ALBANIAN STUDENTS' PREFERENCES FOR REAL-LIFE SITUATIONS IN MATHEMATICS AND ITS GENDER AND SCHOOL LOCATION DIMENSIONS

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ABSTRACT

This study reports the investigation of students' preferences for real-life situations used in mathematics. Participants were 8th -10th grades students from different lower and upper secondary schools in the district of Shkodra, Albania, with balanced gender participation. Rasch rating scale methods were used to analyse the data collected with a questionnaire. This method allowed the investigation of whether the data fit the Rasch model according to the appropriate criteria. It concluded that students revealed a hierarchy of preferences of contextual situations used in Mathematics. Items related to students' affiliation with modern technologies were highly preferred, followed closely by items perceived as connected to a safe economic future and upward mobility and entertainment. At a middle range were items about more global concerns such as environmental matters. The least preferred items represent activities perceived as unprofitable in the current stage of the Albanian societal development. Four items exposed differential item functioning for girls and boys, and two items exposed differential item functioning according to school location. The use of the concepts of habitus, field, and capital from Bourdieu as heuristic tools to explain students' motives for preferences revealed that being educated is seen as necessary capital for a good position in students' future fields of higher education and employment. Therefore students show positive dispositions toward items that are perceived as helpful in this direction.

Keywords: students' interests, real-life situations, Rasch methods, habitus, gender.

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INTRODUCTION

The use of real-life situations or contexts in mathematics is a widely discussed matter in school mathematics in general and this is seen in different mathematics curricula and textbooks (Romberg 1998; Lappan, Fey, Fitzgerald, Friel and Phillips 2004; COMAP 2000; Du Toit, Human, Olivier, Nicholson and Pillay 1991; Qualifications and Curriculum Authority 2007; National Mathematics Advisory Panel 2008; Encyclopaedia Britannica 2011; Julie, Holtman and Mbekwa 2011). Contexts constitute an important dimension in well-known international assessment programs such as the Programme for International Student Assessment (PISA), (OECD 2006). In the PISA mathematics assessment, one of the three components of the Mathematics domain is 'situations or contexts' where the problems are located, the other components are the mathematical content and the mathematical competencies required for solving a specific problem.

Similar notions are present in the Albanian school mathematics curriculum where importance is placed on the need for students to recognize and use mathematics in everyday life and in other school subjects (Institute of Curricula and Training 2006; 2007; 2008; 2010). The concepts of numeracy and literacy are introduced in curricula respectively as 'the group of mathematical concepts and skills that serve an individual in everyday life, at home, in his workplace, in community' (Institute of Curricula and Standards, Albania 2006 p. 2, author's translation), and "individual's ability to understand and use the written information in everyday life (*by using mathematics*)" (p. 12). Mathematics teachers are recommended and encouraged to include facts and information from everyday life, and cross curricular links, in teaching.

A great deal of work about realistic contexts in mathematics learning is done within the tradition of Realistic Mathematics Education (Freudenthal 1983; 1991; Treffers 1987; Streefland 1991; Gravemeijer 1994; De Lange 1996; Gravemeijer and Doorman 1999; Van den Heuvel- Panhuizen 2006), where connection of mathematics to reality is at the core. This reality is the one that fits with students' experiential world, and mathematics is conceptualized as a human activity.

Researchers working in this tradition suggest a broad use of realistic contexts from primary to more advanced mathematics levels of undergraduate studies.

Other researchers have pointed towards the problems of learning mathematics in context. Boaler (1993a; 1993b; 1994) discussed one such problem connected to the degree of 'reality' that students perceive as useful to include while solving tasks. Boaler (1994) suggests that 'contexts which involve real world variables should only be used in mathematics examples and questions if they require students to *consider* the real world variables introduced in the question' (p.563). She also drew attention to the oversimplified assumptions that constitute the basis of real-life contexts' use. Transfer of learning is presumed to result from the discussions generated by the task, its openness, negotiations and interpretations of it, and students' given degree of autonomy (Boaler 1993b)

On the use of realistic tasks in assessment in the UK (Cooper 1998a; 1998b; Cooper and Dunne, 1998; 2000; Cooper and Harries, 2002) researchers explored influence of context on students. Cooper and Dunne (1998) found differences in performance between students from different socio-cultural backgrounds in solving contextualized tasks. These differences in performance come from problems in recognizing and interpreting the demands, and including the appropriate everyday knowledge, in solving realistic tasks. Cooper and Harries (2002) report that tasks which require students' deeper consideration of the realistic context in responding, as suggested by Boaler (1994), were important to help students avoid the problems of recognition reported by Cooper and Dunne (1998).

