year of difference of schooling, in terms of its effect (Pavlovć, Babić, & Baucal, as citen in Lazarević, & Ana Orlić, 2018), very few students (i.e., less than 5% of Serbian students) achieving a level of proficiency. with less than 5% of students (Lazarević, & Ana Orlić, 2018).

In fact, a number of difficulties have been identified in mathematics, such as difficulties relating to number sense (Baroody, Bajwa, & Eiland, 2009), visual-spatial and information skills (Tambychika, & Meerah, 2010). Moreover, many difficulties are revealed not only by students with low academic performance, but also by students who present a medium or high academic performance in the other school disciplines (González-Pienda et al., 2002, as cited in González-Pienda et al., 2006). Various authors (e.g., Wu, Willcutt, Escovar, & Menon, 2014) have demonstrated that students generally perceive math as a complex subject, reporting feelings of anxiety during math-related tasks.

Considering, on the one hand, the above described difficulties and, on the other, the importance attributed to mathematics in developing students' decision-making and judgment-making powers (OECD, 2016), understanding the various variables that may be related to the

failure of this discipline plays an important role in developing better intervention programmes (Schukajlow, Rakoczy & Pekrun, 2017). Indeed, authors such as Aunio et al. (2015) point out that there are several dimensions related to mathematical competencies and performance that begin to be developed as early as the first years of school and that, nevertheless, it is fundamental to understand the variables involved in poor academic performance to mathematics. In this study, we aimed to understand, specifically, the affective-motivational variables involved in learning mathematics.

Emotions

Emotions represent a central dimension of the human being, and affective experiences are a constant in an individual's life. In fact, children start to display emotional states at a very young age, even though their understanding of emotions is still elemental, with skills such as recognizing, naming, and regulating emotions emerging only when children are older (Denham, 1986). Comprehending the role of emotions, in their complexity and diversity is, therefore, considered essential to better understanding the human function.

According to Schutz, Hong, Cross and Osbon (2006), emotions are built socially and contextually, representing modes of being and being in the world. Emotions have been defined as a subjective state of discrete nature, which arise in response to a specific event or object (Frijda, Kuipers, & ter Schure, 1989), and which tend to be accompanied by a physiological response and an evaluative judgment, before a given event. The authors have also added that emotions tend to influence or produce some action or behavior.

On the other hand, emotions and emotional responses are highly influenced by the surroundings, with emotional system adapts to the more stable conditions of the surroundings, suffering both genetic and environmental influences (Sameroff, 2010). Accordingly, family, peers, teachers and other members surrounding an individual will influence the emotions that same individual experience (e.g., Frenzel, Pekrun, & Goetz, 2007, Pekrun, Goetz, Titz, & Perry, 2002; Wigfield & Eccles, 2000).

Considering the inevitable presence of emotions in everyday life, some investigations have also shown that emotions play an important role in areas such as motivation, cognition and learning (e.g., Izard, Stark, Trentacosta, & Schultz, 2008). Emotions thus appear to be a variable of interest in educational contexts, as they appear to be triggering contexts for various emotions (Meyer, & Turner, 2006) and that emotions arise as a variable involved in most teaching and learning processes (Schutz, & Lanehart, 2002).

The role of emotions in the educational field wasn’t, however, always been seen as a main

concern. Authors such as Aspinwall (1998) have set a reminder that the learning process wasn't seen as having the promotion of students' well-being as a primary goal, and that, in fact, promoting positive emotions in students could result in them becoming lazy. Furthermore, most of the research that has indeed been carried out on emotions in the educational field has primarily focused on negative emotions, (Peixoto, Sanches, Mata, & Monteiro, 2017; Pekrun, 2006, 2009). Valiente, Swanson and Eisenberg (2012) have suggested that positive emotions exist in fewer number and are more difficult to observe and differentiate, when compared to negative emotions, which could be part of the reason for this disregard of positive emotions.

Despite the lower number of studies relating to students' positive emotions, some studies have started emerging, in the last decades, alerting for the importance of positive emotions on students' academic adjustment, with a growing body of theories and literature pointing to the effect positive emotions might have on cognitive and behavioural outcomes (Pekrun, 2009). Authors such as Seligman, Ernst, Gilham, Reivich and Linkins (2009) claim that this focus on positive, as well as on negative emotions demonstrates a switch of mindset, in order to achieve a more realistic and holistic view of a student's experiences.

Additionally, considering the variety and specificity of emotions experienced in contexts of achievement, such as in the educational context, Pekrun (2006) proposed a theoretical model, Control Value Theory of emotions (CVT), that sought to understand the role of emotions specifically in achievement contexts. This theory finds its foundations on previous theories such as the expectancy-value theory (Wigfield, Tonks, & Klauda, 2009), integrating it with approaches to emotions (Pekrun, 1992), attributional theories of achievement emotions (Weiner, 1985), various models on the effects of emotions on learning and achievement (Fredrickson, 2001; Zeidner, 1998), as well as on theories of perceived control (Perry, as cited in Pekrun, 2006).

Thus, the author considers emotions as being multidimensional, and influenced by affective, cognitive, motivational, expressive and physiological variables simultaneously. Achievement emotions are specifically defined as emotions that relate directly to achievement tasks or task outcomes, that is, emotions that exist in relating to an academic task or activity (Pekrun, 2006, 2009).

Hence, most emotions are considered, according to CVT, as variables that relate to the learning process, since they pertain to tasks which will be evaluated either by the students themselves, or according to and external reference or standard. The various achievement emotions are, accordingly to all above mentioned theories, are aroused by cognitive appraisals of control over a specific task, as well as by the subjective value perceived in an achievement task, and

the outcomes of that task. These same emotions will, on the other hand, influence students' achievement and performance, establishing a mutual causation relation.

Therefore, Pekrun (2006) argues that the contexts of learning influence two distinct components of cognitive appreciation - subjective control and subjective value - that contribute to the development of achievement emotions.

Subjective control seeks to encompass cognitive aspects related to control, such as expectations for self-efficacy and causal attributions of outcomes. The subjective value refers to the perceived value of the actions performed and their results. In this way, the model refers to the beliefs that an individual has about his or her competence in a given task and to the intrinsic and extrinsic value that the task has for itself, indicating that the emotions are a product of the two components explained.

This theory contemplated anticipated forward-looking emotions, such as hope of success, or, on the opposite end, anxiety towards failure, as well as retrospective emotions, which could emerge, for instance, when feeling pride or shame after succeeding or failing in an achievement task (Pekrun, 2006). Additionally, the theory classifies emotions according to three axes. Object focus refers to the fact that the focus of the emotion experienced may be on the activity performed or on the subsequent result that may result from the activity; valence, which refers to the fact that the emotions may be negative or positive; and degree of activation, and the emotions of activation or deactivation.

Classifying emotions according to these axes forms four differentiated groups of emotions. Specifically, positive activating emotions (e.g., pride, enjoyment), positive deactivating emotions (e.g., relief), negative activating emotions (e.g., anxiety, anger), and negative deactivating emotions (e.g., hopelessness; Pekrun, 2006, 2009; Pekrun, Goetz, Frenzel & Perry, 2011).

Positive and activating emotions could thus foster interest and motivation for learning, making cognitive resources necessary to succeed in a task more accessible to students. On the other hand, negative deactivating emotions will diminish the interest and motivation of a student. Activating negative emotions, on the other hand, tend to be pointed out as being negatively associated with student performance, for example, reducing intrinsic motivation.

Therefore, negative activating emotions (Pekrun, 2006) are seen as having a detrimental effect on the learning process, diminishing students' motivation, as well as requiring attentional resources, directing students' attention to the emotional focus. Nonetheless, the effect of some emotions has shown to be ambiguous (Pekrun et al., 2002), with anger or shame seeming able

to foster student's motivation and will to avoid those emotions in the future, and anxiety forcing students to take an action, thus fostering a better achievement.

Moreover, the various emotions experienced influence the way the student their school life) state, the learning environment experienced by a student who is in a positive affective state is substantially different from that experienced by a student who is in a negative affective state (Dettmers, Trautwein, Ludtke, Goetz, Frenzel, & Pekrun, 2011). Hence, it becomes fundamental to understand the nature of emotions in the school context, since this understanding can also prove to be helpful in the development of different teaching methods, targeting students with specific mathematics difficulties (Wu et al., 2013).

Finally, since, as mentioned by Pekrun (2006), emotions arise in a specific context, differences in the different learning contexts have also been studied - for example, it has been noticed that tests tend to triggering more negative emotions such as anxiety (Goetz, & Perry, 2005; Goetz, Frenzel, Pekrun, Hall, & Ludtke, 2007), when compared to performing homework, or with the classroom context. Test-related tasks, for instance, might be more prone, when comparing to homework or classroom activities, to fostering anxiety, hopelessness or hope. Homework and classroom activities, on their turn, might lead to higher levels of boredom and enjoyment, since they aren't necessarily perceived as moments of evaluation by students.

In conclusion, CVT tries to integrate antecedents and consequences of achievement emotions in learning and academic contexts, based on the notion that perceived control and value of a task are precedents of achievement emotions, and that emotions might be directly related to a specific activity, or with the results of that task and the way they are associated with the perspective of success or failure.

Other theories have emerged, pertaining to the role of emotions in the learning process, such as the broaden-and-built theory (Frederickson, 2001), which maintains the view that emotions, specifically positive emotions, produce an effect on cognitive processing, as well as on thoughts and behaviours, building psychological resources (e.g., resilience, flexibility) that contribute to a better adaptation in face of challenges in the environment, while negative emotions narrow these factors, hence leading to a more rigid adaptation. However, considering the extended body of literature pertaining to CVT, and that, as aforementioned, the theory gathers various aspects of previous theories, this study will henceforth adopt and refer to emotions as conceived by CVT (i.e., as achievement emotions).

Motivation

Motivation is another variable that is indissociable from the learning context; in fact, when students are interested and feel motivated while performing an activity, they are more likely to be engaged and often deeply engaged in it and can persist at it for a long time (Wigfield et al., 2009). Given the importance of motivation in the educational context, theories have emerged that seek to explain the factors that influence a person's involvement in a given task. One of the theories that best offers theoretical support is the value-expectation theory (Eccles, 2006; Wigfield, & Eccles, 2000), which theorizes that the performance, choices and involvement of an individual in an assignment are influenced by their beliefs about how successful they believe they can be in the task (expectation) and how they value and value this same activity (Wigfield, & Eccles, 2000). Specifically, the value of the task can be conceptualized according to four axes - realization value, interest value, utility value and cost.

The attainment value refers to the subjective and personal importance of obtaining a good result in a given task, where a task is seen as an opportunity to express aspects of the real self, as is the case of competence in the task domain. The interest value, on the other hand, is related to the pleasure or satisfaction related to the satisfaction that the individual obtains from the accomplishment of a certain task, and can also refer to the subjective interest that the individual experiences regarding a specific subject.

Utility value, in turn, is determined by how the task relates to current and future goals, such as career-related goals. A task can have a positive value for someone because it facilitates important future goals, even if the person is not interested in the task itself (Eccles, 2006; Eccles, & Wigfield, 2002). Since intrinsic value reports to the value and interest a task presents by itself, without taking outcomes into account, it might be considered as a measure of intrinsic motivation; extrinsic value, on the other hand, refers to what a person can achieve, by performing a given task, hence being related to extrinsic motivation (Wigfield et al., 2009).