Van Den Heuvel-Panhuizen (2005), from the RME tradition, discussed important characteristics that realistic mathematics tasks in assessment should possess, these are: being accessible, inviting and challenging for the students, allowing flexibility in solution, reflecting important goals, including open-ended questions, allowing teachers to see an 'accurate picture of the student' (p. 3). Van Den Heuvel-Panhuizen indicated some unsolved issues with real-life contexts in assessment including students' unwillingness to take context into account, their excessive involvement with the contexts, and the degree of reality supposed to be taken into account as in the above discussions.

The effects of using real-life situations in mathematics depend on many factors, among them can be how a context is chosen and students' degree of interest in it. The study presented here belongs to the affective domain, and it explores students' hierarchy of preferred contexts to use in mathematics. The view taken here is that knowledge from specific fields of students' interest can be introduced and discussed in mathematics lessons or tasks where the aforementioned suggestions from different researchers can be taken into account. Students' voices are important to hear, and there are virtually no research studies on students' preferences for real-life situations to be used in mathematics (Julie and Mbekwa 2005). There are indeed a few studies that include results about students' preferences for real-life situations as part of other projects (Kaiser-Messmer 1993; Lingefjard 2006). The lack of research was one of the main motivations for researchers from different countries to embark on a project, the Relevance of School Mathematics Education (ROSME) (Julie and Holtman 2008). At the outset, the project involved mathematics educators from South Africa, Zimbabwe, Uganda, Eritrea, Norway and mathematics teachers from South Africa and South Korea (Julie and Mbekwa 2005). It focused on students in grades 8 to 10, and a 61-items questionnaire was designed to collect information about students' expressed preferences for different real-life situations to be used in mathematics. The questionnaire was then modified into a second version with 23 items.

In august 2008 the author started conducting the study with Albanian students. The project in Albania used both quantitative and qualitative methods to explore students' preferences for real-life situations to be used in mathematics and their motives for preferences. The target groups are students in grades 8 to 10 (13-16 or 17 years old). In this article the quantitative part of the Albanian study is presented in detail, and excerpts from interviews are used to discuss students' motives for the preferences they expressed. The research questions that guided the study are:

1. What is students' hierarchy of preferences for real-life contexts that can be used in mathematics?

2. Are there differences in students' preferences in relation to gender or school location?

3. What are students' motives for their preferences for real-life contexts that can be used in mathematics?

In the following sections the theoretical underpinnings, the research procedure, the Rasch method for data analysis and the results are presented.

THEORETICAL SITUATEDNESS AND TOOLS

Interest as a latent trait

In this section there is first a definition of interest, the main concept upon which the study is developed. A discussion of the latent trait follows as defined by the items' hierarchy, and an expected hierarchy is constructed beforehand.

As mentioned above the study is about students' preferences for contexts to use in learning Mathematics, and as such it is connected to the construct of interest students have in learning mathematics in some contexts of their preference. Studies on interest fall within the affective domain. In this research, interest is conceptualized as a person-object relationship, as in the "Person-Object Interest" (POI) theory (Krapp 2007). In POI interest is defined as "content specific motivational variables that have an important influence on learning and the direction of human development" (Krapp 2007, pp. 6- 7).Thus interest is always directed towards an object and it comes as a result of a person's interaction with his/her environment (Krapp 2002a; 2007). This directedness is what makes interest different from motivational concepts in the affective domain. The object of interest can be one of three forms: real object, activities and types of engagement or topics that "represent a certain domain of knowledge" (Krapp 2002b, p. 412). Krapp (2007) refers to two levels of analysis. At one level interest is conceptualized as the "dispositional (or "habitual") motivational structure of an individual" (p. 9), where it is a stable tendency to deal with the object of interest, and it is about individual or personal interest (Renninger, Ewen and Lasher 2002). At the other level it is about "a state or an ongoing process during an actual interest- based activity" (Renninger et al. 2002, p. 9). The cause of this other interest can be either "an already existing dispositional interest (individual or personal interest)" or "special conditions of a teaching or

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learning or work situation (interestingness)" (p. 9). Results from both individual interest and situational interest studies show positive effects of it in educational outcomes (Hidi 1990; Krapp 2002a; 2002b; Renninger et al. 2002; Schiefele 1991).

The study reported here is concerned with a particular aspect of interest, namely the real-life situations that students prefer to use in Mathematics. As such students' preferences for contexts to be used in Mathematics are conceptualized as a latent variable, something that cannot be measured directly. Linacre (2011) defines a latent variable as follows:

> *A latent variable is something which we can have more or less of, but which we cannot measure directly. It is a variable such as "mathematics ability" or "patient quality of life". We conceptualize it to be a straight line marked out in equal- interval units. This line is infinitely long. We can always imagine something (or someone) with more of the attribute than anything (or anyone) we have encountered so far, and also something (or someone) with less of the attribute. We conceptualize each observation in the data to indicate "less" or "more" of this latent variable (n.d).*

The interests that students express for contexts to be used in their learning of mathematics will serve to measure the different levels of the latent variable. In measuring a latent variable, an expected hierarchy is constructed beforehand by researchers using different available resources. The expected hierarchy is a preliminary idea about the order of preferences that students will express. In measuring the latent trait, students' preferences for contexts to use in Mathematics, the expected hierarchy is compared with the one resulting from students' responses. This comparison is the basis for discussion and evaluation of the latent trait's validity. From the comparison the expected hierarchy can either be supported, or contradicted, and in this latter case it is either improved or the quality of the data is discussed. For the construction of the expected hierarchy, it is natural to refer to literature of similar studies in the field and the researcher's own experience of the environmental milieu of the students involved in the study.

Two studies of direct importance were found in a literature search. Kaiser-Messmer (1993) conducted an empirical study into gender differences in attitudes towards mathematics with 748 German students aged 14-19. One part of the questionnaire used in the study was about students' interests in real world examples

that can be used in mathematics teaching. Results from the questionnaire revealed differences between boys and girls in their preferences for themes from the real world in mathematics. Kaiser-Messmer (1993) found that girls at lower secondary school prefer topics such as ecology, sports, biology/medicine and everyday life, while boys at the same level prefer mostly sports, technology, economy and physics. In general it can be concluded that Kaiser-Messmer's study demonstrated learners' strong preference for contexts dealing with technology, biology/medicine, and matters related to the earth and the universe and social issues to be used in school mathematics. In an article by Lingefjärd (2006) five mathematical modeling areas are discussed: geometry, heating-cooling, medicine, population and sports. Students participating in a mathematical modeling course in teacher education would in the end of the course evaluate it. Based on 200 students' preferences, Lingefjärd (2006) reported that medicine was the most preferred real-life situation that students dealt with, followed by population matters and sports.

Preceding the study reported in this paper, a pilot study was conducted in December 2008, one part of which were interviews with Grades 8 – 10 students that set out to explore the reasons for their preferences of some contexts compare to some others (Kacerja 2009). Twenty-four students of the target age-group were interviewed after they completed a 23-items questionnaire previously within the pilot study. Students were provided with 7 cards with images depicting different real-life situations. They were asked to order the cards from those they would most prefer to deal with to those they would least prefer to deal with in their mathematics lessons. After rank ordering, questions probed for the reasons for their choices. The results of the interviews indicated that agriculture, cultural products, and lotteries and gambling were not appealing for students. On the other hand, computer games, sending and receiving sms's, secret codes, and the management of personal financial or business matters were real-life situations that received high endorsement. For the purposes of an expected hierarchy of contextual situations to be used in mathematics, it seems that students' least preferred situations can be connected to undesired material or social consequences (such as lotteries and gambling) and those viewed as non-modern and unprofitable activities (such as cultural products or agricultural matters). The real-life situations most preferred are those that can conceivably contribute to a

secure economic situation and upward mobility in life (such as financial affairs, and health matters), and modern technologies which they already use or would like to use.

As a result it can be expected that real-life situations dealing with technology, those that are indicative of upward mobility, and health matters, will be accorded high preference by students and amongst the most likely to be chosen by them. In the middle range preferences it is postulated that situations related to financial matters, dealing with emergencies and disasters and environmental issues including climate change will be less likely to endorse by students than those mentioned in the former sentence. Lastly, those that are unlikely to be endorsed in relation to the former two categories will be situations that are deemed not modern and of low economic return, in terms of the input that is required, and those that might contribute towards undesirable social behaviours in society. This then is the expected hierarchy of preferences Albanians might have for contextual situations to be included in their learning of Mathematics (table 1).

Table 1. Expected hierarchy

Preference level	Real-life situations
High	Technology
	Upward Mobility
	Health
Medium	Financial matters
	Emergencies and disasters
	Environment
Low	Traditional activities of low economic returns
	Undesirable social behaviors

It is this hierarchy that will be tested against the empirical data that were collected for this study.

Habitus, field and capital as heuristic tools

Three conceptual tools from Bourdieu (1977) are used here as heuristic tools, as one of the possible ways to look at students' preferences: habitus, field and

capital. These key concepts focus on the individual with its habitus and capital, but they allow consideration of the individual within a broader frame also, and the shaping of individual's habitus in encounters with others in different activities in life.