Finally, cost is conceptualized in terms of the negative aspects related to task involvement, such as performance-related anxiety and fear of both success and failure, as well as the amount of effort required to be successful and the lost opportunities that result from one choice over another (Eccles, & Wigfield, 2002). Cost, however, is the least studied motivational component in this theory (Flake, Kenneth, Hulleman, McCoach,, & Welsh, 2015; Wigfield et al., 2009).

Even though that this theory preconizes the aforementioned values as separate, although interrelated (e.g., utility value has a relation to personal goals and sense of self, thus presenting some correlation to intrinsic value (Wigfield et al., 2009), components, most of the research

adopting this theoretical framework has not measured the four dimensions separately (Wigfield, & Cambria, 2010).

Despite that, Trautwein, Marsh, Nagengast, Ludtke, Nagy and Jonkmann (2012) have demonstrated that the different components can clearly be empirically studied separately. All the more, several studies (e.g., Flake, Barron, Hulleman, McCoach, & Welsh, 2015; Gaspard, Dicke, Flunger, Schreier, Hfner, & Trautwein, 2015) have demonstrated – for instance, it has been suggested that cost might include various facets, including emotional cost, psychological cost, effort and opportunity cost. Attainment value, on the other hand, has been conceptualized as possibly separated between the relevance of achievement, and the personal importance/relevance of a task (Gaspard et al., 2015).

Furthermore, similarly to what happens with achievement emotions, motivation has proven to be very domain-specific, since students' appreciations of particular subjects can be very different, showing very low correlations (e.g., Trautwein et al., 2012). This differentiation between domains, although present from a very young age, has been shown to increase as students grow older (Denissen, Zarrett, & Eccles, 2007; Marsh & Ayotte, 2003). Therefore, studying this variable in a specific context also proves to be fundamental.

As aforementioned, CVT was influenced by the expectancy value theory (Pekrun, 2006). In sum, on the one hand, the perception of the controllability regarding the achievement activities and their results, and, on the other hand, the subjective value of these said activities and their results (Pekrun, 2006, Pekrun, Frenzel, Goetz, & Perry, 2007). Specifically, it is postulated that perceived controllability and positive subjective value of achievement activities produce positive emotions of activity and reduce negative emotions of activity (Pekrun, Elliot & Maier, 2009). The controllability of achievement results and the positive subjective value of these results promote positive outcome emotions and, on the other hand, the lack of controllability and the negative subjective value of outcomes produce negative emotions (Pekrun et al., 2009).

Considering that the expectancy value theory theorizes that variables such as student performance, or their choices regarding a specific task are influenced by their beliefs or expectancies about how successful they believe they can be in the task and how they value and value this same activity (Wigfield, & Eccles, 2000; Wigfield et al., 2009), it's therefore, possible to see clear similarities between CVT and the expectancy value theory, with both theories emphasizing the relevance students perceptions about their possibility of success and the value they attribute to a specific task.

Hence, in the present study, motivation will be conceptualized according to the expectancy value theoretical framework, as described above. The dimensions related to the perceived competence in mathematics, the utility attributed to it, the perceived costs and the intrinsic interest in mathematics will, therefore, be taken into account.

Motivation and emotions

In recent years, the importance of studying the emotions experienced by students in the academic context, as well as the relationship they have with other variables, such as student motivation has increased (Pekrun et al., 2009). Authors such as Pekrun et al. (2007) argued that enjoyment for learning would increase, when associated with the students' intrinsic and extrinsic motivation levels. A close relationship is established between motivation and achievement emotions, both in terms of perceptions of value and control, and in terms of the value attributed to activities (Pekrun, 2006, 2009), as well as in terms of the way these two variable interact with one another (Goetz, Sticca, Pekrun, Murayama, & Elliot, 2016; Lichtenfeld, Pekrun, Stupnisky, Reiss, & Murayama, 2012; Meyer & Turner, 2006).

Lichtenfeld et al. (2012) argue that emotions play an important role in motivation, learning, performance and even in the overall well-being of the students. In terms of motivation, Pekrun (2006) suggested that there is an association between the perceptions of competence, for instance and the various different emotions experienced by a student, thus demonstrating, once more, the importance of studying other emotions besides anxiety. In this line, negative emotions would produce a negative effect on students' motivation (e.g., Frenzel, Pekrun et al., 2007; Pekrun et al., 2009), while, even more specifically, interfering with the effect of perceived control (Ruthig, Perry, Hladkyj, Hall, Pekrun, & Chipperfield, 2008) and students' perceived competence on students' achievement. On the other hand, Mouratidis and Michou (2011) found, in primary school students, a relevant positive correlation between students' interest, students' engagement in a task and positive emotions.

Emotions, motivation and achievement. As far as academic performance is concerned, research has shown that positive emotions, such as pleasure, tend to have a positive association with performance levels, while negative emotions, such as anxiety, arise associated with levels of negative performance (e.g., Linnenbrik, 2007). However, not all emotions establish similar relationships with academic achievement, nor for the same reasons; therefore, in order to understand how emotions are reflected in student performance, specific definitions of positive and negative emotions are needed (Valiente et al., 2012).

Authors such as Ahmed, van der Werf, Kuyper, and Minnaert (2013) have reported a positive correlation between students' performance and positive emotions, regarding mathematics. Positive achievement emotions are, therefore, usually positively associated with student control and value evaluations (Pekrun et al., 2011), and academic self-concept (Frenzel, Pekrun, et al. 2007). Nonetheless, some studies have found contradictory results (e.g., Luo, Lee, Ng, & Wong, 2014; Pinxten, Marsh, DeFraine, Van Der Noortgate, & Van Damme, 2014) on the relationship between positive emotions regarding math achievement, with some studies reporting no or a negative correlation between the two variables.

Contrarily, with students reporting low achievement, the opposite would happen (e.g., Dettmers et al. 2011; Frenzel, Pekrun, et al. 2007) According to Pekrun (2006, 2009), low achieving students would also present lower control and value evaluations, which, according to CVT, would be precedents to negative emotions. In addition, students with low achievement and low reasoning ability have been shown to experience more negative emotions while performing mathematical tasks, when compared to students with a higher achievement (Goetz, Preckel, Pekrun, & Hall, 2007).

Some results indicate that anxiety, for one, is a negative predictor of achievement in mathematics (Metallidou, & Vlachou, 2007), putting extra pressure and tension over students, which can have an effect both on their achievement and intrinsic motivation (Pekrun, & Stephens, 2009; Pekrun, 2009). In fact, generally, studies regarding anxiety and its relation to academic performance have demonstrated it to be a predictor of negative performance (Pekrun et al., 2009).

It's also noteworthy that, while emotions have an effect on achievement, it has been demonstrated that the two variables establish a relation of mutual causation. That is, emotions have shown to be quite relevant for students' achievement, but achievement has also demonstrated a relevant role on development and sustainment of emotions (Pekrun, Lichtenfeld, Marsh, & Murayama, 2017).

Motivation has also often been pointed out as a variable associated with learning and overall school performance (Broussard, & Garrison, 2004) and specifically with student performance in mathematics (e.g., Pintrich, Smith, García, & McKeachie, 1993; Skaalvik, Federici, & Klassen, 2015). However, the relationships established between this variable and variables such as performance or emotions are not yet clear. In the case of performance, some studies suggest that motivation and academic performance have a two-way relationship (Ryan, & Deci, 2000), while others demonstrate that performance predicts student motivation (e.g., Garon-Carrier et al., 2015).

More specifically, for instance, a decline on intrinsic math motivation is accompanied by a decline in achievement (Gottfried, Marcoulides, Gottfried, Oliver, & Guerin, 2007). Furthermore, when relying on the expectancy value theory, both expectancies and values have shown to establish a significant correlation with students' achievement. All the more, these correlations tend to show up while students still attend elementary school, and be maintained from there onwards (Guo et al., 2016; Marsh, Trautwein, Lüdtke, Köller, & Baumert, 2005).

Gender differences in emotions and motivation. In addition, gender differences have been studied in relation to the emotions experienced in an educational context. Regarding these gender differences, boys tend to have more positive emotions than girls (Pekrun et al., 2011), while girls have higher levels of negative emotions (Frenzel, Pekrun, et al., 2007).

The impact of gender and year of schooling has also been studied in the area of motivation for mathematics. Thus, authors such as Eccles, Wigfield, Harold and Blumenfeld (1993) report that the boys' competence perception of math is superior to that of girls, and therefore their expectation of success in math-related tasks is also superior. Girls, on the other hand, tend to report higher concerns about having worse math results. Skaalvik and Skaalvik (2004) also demonstrated a higher mathematical self-concept, as well as higher levels of intrinsic motivation towards mathematics.

Year of school differences in emotions and motivation. As far as the year of schooling is concerned, in general terms, it has been possible to observe that positive emotions tend to decrease as students progress in schooling (Mata, Peixoto, Monteiro, & Sanches, 2017). Even throughout a single year of schooling, results have suggested that positive emotions (i.e., enjoyment and pride) decrease, and boredom increases (Ahmed, Werf, Kuyper, & Minnaert, 2013).

Likewise, literature has shown that the motivation for mathematics tends to decrease as students' progress in their schooling (e.g., Chouinard & Roy, 2008), and that this decrease is particularly evident for girls (Eccles et al., 1993). While trying to explain these results, an increase in competition and academic pressure, as well as a progressive complexification of academic tasks, have appeared as variables that might explain the decrease in motivation with age (e.g., Gottfried, Fleming, & Gottfried, 2001).

Cultural differences in emotions and motivation. Finally, few studies have been found on specific cultural differences in emotions and motivation, with this gap being particularly evident for comparison studies englobing Eastern Europe (Wigfield et al., 2009). However, some studies demonstrate that cultural context also has an influence students' achievement

emotions (e.g., Frenzel, Thrash, Pekrun, & Goetz, 2007), and some motivation goals (e.g., Dekker, & Fischer, 2008).

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Appendix B – Measures

Math Motivation Scale – 3rd and 4th grade

CÓDIGO	
ESCOLA	
TURMA	

Alguma informação sobre ti	
Assinala a figura em baixo que melhor te descreve	
 **Sou um rapaz**	 **Sou uma rapariga**
Quantos anos tens?	**Escreve aqui a tua idade:**
Vira a página	

MMS

Caro(a) aluno(a),

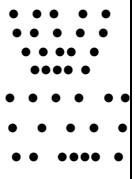
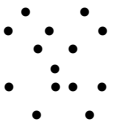
Neste questionário são colocadas algumas questões relacionadas com a matemática e o quanto tu gostas desta disciplina.
Não há respostas certas ou erradas. Certifica-te de que as respostas correspondem realmente ao que tu sentes.
Quando estiveres a responder às questões, se mudares de ideias e quiseres alterar alguma resposta faz uma cruz na resposta que queres eliminar e coloca um círculo na resposta que preferes.
Se não tens a certeza que resposta escolher, escolhe a que for mais parecida com a forma como te sentes.
Só podes escolher uma resposta em cada questão.
Por favor responde a todas as questões.
Se durante a realização desta tarefa tiveres alguma dúvida pergunta à pessoa que te entregou o questionário.
Há questões que são muito parecidas umas com as outras. Não é nenhuma ratoeira. É apenas porque neste tipo de estudos é necessário colocar a mesma questão de formas ligeiramente diferentes. Responde exatamente como te sentes realmente.

Antes de começares, aqui tens alguns exemplos:

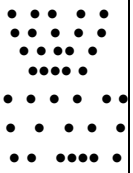
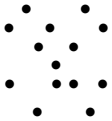
Este aluno selecionou "poucas vezes" na questão **A** porque ele pensa poucas vezes que a escola é difícil.