Bourdieu (1977) describes habitus as "systems of durable, transposable *dispositions*, structured structures predisposed to function as structuring structures" (p. 72). Habitus is a set of dispositions, present in everyone, that guide people's reaction and behaviour towards everyday life events, that make them perceive possibilities and chances as such, fulfilling in this way their role as structuring structures that generate practices. The way habitus is constituted is through the past experiences of participating in practices in life. These experiences shape people's views, thought and perceptions of specific practices and life in general, creating dispositions which constitute everyone's habitus. As Zevenbergen (2005) asserts, *habitus* "allows the researcher to understand the dynamic structure between social reality and the individual" (p. 609). In this study habitus is used is to explain students' preferences for real-life contexts that can be used in mathematics.

Students participating in the study have their own habitus, formed from participation in past experiences, which are transposable in that they frame reactions in new practices as well. Here the notion of field comes into play as a "network, or a configuration, of objective relations between positions" (Bourdieu and Wacquant 2002, p. 97). Education, and in particular mathematics education, is an example of field in Bourdieu's meaning, as a network of relations between positions that are occupied by social agents such as researchers, teachers, educators, and students. It is in an encounter with a field that habitus is actualized or not, depending on the conditions found there. But on the other hand, it is habitus that helps to have a sense of the field, to give it a meaning and value so that it will be worth investing some energy on it.

Habitus is first formed in families, but it is continuously shaping when in contact with other people's habitus through participation in further practices within different fields during life, such as education and occupation.   Habitus' further development is influenced by the different types and amounts of capital one has as well, which are first developed in a family. Bourdieu (2004) defines capital as "accumulated labor (in its materialized form or its "incorporated", embodied form)

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which, when appropriated on a private, i.e., exclusive, basis by agents or groups of agents, enables them to appropriate social energy in the form of reified or living labor" (p. 15). Capital is seen in four forms: economic, cultural, social and symbolic. Economic capital, together with cultural capital, such as educational qualifications or cultural goods, social capital, such as a network of family, friends and acquaintances, and symbolic capital, such as honour, are found in different amounts in students' families. Wacquant (Bourdieu and Wacquant, 2002) treats habitus as the mechanism that induces people to choose a certain way of behaving in the field by using their capital. Based on capital as well, each family has its own view of life, and its own values, which influence children's habitus. These views and values are to a certain degree shaped by life in Albanian society, and therefore some parts of habitus can be similar.

On the other hand, there might also be more individual characteristics or differences coming from different life situations, depending on capital as well. Students coming from families living in the country might develop a different habitus from those living in the urban areas. Reasons for this can be: their different living conditions, the cultural capital they bring from families, their socialization, and future opportunities offered to them and perceived by them. The same thing is true of gender differences, where students' habitus guides them into following the possibilities offered, because "one's habitus is also gendered as a result of the possibilities available to each group" (Dumais 2002, p. 47). Therefore gender and school location can be factors of differentiation.

INSTRUMENTATION, DATA COLLECTION AND DATA ANALYSIS PROCEDURES

Instrumentation

For data collection a 23-item questionnaire was used. The questionnaire was developed by the multi-country ROSME group (Julie and Holtman 2008). It is a 4-point Likert-type instrument which asks students to express their level of interest for wanting to deal with specific contexts in their learning of Mathematics. Demographic

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data such as age, grade and gender were also collected. Figure 1 shows how the items were formulated.

My interest in learning about mathematics involved in					
C7	health matters such as the state of health of a person, the amount of medicine a sick person must take is	Very high	High	Low	Nil/Zero

Figure 1. Formulation of an item

Permission was sought and obtained from the schools' principals to conduct the study in their schools. Students' consent was obtained prior to the administration of the questionnaire. They were informed that their participation was voluntary, and that anonymity would be maintained, before completing the questionnaire. All the other ethical requirements were taken into account.

For interviews, 24 students from the city of Shkodra, in grades 8-10, were included in a first round in November 2008, and 8 other students from grades 8-9 participated in the second round, in April 2010.

Data collection

Quantitative data for this research were collected in April 2010 in the district of Shkodra, in the northern part of Albania. The researcher herself collected the data in every classroom. Students were allowed to use as much time as they needed, they were informed that they could request clarifications and it was emphasised that personal opinions were asked and there was no right or wrong answer.

A convenience sample was selected based on possibilities for access that the researcher had to the schools, however, representation of both genders and of both urban and rural areas were sought. The choice was also influenced by the decision to include schools that had a relatively high number of students. In some of the remote villages of the district of Shkodra, there are schools with a very small number of students, one for example has five students at grade 8 and five at grade 9, and these schools are difficult to access for infrastructural reasons. Ten schools participated in the data collection: four lower secondary (5th-9th grade), two upper

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secondary (10th-12th grade) one of them was private, four mixed lower and upper secondary (from 5th-12th grade). One class for each target grade, 8, 9 and 10, from the selected schools was randomly chosen to complete the questionnaire. Table 2 presents the demographic data for the 825 students from the district of Shkodra who participated in the study. Their ages varied from 13 to 17 years old.