Na questão **B** no entanto o aluno selecionou "muitas vezes" porque ele pensa muitas vezes que gosta de ir à escola.

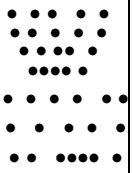
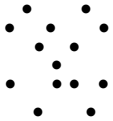
Podes começar!

		Muitas vezes	Algumas vezes	Poucas vezes	Nunca
					
A	**A escola é difícil.**	☐	☐	X	☐
B	**Eu gosto de ir à escola.**	X	☐	☐	☐

Para cada questão assinala o quadrado que melhor corresponde ao que sentes.

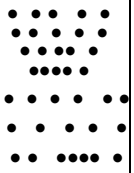
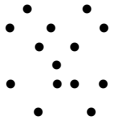
		Muitas vezes	Algumas vezes	Poucas vezes	Nunca
					
1.	**Eu gosto de matemática.**	☐	☐	☐	☐
2.	**A matemática exige muito esforço.**	☐	☐	☐	☐
3.	**Fazer exercícios de matemática faz-me feliz.**	☐	☐	☐	☐
4.	**Fico aflito se não sou capaz de fazer os exercícios de matemática.**	☐	☐	☐	☐
5.	**Sinto-me bem quando faço atividades de matemática.**	☐	☐	☐	☐
6.	**Tenho de deixar de fazer muitas coisas para ter sucesso a matemática.**	☐	☐	☐	☐
7.	**A matemática entusiasma-me.**	☐	☐	☐	☐
8.	**Aprender matemática ocupa muito do meu tempo.**	☐	☐	☐	☐
9.	**A matemática é uma das minhas disciplinas favoritas.**	☐	☐	☐	☐
10.	**Fazer problemas de matemática afasta-me de outras atividades que eu gosto de fazer.**	☐	☐	☐	☐

Para cada questão assinala o quadrado que melhor corresponde ao que sentes.

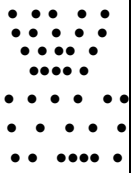
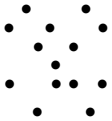
		Muitas vezes	Algumas vezes	Poucas vezes	Nunca
					
11.	**Eu faço exercícios de matemática mesmo quando não tenho de fazer.**	☐	☐	☐	☐
12.	**Quando estou a fazer exercícios de matemática preferia estar a fazer outras coisas.**	☐	☐	☐	☐
13.	**Quero realmente sair-me bem a matemática. A matemática é importante.**	☐	☐	☐	☐
14.	**Não gosto de gastar energia com atividades de matemática.**	☐	☐	☐	☐
15.	**Quando eu crescer será útil saber matemática.**	☐	☐	☐	☐
16.	**Se eu tivesse escolha não faria atividades de matemática.**	☐	☐	☐	☐
17.	**Se eu me sair bem a matemática, então vou sair-me bem na escola.**	☐	☐	☐	☐
18.	**Eu não sou bom a matemática.**	☐	☐	☐	☐
19.	**O que eu aprendo a matemática posso utilizar na vida do dia a dia.**	☐	☐	☐	☐

20.	**A matemática tem sido a disciplina mais difícil da escola.**	☐	☐	☐	☐

Para cada questão assinala o quadrado que melhor corresponde ao que sentes.

		Muitas vezes	Algumas vezes	Poucas vezes	Nunca
					
21.	**Eu acho que as atividades da matemática tornam-me mais esperto.**	☐	☐	☐	☐
22.	**Há muitas coisas difíceis na matemática.**	☐	☐	☐	☐
23.	**Eu posso aprender muitas coisas uteis fazendo atividades de matemática.**	☐	☐	☐	☐
24.	**Eu aprendo matemática só para ter boas notas.**	☐	☐	☐	☐
25.	**Para a vida do dia a dia é importante aprender matemática.**	☐	☐	☐	☐
26.	**Eu não gosto de fazer atividades de matemática.**	☐	☐	☐	☐
27.	**A matemática é fácil para mim.**	☐	☐	☐	☐
28.	**A matemática não é importante para mim.**	☐	☐	☐	☐
29.	**Quando estou a fazer atividades de matemática o tempo passa depressa.**	☐	☐	☐	☐

Para cada questão assinala o quadrado que melhor corresponde ao que sentes.

		Muitas vezes	Algumas vezes	Poucas vezes	Nunca
					
30.	**A matemática é aborrecida.**	☐	☐	☐	☐
31.	**Eu consigo resolver com facilidade problemas de matemática que são difíceis para outros alunos.**	☐	☐	☐	☐
32.	**A matemática é inútil.**	☐	☐	☐	☐
33.	**Eu resolvo com facilidade problemas de matemática.**	☐	☐	☐	☐

Por favor verifica se respondeste a todas as questões. Muito obrigado pela tua colaboração!

Math Motivation Scale – 5th and 6th grade

CÓDIGO	
ESCOLA	
TURMA	

Alguma informação sobre ti.
Assinala em baixo a informação que melhor te descreve.
Género: Masculino ☐ Feminino ☐
Idade: _____
Que nota tiveste a matemática no período passado? 1☐ 2☐ 3☐ 4☐ 5☐
Vira a página, s.f.f.

MMS

Caro(a) aluno(a),

Neste questionário são colocadas algumas questões relacionadas com a matemática e o quanto tu gostas desta disciplina.
Não há respostas certas ou erradas. Certifica-te de que as respostas correspondem realmente ao que tu sentes.
Quando estiveres a responder às questões, se mudares de ideias e quiseres alterar alguma resposta faz uma cruz na resposta que preferes e coloca um círculo à volta dela.
Se não tens a certeza que resposta escolher, escolhe a que for mais parecida com a forma como te sentes.
Só podes escolher uma resposta em cada questão. Por favor responde a todas as questões.
Se durante a realização desta tarefa tiveres alguma dúvida pergunta à pessoa que te entregou o questionário.

Obrigada pela tua participação.
Antes de começares, aqui tens alguns exemplos:

		Muitas vezes	Algumas vezes	Poucas vezes	Nunca
		3	2	1	0
a.	**Jogar futebol é difícil.**	☐	☐	☐	☐
b.	**Eu gosto de ver filmes.**	☐	☐	☐	☐

Para cada questão, assinala o quadrado que melhor corresponde ao que sentes.

		Muitas vezes	Algumas vezes	Poucas vezes	Nunca
		3	2	1	0
1.	Eu gosto de matemática.	☐	☐	☐	☐
2.	A matemática exige muito esforço.	☐	☐	☐	☐
3.	Fazer exercícios de matemática faz-me feliz.	☐	☐	☐	☐
4.	Fico aflito se não sou capaz de fazer os exercícios de matemática.	☐	☐	☐	☐
5.	Sinto-me bem quando faço atividades de matemática.	☐	☐	☐	☐
6.	Tenho de deixar de fazer muitas coisas para ser bom a matemática.	☐	☐	☐	☐
7.	A matemática entusiasma-me.	☐	☐	☐	☐
8.	Aprender matemática ocupa muito do meu tempo.	☐	☐	☐	☐
9.	A matemática é uma das minhas disciplinas favoritas.	☐	☐	☐	☐
10.	Fazer problemas de matemática não me deixa fazer outras atividades que eu gosto.	☐	☐	☐	☐
11.	Eu faço exercícios de matemática mesmo quando não tenho de fazer.	☐	☐	☐	☐
12.	Quando estou a fazer exercícios de matemática preferia estar a fazer outras coisas.	☐	☐	☐	☐
13.	Quero realmente sair-me bem a matemática. A matemática é importante.	☐	☐	☐	☐

		Muitas vezes	Algumas vezes	Poucas vezes	Nunca
		3	2	1	0
14.	**Não gosto de gastar energia com atividades de matemática.**	☐	☐	☐	☐
15.	**Quando eu crescer será útil saber matemática.**	☐	☐	☐	☐
16.	**Se eu tivesse escolha não faria atividades de matemática.**	☐	☐	☐	☐
17.	**Se eu me sair bem a matemática, então vou sair-me bem na escola.**	☐	☐	☐	☐
18.	**Eu não sou bom a matemática.**	☐	☐	☐	☐
19.	**O que eu aprendo a matemática posso utilizar na vida do dia-a-dia.**	☐	☐	☐	☐
20.	**A matemática tem sido a disciplina mais difícil da escola.**	☐	☐	☐	☐
21.	**Eu acho que as atividades da matemática me tornam mais esperto.**	☐	☐	☐	☐
22.	**Há muitas coisas difíceis na matemática.**	☐	☐	☐	☐
23.	**Eu posso aprender muitas coisas úteis fazendo atividades de matemática.**	☐	☐	☐	☐
24.	**Eu dou o meu melhor a matemática para agradar ao(à) professor(a).**	☐	☐	☐	☐
25.	**Para a vida de todos os dias é importante aprender matemática.**	☐	☐	☐	☐
26.	**Eu não gosto de fazer atividades de matemática.**	☐	☐	☐	☐

		Muitas vezes	Algumas vezes	Poucas vezes	Nunca
		3	2	1	0
27.	**A matemática é fácil para mim.**	☐	☐	☐	☐
28.	**A matemática não é importante para mim.**	☐	☐	☐	☐
29.	**Quando estou a fazer atividades de matemática o tempo passa depressa.**	☐	☐	☐	☐
30.	**A matemática é aborrecida.**	☐	☐	☐	☐
31.	**Eu consigo resolver com facilidade problemas de matemática que são difíceis para outros alunos.**	☐	☐	☐	☐
32.	**A matemática é inútil.**	☐	☐	☐	☐
33.	**Eu resolvo com facilidade problemas de matemática.**	☐	☐	☐	☐

Por favor verifica se respondeste a todas as questões.

MUITO OBRIGADO PELA TUA COLABORAÇÃO!

Achievement Emotions Questionnaire – 3rd and 4th grade girls

CÓDIGO	
ESCOLA	
TURMA	

AEQ

Cara aluna,

Gostaríamos de te colocar algumas questões relacionadas com aula de matemática e os seus trabalhos de casa e também a forma como te sentes quando fazes os testes de matemática.
Neste questionário não há respostas certas ou erradas.
Certifica-te apenas de que as tuas respostas mostram realmente o que sentes.

Quando estiveres a responder às questões, se mudares de ideias e quiseres alterar alguma resposta faz uma cruz na resposta que preferes e coloca um círculo à volta dela.
Se não tens a certeza que resposta escolher, escolhe a que for mais parecida com a forma como te sentes.
Só podes escolher uma resposta em cada questão.
Por favor responde a todas as questões.

Se durante a realização desta tarefa tiveres alguma dúvida pergunta à pessoa que te entregou o questionário.
Há questões que são muito parecidas umas com as outras. Não é nenhuma ratoeira. É apenas porque neste tipo de estudos é necessário colocar a mesma questão de formas ligeiramente diferentes.
Responde exatamente como te sentes realmente.

Muito obrigada pela tua colaboração!

VIRA A PÁGINA PARA PODERES VER ALGUNS EXEMPLOS

Antes de começares, aqui tens alguns exemplos:
Cada frase tem algumas caras que mostram como te podes sentir, e tens de escolher qual é a cara que mostra melhor como te sentes em relação à frase.

Exemplos

A	Eu gosto de andar de bicicleta.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

B	Aborrece-me ver um jogo de futebol.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

C	Andar de avião assusta-me.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

SALA DE AULA DE MATEMÁTICA

Por favor coloca uma cruz no círculo que mostra melhor a forma como te sentes em relação à frase.