Table 2. Students' sample

	Location			
	Urban		Rural	
Grade	Male	Female	Male	Female
8	71	63	68	99
9	51	68	77	87
10	38	43	70	90
Total	160	174	215	276

For the qualitative part, in the first interviews four students were taken from each of the six classes (8-10 grades), to answer questions about seven different real-life contexts focusing on reasons for liking or disliking them. In the second round, eight students from grades 8-9 were interviewed from an urban school to answer questions around their preferences (Kacerja 2011).

Data analysis

Methods of data analysis are somewhat constrained because the data does not arise from measurements on an interval scale. Rasch models were chosen in this study since they make it possible to transform the raw data into logit (log-odds) units and, as a result, construct linear measures to operate with (see for example Doig and Groves 2006). With Rasch models each person completing the questionnaire receives a measure of the level of preferences, person's willingness to agree, and each item of the questionnaire receives a measure of difficulty to be endorsed. One important characteristic is that persons' and items' measures are converted into the same unit, and persons and items are therefore placed on the same scale along the

latent variable (Bond and Fox 2001). On a variable map is possible to see how the latent variable is defined, how well the items cover it, and how items and persons are placed in relation to each other.

To bring together observations from the Likert scale questionnaires the Rasch-Andrich Rating Scale (Andrich 1978) was chosen. This is a polytomous model based on differences between a person's ability (willingness) to agree and the item's difficulty to be endorsed (agreed upon). Let n be a person of ability B_n answering on an item i of difficulty D_i. Let P_{nij} be the n's probability to choose category j (j=1,2,3,4) of likeness for item i, and $P_{ni(j-1)}$ probability for choosing category j-1 .On a rating scale the following formula is used for constructing measurement from observations (Linacre 2004):

$$\log_e(P_{nij}/P_{ni(j-1)})= B_n - D_i - F_j.$$

An item's difficulty to be endorsed, D_i, is calculated using the item's raw scores and a person's ability to endorse, B_n, is calculated based on the person's raw scores. F_j, the Rasch-Andrich thresholds, are the points where the probability of choosing one category of the answer is equal to the probability of choosing the answer at the adjacent category. The unit obtained for measures of both items and persons is logit (log-odds).

Rasch analysis was done using the Winsteps 3.65.0 software (Linacre 2008).

RESULTS

In Rasch methods some elements are considered as core in the data analysis process and these elements are presented here. After ensuring that the indicators show a good functioning of the instrument, the analysis further produces an answer to the research questions posed about students' hierarchy of preferences for contexts to be used in mathematics, and its different dimensions.

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Differential Item Functioning

A differential item functioning (DIF) analysis is a tool to explore whether the instrument functions the same way for different groups participating in the study. During this analysis two DIF measures are calculated for each item with data from the two different groups, with all else held constant. A DIF contrast is then calculated as a difference of the two DIF measures which is considered as significant when it exceeds 0.5 logits with a probability $p < 0.05$ of observing that contrast by chance. DIF was run for three variables: gender, grade, and school location, i.e. city or country. Existence of DIF effect means that an item is easier to be endorsed, or preferred, for one group of respondents compared to another group. No DIF effects were found according to grades.

Three items were problematic in terms of DIF effect according to gender: item C2 has a DIF contrast -0.70 which means that this item is easier for girls than for boys to endorse; item C3 with a DIF contrast of -0.88 is also easier for girls and item C23, with DIF contrast 0.63 is easier for boys to endorse. In order for the instrument to measure all the participants' preferences in the same way, one recommendation is to divide the items into two other items, one for boys and one for girls. So the item 'cultural products such as handmade carpets' is divided into C2 'cultural products such as handmade carpets (a boys' item)' and C24 'cultural products such as handmade carpets (a girls' item)', the item C3 'the latest designer clothes' is divided into C3 'the latest designer clothes (boys)' and C25 'the latest designer clothes (girls)', and the item 'construction and engineering' is divided into C23 'construction and engineering (boys) and C26 'construction and engineering (girls)'. In each of these items data from the other gender are treated as missing.

After these changes, another DIF analysis showed 2 items causing DIF effects for students from the country and the city schools. In order to avoid the instrument to work differently for these two groups the following changes were considered: item C5 'agricultural matters' was divided into C5 'agricultural matters (city students)', and C27 'agricultural items (country students)', while item C24 became 'cultural products (city girls)', and C28 'cultural products (country girls). After dividing again item C5 into C5 'agricultural matters (city girls)' and C29 'agricultural matters (city boys)' no further

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DIF effects were noticed, thus the adapted instrument was considered suitable for further analysis.