1	Eu gosto da aula de matemática.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

2	A aula de matemática aborrece-me.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

3	Quando penso em matemática fico aflita.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

4	Sinto que não vale a pena preparar-me para a aula de Matemática porque, seja como for, eu não entendo a material.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

5	Eu estou desejosa de ir para a aula de matemática.			
				
○	○	○	○	○
Nada	Pouco	Assim-Assim	Bastante	Muito

6	Quando eu penso na aula de matemática, fico nervosa.			
				
○	○	○	○	○
Nada	Pouco	Assim-Assim	Bastante	Muito

7	Mesmo antes de entrar para a aula de Matemática, já sei que não vou perceber a matéria.			
				
○	○	○	○	○
Nada	Pouco	Assim-Assim	Bastante	Muito

8	A matemática aborrece-me.			
				
○	○	○	○	○
Nada	Pouco	Assim-Assim	Bastante	Muito

9	Quando eu penso na aula de matemática, fico com dores de barriga.			
				
○	○	○	○	○
Nada	Pouco	Assim-Assim	Bastante	Muito

10	A matemática para mim é divertida.			
				
○	○	○	○	○
Nada	Pouco	Assim-Assim	Bastante	Muito

11	Preferia não ir à aula de Matemática, pois não há hipótese de perceber a matéria.			
				
○	○	○	○	○
Nada	Pouco	Assim-Assim	Bastante	Muito

12	Eu acho que fazer exercícios de matemática é “uma seca”.			
				
○	○	○	○	○
Nada	Pouco	Assim-Assim	Bastante	Muito

13	Na aula de matemática, fico preocupada que as coisas sejam difíceis para mim.			
				
○	○	○	○	○
Nada	Pouco	Assim-Assim	Bastante	Muito

14	Sinto que não estou a perceber o que se passa durante a aula de Matemática.			
				
○	○	○	○	○
Nada	Pouco	Assim-Assim	Bastante	Muito

15	Eu acho a aula de matemática tão aborrecida que preferia fazer outra coisa qualquer.			
				
○	○	○	○	○
Nada	Pouco	Assim-Assim	Bastante	Muito

16	Perdi a esperança de perceber a matéria de Matemática.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

17	Eu gosto de fazer atividades de matemática.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

18	Sinto-me desanimada para continuar a vir às aulas de Matemática.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

TRABALHOS DE CASA DE MATEMÁTICA

Por favor coloca uma cruz no círculo que mostra melhor a forma como te sentes em relação à frase.

19	Quando faço os trabalhos de casa de Matemática, apetece-me desistir.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

20	Quando faço os trabalhos de casa de matemática, estou bem-disposta.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

21	Os trabalhos de casa de matemática são “uma seca!”.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

22	Fico tão preocupada se não consigo fazer os trabalhos de casa de Matemática que começo a transpirar.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

23	Sinto-me desanimada quando penso em fazer os trabalhos faço os trabalhos de casa de Matemática.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

24	Os trabalhos de casa de matemática são tão chatos que não me apetece fazê-los.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

25	Fico preocupada se não sou capaz de fazer os trabalhos de casa de matemática.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

26	Gosto tanto dos trabalhos de casa de matemática que não quero parar de os fazer.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

27	Sinto-me desencorajada depois de fazer os trabalhos de casa de Matemática, porque sinto que nunca vou aprender a matéria.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

28	Fico tão aflita quando tenho de fazer os trabalhos de casa de matemática que não me apetece começar a fazê-los.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

29	Quando faço os trabalhos de casa de matemática, canso-me depressa porque estou aborrecida.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

30	Quando faço os trabalhos de casa de Matemática, sinto-me desanimada.			
				
○	○	○	○	○
Nada	Pouco	Assim-Assim	Bastante	Muito

11

TESTES DE MATEMÁTICA

Por favor coloca uma cruz no círculo que mostra melhor a forma como te sentes em relação à frase.

31	Durante o teste de Matemática, apetece-me desistir.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

32	Durante os testes de Matemática, eu penso: “Isto está a correr muito bem!”.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

33	Antes de começar o teste de Matemática, fico triste/aborrecida, porque sinto que não tenho muitas hipóteses de ter sucesso.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

34	Fico tão nervosa durante os testes de matemática que não me consigo lembrar bem do que aprendi.			
				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito

35	Fico desejosa de fazer os testes de matemática.			
				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito

36	Durante o teste de Matemática, deixo de acreditar que consigo responder às perguntas.			
				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito

37	Os testes de matemática assustam-me tanto que preferia não os fazer.			
				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito

38	Fico tão nervosa durante um teste de matemática que não me consigo concentrar.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

39	Durante o teste de Matemática, fico tão desanimada que nem tenho energia para fazer o teste.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

40	Fico muito nervosa durante os testes de matemática.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

41	Quando faço um teste de matemática, fico com medo de errar.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

42	Quando faço um teste de matemática, fico com medo de ter uma má nota.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

15

Achievement Emotions Questionnaire – 3rd and 4th grade boys

CÓDIGO	
ESCOLA	
TURMA	

AEQ

Caro aluno,

Gostaríamos de te colocar algumas questões relacionadas com aula de matemática e os seus trabalhos de casa e também a forma como te sentes quando fazes os testes de matemática.
Neste questionário não há respostas certas ou erradas.
Certifica-te apenas de que as tuas respostas mostram realmente o que sentes.

Quando estiveres a responder às questões, se mudares de ideias e quiseres alterar alguma resposta faz uma cruz na resposta que preferes e coloca um círculo à volta dela.
Se não tens a certeza que resposta escolher, escolhe a que for mais parecida com a forma como te sentes.
Só podes escolher uma resposta em cada questão.
Por favor responde a todas as questões.

Se durante a realização desta tarefa tiveres alguma dúvida pergunta à pessoa que te entregou o questionário.
Há questões que são muito parecidas umas com as outras. Não é nenhuma ratoeira. É apenas porque neste tipo de estudos é necessário colocar a mesma questão de formas ligeiramente diferentes.
Responde exatamente como te sentes realmente.

Muito obrigado pela tua colaboração!

VIRA A PÁGINA PARA PODERES VER ALGUNS EXEMPLOS

1

Antes de começares, aqui tens alguns exemplos:
Cada frase tem algumas caras que mostram como te podes sentir, e tens de escolher qual é a cara que mostra melhor como te sentes em relação à frase.

Exemplos

A	Eu gosto de andar de bicicleta.				
				
○	○	○	○	○
Nada	Pouco	Assim-Assim	Bastante	Muito

B	Aborrece-me ver um jogo de futebol.				
				
○	○	○	○	○
Nada	Pouco	Assim-Assim	Bastante	Muito

C	Andar de avião assusta-me.				
				
○	○	○	○	○
Nada	Pouco	Assim-Assim	Bastante	Muito

SALA DE AULA DE MATEMÁTICA

Por favor coloca uma cruz no círculo que mostra melhor a forma como te sentes em relação à frase.

1	Eu gosto da aula de matemática.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

2	A aula de matemática aborrece-me.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

3	Quando penso em matemática fico aflito.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

4	Sinto que não vale a pena preparar-me para a aula de Matemática porque, seja como for, eu não entendo a matéria.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

5	Eu estou desejoso de ir para a aula de matemática.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

6	Quando eu penso na aula de matemática, fico nervoso.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

7	Mesmo antes de entrar para a aula de Matemática, já sei que não vou perceber a matéria.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

8	A matemática aborrece-me.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

9	Quando eu penso na aula de matemática, fico com dores de barriga.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

10	A matemática para mim é divertida.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

11	Preferia não ir à aula de Matemática, pois não há hipótese de perceber a matéria.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

12	Eu acho que fazer exercícios de matemática é “uma seca”.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

13	Na aula de matemática, fico preocupado que as coisas sejam difíceis para mim.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

14	Sinto que não estou a perceber o que se passa durante a aula de Matemática.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

15	Eu acho a aula de matemática tão aborrecida que preferia fazer outra coisa qualquer.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

16	Perdi a esperança de perceber a matéria de Matemática.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

17	Eu gosto de fazer atividades de matemática.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

18	Sinto-me desanimada para continuar a vir às aulas de Matemática.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

TRABALHOS DE CASA DE MATEMÁTICA

Por favor coloca uma cruz no círculo que mostra melhor a forma como te sentes em relação à frase.

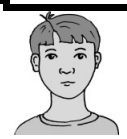
19	Quando faço os trabalhos de casa de Matemática, apetece-me desistir.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

20	Quando faço os trabalhos de casa de matemática, estou bem-disposto.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

21	Os trabalhos de casa de matemática são “uma seca!”.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

22	Fico tão preocupado se não consigo fazer os trabalhos de casa de Matemática que começo a transpirar.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

23	Sinto-me desanimado quando penso em fazer os trabalhos faço os trabalhos de casa de Matemática.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

24	Os trabalhos de casa de matemática são tão chatos que não me apetece fazê-los.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

25	Fico preocupado se não sou capaz de fazer os trabalhos de casa de Matemática.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

9

26	Gosto tanto dos trabalhos de casa de matemática que não quero parar de os fazer.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

27	Sinto-me desencorajado depois de fazer os trabalhos de casa de Matemática, porque sinto que nunca vou aprender a matéria.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

28	Fico tão aflito quando tenho de fazer os trabalhos de casa de matemática que não me apetece começar a fazê-los.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

29	Quando faço os trabalhos de casa de matemática, canso-me depressa porque estou aborrecido.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

10

30	Quando faço os trabalhos de casa de Matemática, sinto-me desanimado.				
				
○	○	○	○	○
Nada	Pouco	Assim-Assim	Bastante	Muito

11

TESTES DE MATEMÁTICA

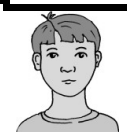
Por favor coloca uma cruz no círculo que mostra melhor a forma como te sentes em relação à frase.

31	Durante o teste de Matemática, apetece-me desistir.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

32	Durante os testes de matemática, eu penso: “Isto está a correr muito bem!”.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

33	Antes de começar o teste de Matemática, fico triste/aborrecido, porque sinto que não tenho muitas hipóteses de ter sucesso.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

12

34	Fico tão nervoso durante os testes de matemática que não me consigo lembrar bem do que aprendi.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

35	Fico desejoso de fazer os testes de matemática.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

36	Durante o teste de Matemática, deixo de acreditar que consigo responder às perguntas.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

37	Os testes de matemática assustam-me tanto que preferia não os fazer.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

38	Fico tão nervoso durante um teste de matemática que não me consigo concentrar.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

39	Durante o teste de Matemática, fico tão desanimado que nem tenho energia para fazer o teste.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

40	Fico muito nervoso durante os testes de Matemática.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

41	Quando faço um teste de matemática, fico com medo de errar.				
					
○	○	○	○	○	
Nada	Pouco	Assim-Assim	Bastante	Muito	

42	Quando faço um teste de matemática, fico com medo de ter uma má nota.				
				
○	○	○	○	○
Nada	Pouco	Assim-Assim	Bastante	Muito

15

Achievement Emotions Questionnaire – 5th and 6th grade

CÓDIGO	
ESCOLA	
TURMA	

AEQ

Caro aluno,

Gostaríamos de te colocar algumas questões relacionadas com aula de matemática e os seus trabalhos de casa e também a forma como te sentes quando fazes os testes de matemática.
Neste questionário não há respostas certas ou erradas.
Certifica-te apenas de que as tuas respostas mostram realmente o que sentes.