Fit statistics

In a Rasch analysis data are sought to fit the model, and the fit statistics indicate to what degree the data fit the model's requirements. The infit mean square value (MNSQ) indicates how unexpected one person's answers are to items near his/her ability levels, while the outfit MNSQ value indicates unexpected answers to items that are very hard or very easy for one person's abilities. In this study item infit and outfit mean square (MNSQ) values were in a range of 0.89-1.17 and 0.92-1.56 logits respectively, therefore within the recommended interval (Linacre 2008).

It was not the same with the persons' fit statistics. There were 23 students that had fit values bigger than 2 logits, which can give a distorted picture of the data. These are problems of underfit i.e. the data are too unpredictable by the model. High outfit values can be caused by unexpected answers to items that are far from students' measured ability (in this case likeability of contexts). An outfit of 2.3 for example means that there is 130% more noise than expected in the data. The decision taken in this study to impede these 23 'problematic' persons' answers to deform the measurement was to delete them from the data and perform the analysis without them. The analysis is further performed with 802 students.

A look at the scalogram for the answers can help understanding the reasons for high outfit values. Two of the most misfitting persons are student 584 (female, country), and student 413 (male, city). Their answers to the items from the most (left) to the least preferred (right) looked like this (table 3):

Table 3. Scalogram of two students' answers

Item	Person 584	Person 413
C10	1	1
C21	1	1
C9	1	2
C8	1	3
C18	-	4
C23	1	1
C7	1	3
C17	1	-

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C16	1	4
C25	1	1
C15	1	1
C13	1	1
C20	4	1
C19	1	1
C12	1	3
C22	1	2
C11	4	2
C4	2	3
C26	1	-
C6	1	-
C27	1	-
C28	1	4
C14	1	4
C3	-	4
C1	1	-
C5	-	2
C24	-	-
C2	-	-
C29	-	-

In the table, the sign '–' stands for a missing answer, 1 means null/zero interest, 2 means low interest, 3 means high interest, 4 means very high interest.

Student 584 was amongst the ones with lowest measures (preferences), and as such one would expect the left part of the answers' row, but an unexpected high score given to low preferred items (or difficult items) such as C20, C11 and C4 can be noticed. This explains her high outfit value. Student 413 has higher preferences than student 584. His answers reveal an unexpected low score for the most preferred item C10 and for C21, and unexpected high scores for less preferred items such as C1, C5, C6, and C14. High outfit values are indicators of different possible factors such as carelessness in completing the questionnaire or reading the items properly, failure to understand it correctly, influence by other peers participating in the study, the time pressure students perceived by having a researcher in the classroom together with a teacher, or even the dilemma between giving an answer that is expected or giving the answer that one thinks is the 'truth'.

After the deletion of the 23 students, the persons' misfit table showed that fit statistics were improved. Therefore 802 students were definitively included. For this new analysis item fit statistics were also improved: the outfit values range from 0.90-

1.19 and infit from 0.91-1.17, showing a good fit of the items' data to the Rasch model (Table 4).
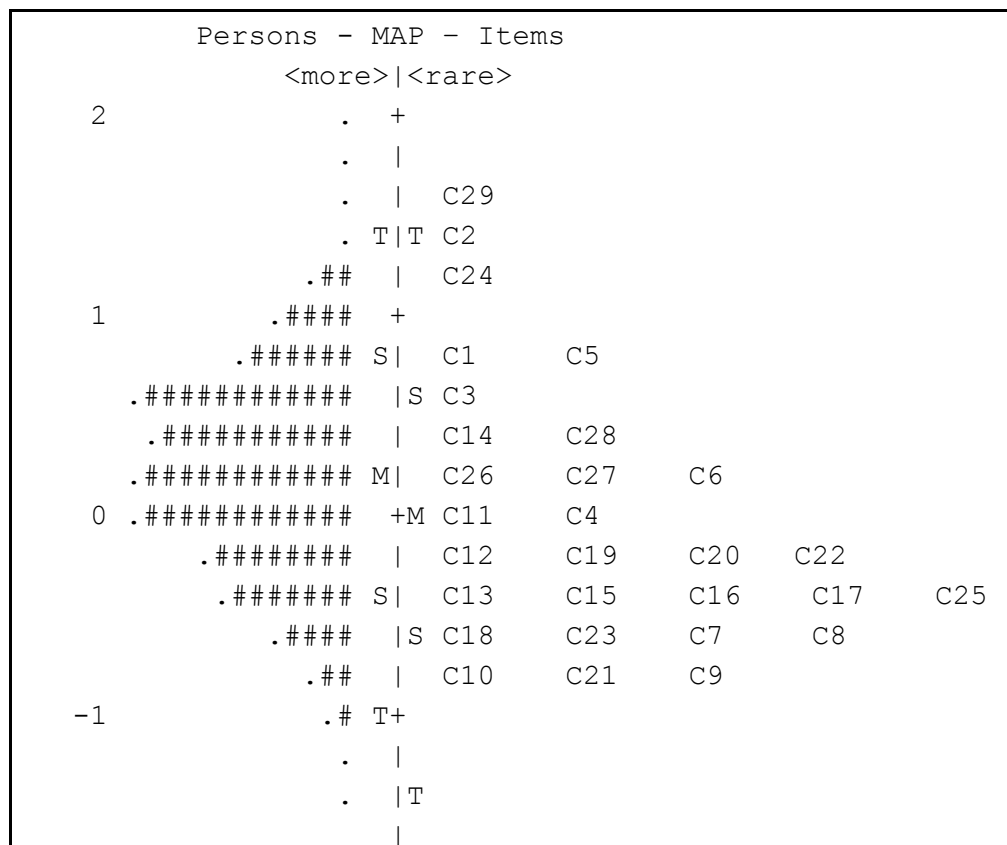
Table 4. Items' measures