Quando estiveres a responder às questões, se mudares de ideias e quiseres alterar alguma resposta faz uma cruz na resposta que preferes e coloca um círculo à volta dela.
Se não tens a certeza que resposta escolher, escolhe a que for mais parecida com a forma como te sentes.
Só podes escolher uma resposta em cada ques-
tão. Por favor responde a todas as questões.

Se durante a realização desta tarefa tiveres alguma dúvida pergunta à pessoa que te entregou o questionário.
Há questões que são muito parecidas umas com as outras. Não é nenhuma ratoeira. É apenas porque neste tipo de estudos é necessário colocar a mesma questão de formas ligeiramente diferentes.
Responde exatamente como te sentes real-

mente. Muito obrigado pela tua colaboração!

VIRA A PÁGINA PARA PODERES VER ALGUNS EXEMPLOS

Antes de começares, aqui tens alguns exemplos:
Cada frase tem algumas caras que mostram como te podes sentir, e tens de escolher qual é a cara que mostra melhor como te sentes em relação à frase.

Exemplos

A	Eu gosto de andar de bicicleta.				
	○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito

B	Aborrece-me ver um jogo de futebol.				
	○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito

C	Andar de avião assusta-me.				
	○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito

SALA DE AULA DE MATEMÁTICA

Por favor coloca uma cruz no círculo que mostra melhor a forma como te sentes em relação à frase.

1	Eu gosto da aula de matemática.				
	○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito

2	A aula de matemática aborrece-me.				
	○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito

3	Quando penso em matemática fico aflito/a.				
	○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito

4	Sinto que não vale a pena preparar-me para a aula de Matemática porque, seja como for, eu não entendo a matéria.				
	○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito

5	Eu estou desejoso/a de ir para a aula de matemática.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

6	Quando eu penso na aula de matemática, fico nervoso/a.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

7	Mesmo antes de entrar para a aula de Matemática, já sei que não vou perceber a matéria.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

8	A matemática aborrece-me.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

9	Quando eu penso na aula de matemática, fico com dores de barriga.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

10	A matemática para mim é divertida.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

11	Preferia não ir à aula de Matemática, pois não há hipótese de perceber a matéria.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

12	Eu acho que fazer exercícios de matemática é “uma seca”.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

SALA DE AULA DE MATEMÁTICA

Por favor coloca uma cruz no círculo que mostra melhor a forma como te sentes em relação à frase.

13	Na aula de matemática, fico preocupado/a que as coisas sejam difíceis para mim.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

14	Sinto que não estou a perceber o que se passa durante a aula de Matemática.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

15	Eu acho a aula de matemática tão aborrecida que preferia fazer outra coisa qualquer.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

16	Perdi a esperança de perceber a matéria de Matemática.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

17	Eu gosto de fazer atividades de matemática.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

18	Sinto-me desanimado/a para continuar a vir às aulas de Matemática.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

TRABALHOS DE CASA DE MATEMÁTICA

Por favor coloca uma cruz no círculo que mostra melhor a forma como te sentes em relação à frase.

19	Quando faço os trabalhos de casa de Matemática, apetece-me desistir.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

20	Quando faço os trabalhos de casa de matemática, estou bem-disposto/a.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

21	Os trabalhos de casa de matemática são “uma seca!”.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

22	Fico tão preocupado/a se não consigo fazer os trabalhos de casa de matemática que começo a transpirar.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

23	Sinto-me desanimado/a quando penso em fazer os trabalhos de casa de Matemática.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

24	Os trabalhos de casa de matemática são tão chatos que não me apetece fazê-los.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

25	Fico preocupado/a se não sou capaz de fazer os trabalhos de casa de matemática.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

TRABALHOS DE CASA DE MATEMÁTICA

Por favor coloca uma cruz no círculo que mostra melhor a forma como te sentes em relação à frase.

26	Gosto tanto dos trabalhos de casa de matemática que não quero parar de os fazer.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

27	Sinto-me desencorajado/a depois de fazer os trabalhos de casa de Matemática, porque sinto que nunca vou aprender a matéria			
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

28	Fico tão aflito/a quando tenho de fazer os trabalhos de casa de matemática que não me apetece começar a fazê-los.			
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

29	Quando faço os trabalhos de casa de matemática, canso-me depressa porque estou aborrecido/a.			
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

30	Quando faço os trabalhos de casa de Matemática, sinto-me desanimado/a.			
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

TESTES DE MATEMÁTICA

Por favor coloca uma cruz no círculo que mostra melhor a forma como te sentes em relação à frase.

31	Durante o teste de Matemática, apetece-me desistir.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

32	Durante os testes de matemática, eu penso: “Isto está a correr muito bem!”.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

33	Antes de começar o teste de Matemática, fico triste/aborrecido, porque sinto que não tenho muitas hipóteses de ter sucesso.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

34	Fico tão nervoso/a durante os testes de matemática que não me consigo lembrar bem do que aprendi.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

35	Fico desejoso/a de fazer os testes de matemática.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

36	Durante o teste de Matemática, deixo de acreditar que consigo responder correta-mente às perguntas.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

37	Os testes de matemática assustam-me tanto que preferia não os fazer.				
○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito	

TESTES DE MATEMÁTICA

Por favor coloca uma cruz no círculo que mostra melhor a forma como te sentes em relação à frase.

38	Fico tão nervoso/a durante um teste de matemática que não me consigo concentrar.				
	○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito

39	Durante o teste de Matemática, fico tão desanimado/a que nem tenho energia para fazer o teste.				
	○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito

40	Fico muito nervoso/a durante os testes de matemática.				
	○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito

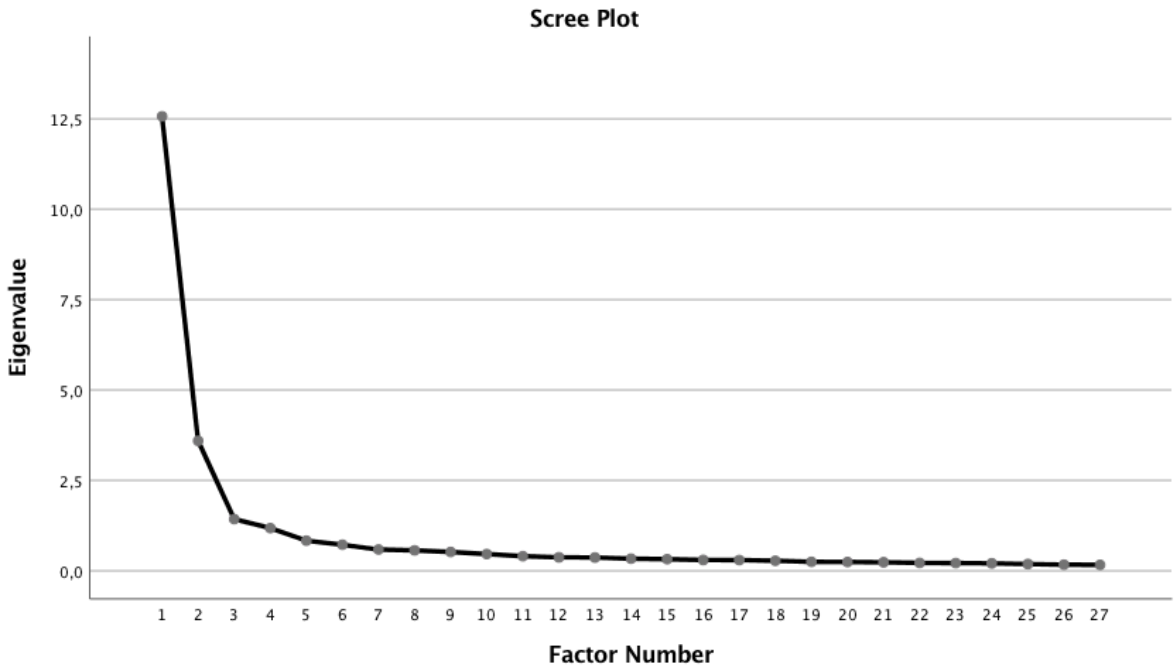
41	Quando faço um teste de matemática, fico com medo de errar.				
	○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito

42	Quando faço um teste de matemática, fico com medo de ter uma má nota.				
	○ Nada	○ Pouco	○ Assim-Assim	○ Bastante	○ Muito

Appendix C – Exploratory factor analysis: AEQ-ES

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,977
Bartlett's Test of Sphericity	Approx. Chi-Square	40261,039
	df	861
	Sig.	,000



Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	12,568	46,547	46,547	12,125	44,906	44,906	9,479
2	3,593	13,307	59,854	3,305	12,242	57,148	6,949
3	1,429	5,291	65,145	1,042	3,859	61,008	9,018
4	1,180	4,372	69,517	,802	2,971	63,979	5,996
5	,832	3,080	72,597				
6	,719	2,664	75,261				
7	,588	2,177	77,438				
8	,565	2,091	79,529				
9	,521	1,928	81,457				
10	,460	1,705	83,162				
11	,404	1,495	84,657				
12	,372	1,377	86,034				
13	,366	1,357	87,391				
14	,333	1,235	88,626				
15	,321	1,189	89,815				
16	,299	1,106	90,921				
17	,296	1,097	92,018				
18	,277	1,026	93,044				
19	,248	,919	93,964				
20	,242	,896	94,859				
21	,234	,868	95,728				
22	,216	,802	96,529				
23	,214	,791	97,321				
24	,205	,760	98,081				
25	,186	,688	98,768				
26	,169	,626	99,394				
27	,164	,606	100,000				

Extraction Method: Maximum Likelihood.

Appendix D – Reliability: AEQ-ES

Enjoyment

Reliability Statistics

Cronbach's Alpha	N of Items
,948	7

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Math class bores me.	13,66	50,870	,828	,940
Math class annoys me.	13,90	50,803	,805	,942
I find doing math boring.	13,70	49,318	,840	,939
I find Math class so boring that I would rather do something else.	13,68	48,464	,850	,938
Math homework bores me to death.	13,57	47,981	,852	,938
Math homework bores me so much that I don't want to keep doing it.	13,66	48,034	,844	,938
When I do math homework, I get tired quickly because I am bored	13,59	49,660	,766	,945

Boredom

Reliability Statistics

Cronbach's Alpha	N of Items
,948	7

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Math class bores me.	13,66	50,870	,828	,940
Math class annoys me.	13,90	50,803	,805	,942
I find doing math boring.	13,70	49,318	,840	,939
I find Math class so boring that I would rather do something else.	13,68	48,464	,850	,938
Math homework bores me to death.	13,57	47,981	,852	,938
Math homework bores me so much that I don't want to keep doing it.	13,66	48,034	,844	,938
When I do math homework, I get tired quickly because I am bored	13,59	49,660	,766	,945

Anxiety

Reliability Statistics

Cronbach's Alpha	N of Items
,829	6

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Math scares me.	8,95	17,273	,641	,793
When I think about math class, I get nervous.	8,91	16,640	,681	,784
When I think about math class, my stomach feels upset.	9,27	19,021	,528	,816
During math class, I worry that everything is too difficult for me.	8,60	16,182	,674	,785
I worry so much about not finishing my math homework that I start sweating	9,08	18,386	,499	,821
When I do math homework, I worry if I will ever understand it	8,51	16,434	,588	,806

Test Anxiety

Reliability Statistics

Cronbach's Alpha	N of Items
,829	6

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Math scares me.	8,95	17,273	,641	,793
When I think about math class, I get nervous.	8,91	16,640	,681	,784
When I think about math class, my stomach feels upset.	9,27	19,021	,528	,816
During math class, I worry that everything is too difficult for me.	8,60	16,182	,674	,785
I worry so much about not finishing my math homework that I start sweating	9,08	18,386	,499	,821
When I do math homework, I worry if I will ever understand it	8,51	16,434	,588	,806

Appendix E – Reliability: MMS

Intrinsic Value

Reliability Statistics

Cronbach's Alpha	N of Items
,898	7

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
I like doing math.	15,06	25,067	,787	,874
Doing math makes me happy.	15,46	24,552	,795	,872
I feel good when I do my math work.	15,18	24,375	,778	,874
I get excited when I do math.	15,46	24,371	,766	,875
Math is one of my favourite subjects.	15,28	23,312	,747	,878
I do math even when I don?t have to.	15,71	27,210	,495	,905
I don?t enjoy doing math tasks.	15,02	26,459	,567	,897

Utility Value

Reliability Statistics

Cronbach's Alpha	N of Items
,839	6

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
When I grow up it will be useful to know math.	16,26	11,768	,599	,816
If I do well in math, I will do well in school.	16,71	11,416	,479	,845
What I learn in math I can use in daily life.	16,45	11,124	,668	,802
I think that doing math makes me smarter.	16,61	11,053	,631	,810
I can learn many useful things by doing math.	16,54	11,189	,672	,802
For everyday life it?s important to learn how to do math.	16,44	11,266	,679	,801

Competence Self-Beliefs

Reliability Statistics

Cronbach's Alpha	N of Items
,838	6

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
I can easily solve different math problems.	13,11	13,991	,683	,799
I can easily manage math problems that are hard to other pupils.	13,41	14,170	,606	,813
Math is easy for me.	13,35	13,719	,626	,808
Many things are difficult in math.	13,66	14,066	,595	,815
Math has been the hardest subject for me in school.	13,17	13,025	,621	,811
I am no good in math.	13,00	14,305	,562	,821

Costs

Reliability Statistics

Cronbach's Alpha	N of Items
,721	5

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
I have to give up too much to do well in math.	9,00	9,582	,382	,712
Learning math requires too much of my time.	8,69	9,093	,484	,672
Doing math problems keeps me away from other things I like.	9,01	8,382	,600	,622
When I do math I would rather be doing other things.	8,47	9,336	,471	,677
I do not like spending my energy doing math.	9,04	9,497	,466	,679

Appendix E – Multivariate Analysis of Variance

Emotions

Descriptive Statistics

	country	grade	Mean	Std. Deviation	N
Enjoyment	Serbia	3	3,1651	1,07876	159
		4	2,8902	1,06297	154
		5	2,4145	,92265	255
		6	2,3651	,93660	242
		Total	2,6375	1,03649	810
	Portugal	3	3,7520	1,03858	167
		4	3,5916	,93945	185
		5	3,0381	1,06865	201
		6	2,4586	,90781	252
		Total	3,1320	1,11302	805
	Total	3	3,4657	1,09681	326
		4	3,2729	1,05558	339
		5	2,6894	1,03599	456
		6	2,4128	,92228	494
		Total	2,8840	1,10306	1615

Descriptive Statistics

	country	grade	Mean	Std. Deviation	N
Boredom	Serbia	3	1,7680	,91992	159
		4	1,9155	1,00125	154
		5	2,5224	1,11816	255
		6	2,6049	1,21653	242
		Total	2,2836	1,14683	810
	Portugal	3	1,7449	,95453	167
		4	1,8284	,87958	185
		5	2,4456	1,21124	201
		6	3,0730	1,18947	252
		Total	2,3548	1,21514	805
	Total	3	1,7562	,93644	326
		4	1,8680	,93640	339
		5	2,4886	1,15944	456
		6	2,8437	1,22420	494
		Total	2,3191	1,18154	1615

Descriptive Statistics

	country	grade	Mean	Std. Deviation	N
Anxiety	Serbia	3	1,4784	,64606	159
		4	1,4513	,60587	154
		5	1,8707	,85914	255
		6	1,9888	,96425	242
		Total	1,7492	,84427	810
	Portugal	3	1,7984	,85530	167
		4	1,7871	,80584	185
		5	1,8569	,75573	201
		6	1,8115	,79235	252
		Total	1,8145	,79900	805
	Total	3	1,6423	,77603	326
		4	1,6346	,74007	339
		5	1,8646	,81433	456
		6	1,8983	,88432	494
		Total	1,7818	,82241	1615

Descriptive Statistics

	country	grade	Mean	Std. Deviation	N
Anxiety_T	Serbia	3	1,9222	,90507	159
		4	1,8738	,88677	154
		5	2,6839	1,20598	255
		6	2,6548	1,21593	242
		Total	2,3717	1,16077	810
	Portugal	3	2,2239	1,08225	167
		4	2,4285	1,09773	185
		5	2,7090	1,06023	201
		6	2,9568	1,12662	252
		Total	2,6214	1,12785	805
	Total	3	2,0767	1,00959	326
		4	2,1765	1,04328	339
		5	2,6950	1,14288	456
		6	2,8089	1,17975	494
		Total	2,4962	1,15092	1615

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[d]
Intercept	Pillai's Trace	,984	24427,568[b]	4,000	1604,000	,000	,984	97710,274	1,000
	Wilks' Lambda	,016	24427,568[b]	4,000	1604,000	,000	,984	97710,274	1,000
	Hotelling's Trace	60,917	24427,568[b]	4,000	1604,000	,000	,984	97710,274	1,000
	Roy's Largest Root	60,917	24427,568[b]	4,000	1604,000	,000	,984	97710,274	1,000
country	Pillai's Trace	,191	94,588[b]	4,000	1604,000	,000	,191	378,353	1,000
	Wilks' Lambda	,809	94,588[b]	4,000	1604,000	,000	,191	378,353	1,000
	Hotelling's Trace	,236	94,588[b]	4,000	1604,000	,000	,191	378,353	1,000
	Roy's Largest Root	,236	94,588[b]	4,000	1604,000	,000	,191	378,353	1,000
grade	Pillai's Trace	,181	25,745	12,000	4818,000	,000	,060	308,936	1,000
	Wilks' Lambda	,820	27,475	12,000	4244,077	,000	,064	289,468	1,000
	Hotelling's Trace	,217	29,040	12,000	4808,000	,000	,068	348,482	1,000
	Roy's Largest Root	,211	84,563[c]	4,000	1606,000	,000	,174	338,252	1,000
country * grade	Pillai's Trace	,063	8,671	12,000	4818,000	,000	,021	104,051	1,000
	Wilks' Lambda	,937	8,793	12,000	4244,077	,000	,021	92,917	1,000
	Hotelling's Trace	,067	8,892	12,000	4808,000	,000	,022	106,708	1,000
	Roy's Largest Root	,057	22,993[c]	4,000	1606,000	,000	,054	91,974	1,000

a. Design: Intercept + country + grade + country * grade

b. Exact statistic

c. The statistic is an upper bound on F that yields a lower bound on the significance level.

d. Computed using alpha =

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	Enjoyment	402,733[a]	7	57,533	59,225	,000	,205
	Boredom	349,728[b]	7	49,961	42,179	,000	,155
	Anxiety	45,247[c]	7	6,464	9,927	,000	,041
	Anxiety_T	202,912[d]	7	28,987	24,073	,000	,095
Intercept	Enjoyment	13613,580	1	13613,580	14013,968	,000	,897
	Boredom	7784,372	1	7784,372	6571,895	,000	,804
	Anxiety	4789,714	1	4789,714	7355,798	,000	,821
	Anxiety_T	9190,731	1	9190,731	7632,708	,000	,826
country	Enjoyment	97,662	1	97,662	100,534	,000	,059
	Boredom	1,920	1	1,920	1,621	,203	,001
	Anxiety	5,245	1	5,245	8,055	,005	,005
	Anxiety_T	34,008	1	34,008	28,243	,000	,017
grade	Enjoyment	271,606	3	90,535	93,198	,000	,148
	Boredom	316,026	3	105,342	88,934	,000	,142
	Anxiety	25,502	3	8,501	13,055	,000	,024
	Anxiety_T	163,656	3	54,552	45,304	,000	,078
country * grade	Enjoyment	25,765	3	8,588	8,841	,000	,016
	Boredom	24,408	3	8,136	6,869	,000	,013
	Anxiety	19,348	3	6,449	9,904	,000	,018
	Anxiety_T	13,742	3	4,581	3,804	,010	,007
Error	Enjoyment	1561,087	1607	,971			
	Boredom	1903,482	1607	1,184			
	Anxiety	1046,395	1607	,651			
	Anxiety_T	1935,028	1607	1,204			
Total	Enjoyment	15396,536	1615				
	Boredom	10938,949	1615				
	Anxiety	6218,818	1615				
	Anxiety_T	12200,880	1615				
Corrected Total	Enjoyment	1963,820	1614				
	Boredom	2253,211	1614				
	Anxiety	1091,642	1614				
	Anxiety_T	2137,940	1614				

a. R Squared = ,205 (Adjusted R Squared = ,202)

b. R Squared = ,155 (Adjusted R Squared = ,152)

c. R Squared = ,041 (Adjusted R Squared = ,037)

d. R Squared = ,095 (Adjusted R Squared = ,091)

e. Computed using alpha =

Multiple Comparisons

TestTukey HSD

Dependent Variable	(I) grade	(J) grade	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Enjoyment	3	4	,1928	,07646	,057	-,0038	,3894
		5	,7763*	,07149	,000	,5925	,9602
		6	1,0529*	,07033	,000	,8721	1,2338
	4	3	-,1928	,07646	,057	-,3894	,0038
		5	,5835*	,07068	,000	,4018	,7653
		6	,8601*	,06951	,000	,6814	1,0389
	5	3	-,7763*	,07149	,000	-,9602	-,5925
		4	-,5835*	,07068	,000	-,7653	-,4018
		6	,2766*	,06401	,000	,1120	,4412
	6	3	-1,0529*	,07033	,000	-1,2338	-,8721
		4	-,8601*	,06951	,000	-1,0389	-,6814
		5	-,2766*	,06401	,000	-,4412	-,1120
Boredom	3	4	-,1118	,08442	,548	-,3289	,1053
		5	-,7324*	,07894	,000	-,9354	-,5294
		6	-1,0875*	,07766	,000	-1,2872	-,8878
	4	3	,1118	,08442	,548	-,1053	,3289
		5	-,6206*	,07805	,000	-,8213	-,4199
		6	-,9757*	,07676	,000	-1,1731	-,7783
	5	3	,7324*	,07894	,000	,5294	,9354
		4	,6206*	,07805	,000	,4199	,8213
		6	-,3551*	,07068	,000	-,5369	-,1734
	6	3	1,0875*	,07766	,000	,8878	1,2872
		4	,9757*	,07676	,000	,7783	1,1731
		5	,3551*	,07068	,000	,1734	,5369
Anxiety	3	4	,0078	,06260	,999	-,1532	,1687
		5	-,2223*	,05853	,001	-,3728	-,0718
		6	-,2560*	,05758	,000	-,4041	-,1079
	4	3	-,0078	,06260	,999	-,1687	,1532
		5	-,2301*	,05787	,000	-,3789	-,0812
		6	-,2638*	,05691	,000	-,4101	-,1174
	5	3	,2223*	,05853	,001	,0718	,3728
		4	,2301*	,05787	,000	,0812	,3789
		6	-,0337	,05240	,918	-,1685	,1010
	6	3	,2560*	,05758	,000	,1079	,4041
		4	,2638*	,05691	,000	,1174	,4101
		5	,0337	,05240	,918	-,1010	,1685