Rank	Measure	Infit MNSQ	Outfit MNSQ	Item	Description
1	-0,79	0,95	0,92	C10	making computer games, storing music
2	-0,76	0,98	0,98	C21	planning a journey
3	-0,73	0,97	0,97	C9	being productive in doing tasks in a job
4	-0,68	0,95	0,95	C8	level of development of community
5	-0,62	1,03	1,02	C18	recreation, physical exercise, sport
6	-0,61	1,17	1,12	C23	construction and engineering (boys)
7	-0,57	0,96	0,95	C7	health matters (state of health of a person)
8	-0,48	0,99	0,98	C17	managing personal and business finances
9	-0,45	0,94	0,94	C16	sending and receiving electronic messages
10	-0,45	1,1	1,12	C25	the latest designer clothes (girls)
11	-0,41	1,04	1,04	C15	dancing such as rave, disco and hip-hop
12	-0,38	1,01	0,99	C13	all kinds of pop music
13	-0,27	0,93	0,95	C20	spread and decline of epidemics (such as AIDS)
14	-0,24	0,91	0,9	C19	responding to emergencies and disasters
15	-0,2	0,95	0,94	C12	determining the origin and age of the universe
16	-0,17	0,97	0,98	C22	crime fighting, warfare, military matters
17	-0,06	0,95	0,95	C11	environmental issues and climate change
18	0,09	1,05	1,06	C4	secret codes such as PIN numbers
19	0,1	1,08	1,15	C26	construction and engineering (girls)
20	0,13	1,03	1,03	C6	government financial matters (such as taxes)
21	0,25	1,09	1,13	C27	cultural products (country girls)
22	0,41	1,1	1,19	C28	agricultural matters (country students)
23	0,48	0,97	0,96	C14	national and international politics
24	0,55	1,13	1,19	C3	the latest designer clothes (boys)
25	0,84	1,12	1,13	C1	lotteries and gambling

26	0,88	1,01	1,02	C5	agricultural matters (city boys)
27	1,14	1,09	1,06	C24	cultural products (city girls)
28	1,47	0,97	0,99	C2	cultural products (boys)
29	1,52	1,05	1,07	C29	agricultural matters (city girls)
MEAN	0	1,02	1,02		
S.D.	0,66	0,07	0,08		

Variable map

Another element to check the instruments' functioning is the variable map, which verifies if there are gaps between the different items. The variable map (fig. 2) presents persons on the left, and items on the right, ordered along the latent trait. Persons located on the same line with an item have a 50% chance of endorsing it; they have a more than 50% chance for endorsing items with a lower measure and less than 50% chance for endorsing items with a higher measure. From the map (fig. 2) it can be seen that the items are spread and they cover the sections of the latent variable, and there are no gaps harming the working of the instrument.

```
         Persons - MAP – Items
              <more>|<rare>
   2              .  +
                  .  |
                  .  |  C29
                  . T|T C2
                .## |  C24
   1          .#### +
            .###### S|  C1      C5
       .############  |S C3
        .##########  |  C14     C28
      .############ M|  C26     C27     C6
   0 .###########  +M C11     C4
          .######## |  C12     C19     C20     C22
          .####### S|  C13     C15     C16     C17     C25
            .#### |S C18     C23     C7      C8
              .## |  C10     C21     C9
  -1            .# T+
                 .  |
                 .  |T
                    |
```

```
         .  |
        <less>|<frequ>
EACH '#' IS 9.
```
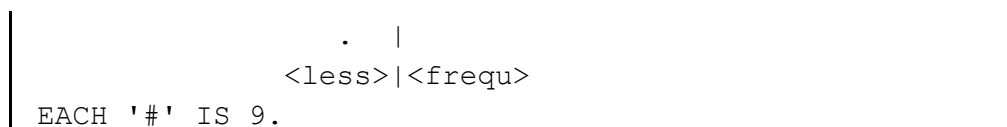
Figure 2. Variable map

The broader variable map with 4 columns was also checked, and further insured the working of the instrument. The most preferred items are located in the lower end of the map, C10, C21, C9, and the least preferred at the top C29, C2, and C24.