Anxiety_T	3	4	-,0998	,08512	,645	-,3187	,1191
		5	-,6182*	,07959	,000	-,8229	-,4135
		6	-,7321*	,07830	,000	-,9335	-,5308
	4	3	,0998	,08512	,645	-,1191	,3187
		5	-,5185*	,07869	,000	-,7208	-,3161
		6	-,6324*	,07739	,000	-,8314	-,4333
	5	3	,6182*	,07959	,000	,4135	,8229
		4	,5185*	,07869	,000	,3161	,7208
		6	-,1139	,07126	,380	-,2972	,0693
	6	3	,7321*	,07830	,000	,5308	,9335
		4	,6324*	,07739	,000	,4333	,8314
		5	,1139	,07126	,380	-,0693	,2972

Motivation

Descriptive Statistics

	grade	country	Mean	Std. Deviation	N
Int_value	3	Serbia	2,7979	,75587	164
		Portugal	3,0961	,65856	174
		Total	2,9514	,72198	338
	4	Serbia	2,5813	,75949	155
		Portugal	3,0556	,69492	188
		Total	2,8413	,76138	343
	5	Serbia	2,2545	,71450	256
		Portugal	2,7183	,80652	201
		Total	2,4585	,78988	457
	6	Serbia	2,0265	,72422	242
		Portugal	2,2855	,78834	252
		Total	2,1586	,76786	494
	Total	Serbia	2,3580	,78851	817
		Portugal	2,7430	,81776	815
		Total	2,5503	,82576	1632

Descriptive Statistics

	grade	country	Mean	Std. Deviation	N
Uti_value	3	Serbia	3,4490	,57681	164
		Portugal	3,6287	,46233	174
		Total	3,5415	,52797	338
	4	Serbia	3,3049	,63591	155
		Portugal	3,6661	,40930	188
		Total	3,5029	,55326	343
	5	Serbia	3,0823	,64948	256
		Portugal	3,4182	,57855	201
		Total	3,2301	,64075	457
	6	Serbia	2,8466	,72818	242
		Portugal	3,2854	,64151	252
		Total	3,0704	,71901	494
	Total	Serbia	3,1283	,69427	817
		Portugal	3,4793	,56431	815
		Total	3,3036	,65643	1632

Descriptive Statistics

	grade	country	Mean	Std. Deviation	N
Comp_Beliefs	3	Serbia	2,9374	,59025	164
		Portugal	2,7202	,63419	174
		Total	2,8256	,62193	338
	4	Serbia	2,8952	,67961	155
		Portugal	2,7727	,66802	188
		Total	2,8280	,67506	343
	5	Serbia	2,5266	,75205	256
		Portugal	2,6312	,73113	201
		Total	2,5726	,74393	457
	6	Serbia	2,4569	,82572	242
		Portugal	2,5228	,72524	252
		Total	2,4905	,77600	494
	Total	Serbia	2,6583	,76069	817
		Portugal	2,6493	,70082	815
		Total	2,6538	,73120	1632

Descriptive Statistics

	grade	country	Mean	Std. Deviation	N
Costs	3	Serbia	1,9542	,57368	164
		Portugal	2,1216	,67247	174
		Total	2,0403	,63115	338
	4	Serbia	1,9041	,64339	155
		Portugal	2,0729	,72647	188
		Total	1,9966	,69430	343
	5	Serbia	2,3287	,72885	256
		Portugal	2,1923	,72385	201
		Total	2,2687	,72902	457
	6	Serbia	2,3973	,84574	242
		Portugal	2,4481	,66637	252
		Total	2,4232	,75920	494
	Total	Serbia	2,1933	,75273	817
		Portugal	2,2287	,71155	815
		Total	2,2110	,73244	1632

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[d]
Intercept	Pillai's Trace	,988	33081,259[b]	4,000	1621,000	,000	,988	132325,038	1,000
	Wilks' Lambda	,012	33081,259[b]	4,000	1621,000	,000	,988	132325,038	1,000
	Hotelling's Trace	81,632	33081,259[b]	4,000	1621,000	,000	,988	132325,038	1,000
	Roy's Largest Root	81,632	33081,259[b]	4,000	1621,000	,000	,988	132325,038	1,000
grade	Pillai's Trace	,172	24,737	12,000	4869,000	,000	,057	296,844	1,000
	Wilks' Lambda	,829	26,267	12,000	4289,054	,000	,061	276,807	1,000
	Hotelling's Trace	,205	27,641	12,000	4859,000	,000	,064	331,697	1,000
	Roy's Largest Root	,197	79,850[c]	4,000	1623,000	,000	,164	319,399	1,000
country	Pillai's Trace	,140	66,164[b]	4,000	1621,000	,000	,140	264,658	1,000
	Wilks' Lambda	,860	66,164[b]	4,000	1621,000	,000	,140	264,658	1,000
	Hotelling's Trace	,163	66,164[b]	4,000	1621,000	,000	,140	264,658	1,000
	Roy's Largest Root	,163	66,164[b]	4,000	1621,000	,000	,140	264,658	1,000
grade * country	Pillai's Trace	,034	4,668	12,000	4869,000	,000	,011	56,014	1,000
	Wilks' Lambda	,966	4,683	12,000	4289,054	,000	,011	49,526	1,000
	Hotelling's Trace	,035	4,693	12,000	4859,000	,000	,011	56,316	1,000
	Roy's Largest Root	,025	9,975[c]	4,000	1623,000	,000	,024	39,899	1,000

a. Design: Intercept + grade + country + grade * country

b. Exact statistic

c. The statistic is an upper bound on F that yields a lower bound on the significance level.

d. Computed using alpha =

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	Int_value	222,191[a]	7	31,742	57,922	,000	,200
	Uti_value	112,384[b]	7	16,055	44,161	,000	,160
	Comp_Beliefs	43,599[c]	7	6,228	12,210	,000	,050
	Costs	56,580[d]	7	8,083	16,039	,000	,065
Intercept	Int_value	10672,902	1	10672,902	19475,815	,000	,923
	Uti_value	17535,495	1	17535,495	48233,628	,000	,967
	Comp_Beliefs	11346,970	1	11346,970	22244,216	,000	,932
	Costs	7473,995	1	7473,995	14830,968	,000	,901
grade	Int_value	156,188	3	52,063	95,003	,000	,149
	Uti_value	59,097	3	19,699	54,185	,000	,091
	Comp_Beliefs	37,154	3	12,385	24,278	,000	,043
	Costs	50,151	3	16,717	33,172	,000	,058
country	Int_value	55,086	1	55,086	100,521	,000	,058
	Uti_value	42,645	1	42,645	117,302	,000	,067
	Comp_Beliefs	,706	1	,706	1,383	,240	,001
	Costs	1,546	1	1,546	3,068	,080	,002
grade * country	Int_value	3,872	3	1,291	2,355	,070	,004
	Uti_value	3,415	3	1,138	3,131	,025	,006
	Comp_Beliefs	6,830	3	2,277	4,463	,004	,008
	Costs	6,273	3	2,091	4,149	,006	,008
Error	Int_value	889,965	1624	,548			
	Uti_value	590,411	1624	,364			
	Comp_Beliefs	828,417	1624	,510			
	Costs	818,407	1624	,504			
Total	Int_value	11726,325	1632				
	Uti_value	18514,016	1632				
	Comp_Beliefs	12365,885	1632				
	Costs	8852,971	1632				
Corrected Total	Int_value	1112,156	1631				
	Uti_value	702,794	1631				
	Comp_Beliefs	872,016	1631				
	Costs	874,987	1631				

a. R Squared = ,200 (Adjusted R Squared = ,196)

b. R Squared = ,160 (Adjusted R Squared = ,156)

c. R Squared = ,050 (Adjusted R Squared = ,046)

d. R Squared = ,065 (Adjusted R Squared = ,061)

e. Computed using alpha =

Multiple Comparisons

TestTukey HSD

Dependent Variable	(I) grade	(J) grade	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Int_value	3	4	,1101	,05674	,211	-,0358	,2560
		5	,4929*	,05311	,000	,3563	,6295
		6	,7928*	,05226	,000	,6584	,9272
	4	3	-,1101	,05674	,211	-,2560	,0358
		5	,3828*	,05289	,000	,2468	,5188
		6	,6827*	,05203	,000	,5489	,8165
	5	3	-,4929*	,05311	,000	-,6295	-,3563
		4	-,3828*	,05289	,000	-,5188	-,2468
		6	,2999*	,04805	,000	,1763	,4234
	6	3	-,7928*	,05226	,000	-,9272	-,6584
		4	-,6827*	,05203	,000	-,8165	-,5489
		5	-,2999*	,04805	,000	-,4234	-,1763
Uti_value	3	4	,0386	,04621	,838	-,0802	,1574
		5	,3115*	,04326	,000	,2002	,4227
		6	,4711*	,04256	,000	,3616	,5805
	4	3	-,0386	,04621	,838	-,1574	,0802
		5	,2729*	,04307	,000	,1621	,3836
		6	,4325*	,04238	,000	,3235	,5415
	5	3	-,3115*	,04326	,000	-,4227	-,2002
		4	-,2729*	,04307	,000	-,3836	-,1621
		6	,1596*	,03913	,000	,0590	,2602
	6	3	-,4711*	,04256	,000	-,5805	-,3616
		4	-,4325*	,04238	,000	-,5415	-,3235
		5	-,1596*	,03913	,000	-,2602	-,0590
Comp_Beliefs	3	4	-,0024	,05474	1,000	-,1432	,1383
		5	,2530*	,05124	,000	,1212	,3848
		6	,3351*	,05042	,000	,2055	,4648
	4	3	,0024	,05474	1,000	-,1383	,1432
		5	,2554*	,05102	,000	,1242	,3866
		6	,3376*	,05020	,000	,2085	,4666
	5	3	-,2530*	,05124	,000	-,3848	-,1212
		4	-,2554*	,05102	,000	-,3866	-,1242
		6	,0821	,04636	,287	-,0371	,2013
	6	3	-,3351*	,05042	,000	-,4648	-,2055
		4	-,3376*	,05020	,000	-,4666	-,2085
		5	-,0821	,04636	,287	-,2013	,0371

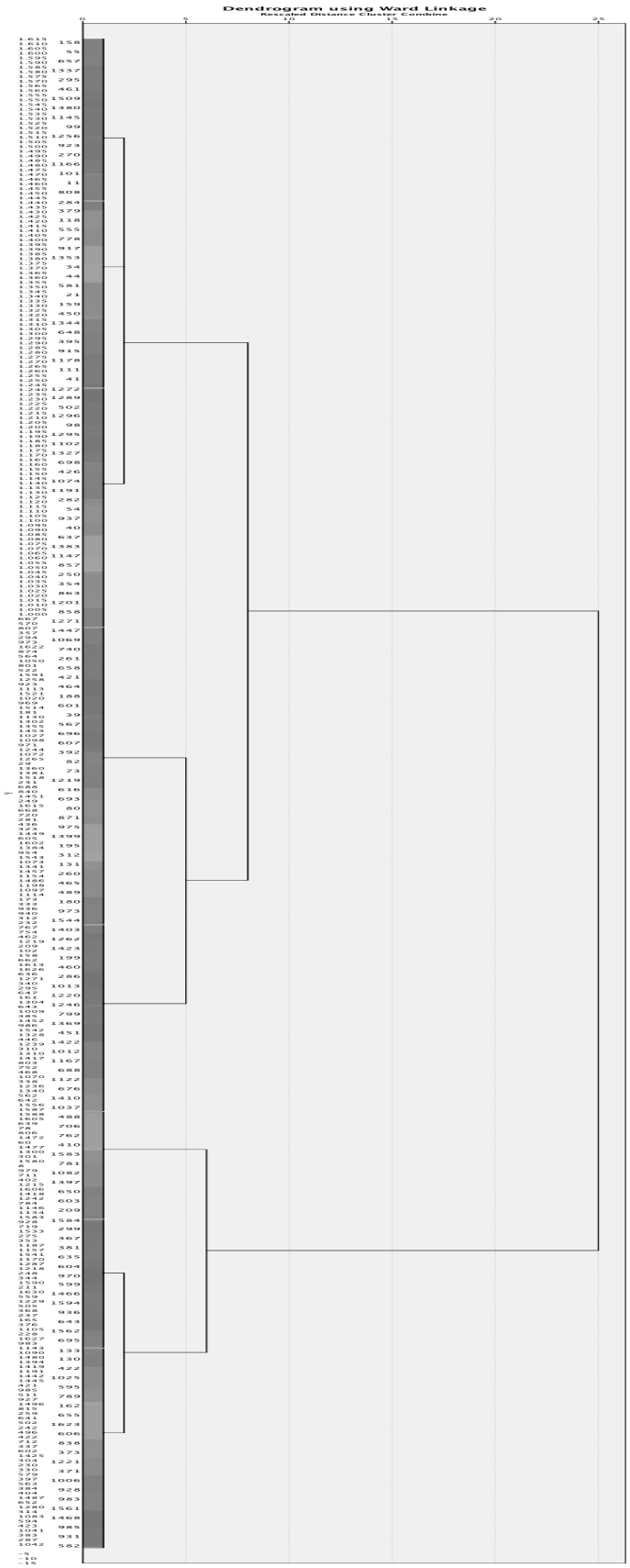
Costs	3	4	,0437	,05441	,853	-,0962	,1837
		5	-,2284*	,05093	,000	-,3593	-,0974
		6	-,3829*	,05011	,000	-,5117	-,2540
	4	3	-,0437	,05441	,853	-,1837	,0962
		5	-,2721*	,05071	,000	-,4025	-,1417
		6	-,4266*	,04989	,000	-,5549	-,2983
	5	3	,2284*	,05093	,000	,0974	,3593
		4	,2721*	,05071	,000	,1417	,4025
		6	-,1545*	,04607	,005	-,2730	-,0360
	6	3	,3829*	,05011	,000	,2540	,5117
		4	,4266*	,04989	,000	,2983	,5549
		5	,1545*	,04607	,005	,0360	,2730

Based on observed means.
The error term is Mean Square(Error) = ,504.

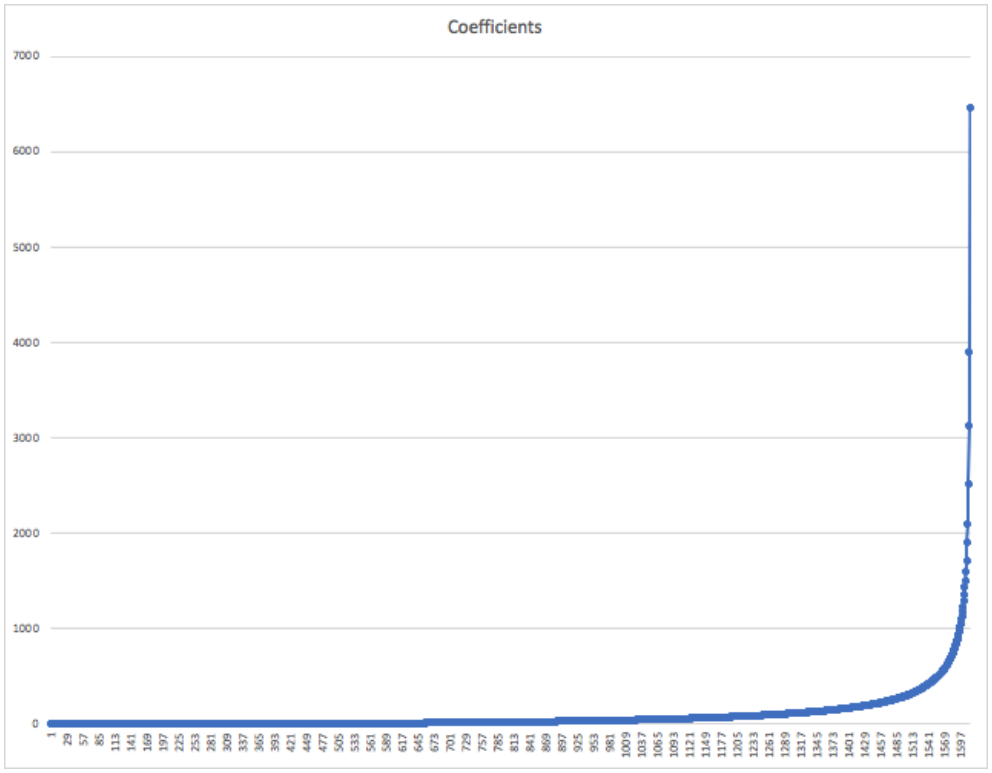
*. The mean difference is significant at the

Appendix F – Cluster analysis

Dendogram



Agglomeration plot



Effects of the clusters on motivation and achievement

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[f]
Corrected Model	Zscore(Int_value)	341,226[a]	3	113,742	143,257	,000	,213	429,770	1,000
	Zscore(Uti_value)	135,699[b]	3	45,233	49,790	,000	,086	149,370	1,000
	Zscore(Comp_Beliefs)	209,272[c]	3	69,757	80,161	,000	,132	240,483	1,000
	Zscore(Costs)	266,631[d]	3	88,877	106,445	,000	,168	319,334	1,000
	Zscore(Math_Grade)	189,057[e]	3	63,019	75,540	,000	,125	226,621	1,000
Intercept	Zscore(Int_value)	47,679	1	47,679	60,051	,000	,036	60,051	1,000
	Zscore(Uti_value)	17,524	1	17,524	19,289	,000	,012	19,289	,992
	Zscore(Comp_Beliefs)	31,441	1	31,441	36,130	,000	,022	36,130	1,000
	Zscore(Costs)	42,508	1	42,508	50,910	,000	,031	50,910	1,000
	Zscore(Math_Grade)	22,576	1	22,576	27,062	,000	,017	27,062	,999
Cluster_4_emot	Zscore(Int_value)	341,226	3	113,742	143,257	,000	,213	429,770	1,000
	Zscore(Uti_value)	135,699	3	45,233	49,790	,000	,086	149,370	1,000
	Zscore(Comp_Beliefs)	209,272	3	69,757	80,161	,000	,132	240,483	1,000
	Zscore(Costs)	266,631	3	88,877	106,445	,000	,168	319,334	1,000
	Zscore(Math_Grade)	189,057	3	63,019	75,540	,000	,125	226,621	1,000
Error	Zscore(Int_value)	1260,035	1587	,794					
	Zscore(Uti_value)	1441,743	1587	,908					
	Zscore(Comp_Beliefs)	1381,032	1587	,870					
	Zscore(Costs)	1325,084	1587	,835					
	Zscore(Math_Grade)	1323,944	1587	,834					
Total	Zscore(Int_value)	1601,279	1591						
	Zscore(Uti_value)	1577,451	1591						
	Zscore(Comp_Beliefs)	1590,341	1591						
	Zscore(Costs)	1591,716	1591						
	Zscore(Math_Grade)	1513,062	1591						
Corrected Total	Zscore(Int_value)	1601,261	1590						
	Zscore(Uti_value)	1577,442	1590						
	Zscore(Comp_Beliefs)	1590,304	1590						
	Zscore(Costs)	1591,715	1590						
	Zscore(Math_Grade)	1513,001	1590						

χ^2 - *Students distribution based on their gender*

Crosstab

			gender		
			boy	girl	Total
Cluster Number of Case	1	Count	373a	325b	698
		Expected Count	347,9	350,1	698,0
		Standardized Residual	1,3	-1,3	
	2	Count	95a	115a	210
		Expected Count	104,7	105,3	210,0
		Standardized Residual	-,9	,9	
	3	Count	163a	152a	315
		Expected Count	157,0	158,0	315,0
		Standardized Residual	,5	-,5	
	4	Count	169a	213b	382
		Expected Count	190,4	191,6	382,0
		Standardized Residual	-1,6	1,5	
Total		Count	800	805	1605
		Expected Count	800,0	805,0	1605,0

Each subscript letter denotes a subset of gender categories whose column proportions do not differ significantly from each other at the ,05 level.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10,642[a]	3	,014
Likelihood Ratio	10,659	3	,014
Linear-by-Linear Association	6,252	1	,012
N of Valid Cases	1605		

a. 0 cells (,0%) have expected count less than 5. The minimum expected count is 104,67.

χ^2 - Students distribution based on their country

Crosstab

			country		
			Serbia	Portugal	Total
Cluster Number of Case	1	Count	354[a]	344[a]	698
		Expected Count	350,1	347,9	698,0
		Standardized Residual	,2	-,2	
	2	Count	125[a]	90[b]	215
		Expected Count	107,8	107,2	215,0
		Standardized Residual	1,7	-1,7	
	3	Count	163[a]	156[a]	319
		Expected Count	160,0	159,0	319,0
		Standardized Residual	,2	-,2	
	4	Count	168[a]	215[b]	383
		Expected Count	192,1	190,9	383,0
		Standardized Residual	-1,7	1,7	
Total		Count	810	805	1615
		Expected Count	810,0	805,0	1615,0

Each subscript letter denotes a subset of country categories whose column proportions do not differ significantly from each other at the ,05 level.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	11,747[a]	3	,008
Likelihood Ratio	11,787	3	,008
Linear-by-Linear Association	3,923	1	,048
N of Valid Cases	1615		

a. 0 cells (,0%) have expected count less than 5. The minimum expected count is 107,17.

χ^2 - Students distribution based on their school grade

Crosstab

			grade				
			3	4	5	6	Total
Cluster Number of Case	1	Count	201a	200a	168b	129c	698
		Expected Count	140,9	146,5	197,1	213,5	698,0
		Standardized Residual	5,1	4,4	-2,1	-5,8	
	2	Count	20a	24a	82b	89b	215
		Expected Count	43,4	45,1	60,7	65,8	215,0
		Standardized Residual	-3,6	-3,1	2,7	2,9	
	3	Count	26a	43b	97c	153d	319
		Expected Count	64,4	67,0	90,1	97,6	319,0
		Standardized Residual	-4,8	-2,9	,7	5,6	
	4	Count	79a	72a	109a	123a	383
		Expected Count	77,3	80,4	108,1	117,2	383,0
		Standardized Residual	,2	-,9	,1	,5	
Total		Count	326	339	456	494	1615
		Expected Count	326,0	339,0	456,0	494,0	1615,0

Each subscript letter denotes a subset of grade categories whose column proportions do not differ significantly from each other at the ,05 level.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	185,780[a]	9	,000
Likelihood Ratio	193,533	9	,000
Linear-by-Linear Association	62,985	1	,000
N of Valid Cases	1615		

a. 0 cells (,0%) have expected count less than 5. The minimum expected count is 43,40.