Reliability

The reliability coefficient tells about the sample functioning. Both measures of reliability were high for the sample of 802 students in this study: person reliability was 0.81, which means that it is enough to distinguish between students of different levels of preferences, and item reliability was 0.99. There is no need thus, according to Rasch analysis, to make decisions about using a bigger sample of students or a larger number of items.

Items' hierarchy

In Table 5 items are ordered from the most to the least preferred based on calculations according to the Rasch rating scale model. The 4 items chosen as most preferred by students were: C10 'making computer games and storing music and videos on CD's and I-pods'; C21 'planning a journey', C9 'being productive with the doing of tasks in a job', and C8 'determining the level of development regarding employment, education and poverty of my community'. The 4 least preferred items were C29 'agricultural matters (City Girls), C2 'cultural products such as handmade carpets' as a male item, C24 'cultural products (City girls), and C5 'agricultural matters (City boys)'. These were followed closely by C1 'lotteries and gambling'.

This hierarchy allows seeing differences in preferences according to gender and school location. The context of 'construction and engineering' was more preferred by boys than girls, and the item was ordered as 6th and 19th respectively.

'The latest designer clothes' are a matter of more interest for girls, who ordered it 10th, than boys, who ordered it 24th. 'Cultural products' was an item separated twice, where girls from the rural schools ordered it 21st, girls from the urban schools ordered it 27th, and boys in the urban schools ordered it 28th. Rural school students ordered 'agricultural matters' 22nd and liked it better than urban school students. There was a difference in gender between girls and boys in the urban schools, where boys ranked the item 26th while girls 29th.

DISCUSSION

The first two subsections discuss two important matters when using a Rasch method: first, how the latent trait functions, what is the expected hierarchy's connection to the hierarchy of students' preferences obtained from data analysis; second, differences on preferences for contexts according to gender and school location. The third subsection discusses students' motives for preferences using Bourdieu's concepts of habitus, field and capital.

Latent trait's functioning

One important tool in Rasch rating scale methods to analyze the validity of the construct underlying the instrument being used is a comparison between an expected hierarchy that is *a priori* hypothesized (see table 1), and the results forthcoming from the empirical data collected through the administration of the instrument. The expected hierarchy was devised in terms of areas of preference for the contexts presented by the questionnaire. Looking at the current hierarchy, most preferred items chosen by students are in line with the expected hierarchy. The items that are easy to endorse are those items that relate to students' affiliation with modern technologies, such as C10 'making computer games, saving music on CD-s, iPods etc.', the ones linked to students' idea of a safe economic future and upward movement such as C9 'being productive in doing tasks in a job', C17 'managing business and personal financial affairs' without neglecting entertainment such as C18 'recreation, physical exercise, sport activities'. Thus the latent variable in the less

difficult to endorse area is expressed as a combination of items about computers, development, health matters, sports and recreations and journeys.

From the item C8, ranked 4th, it can be observed that part of students' personal advancement in life is connected to the development of their community. Other community or more global topics, such as environment, fighting epidemics and fighting crimes, are on another level of preference that could be middle range preferences, as in the expected hierarchy. It requires more from the latent variable to arrive at this level of preference. The item C8 is 'measuring the level of development of my community regarding employment, education and poverty' which connects this item to students' future lives. In the interviews with students, especially with 10th grade students, one of the topics that emerged was their future, their choices of subjects for university studies and careers. Other community matters are not connected directly to students' personal interests, or they are not perceived as very close to students. But their relevance can be connected to what students themselves call 'enlarging their horizons', meaning enlarging or expanding their knowledge about things around them and not only those of direct interest. The axis underlying the latent variable as seen from students' answers is the relevance they give to the contexts as connected to their personal and future professional interests, as well as to their actual preferred activities. This way of reasoning is revealed from the questionnaire and it is supported by interviews with students.

The zone of low preferred contexts also, or difficult to endorse items, fits the expected hierarchy. If one lives in a country where the primary concern of a family is employment and income to support the family, then issues such as 'government financial matters' (C6) or 'national and international politics' (C14) are not perceived as very important. In the same group of preferences are items such as 'cultural products' (C2), 'agricultural matters' (C5), and 'lotteries and gambling' (C1) which in the actual stage of development cannot be considered as profitable activities, and especially children do not consider the possibility of their use in any way in the future.

Differences between boys and girls and between rural and urban school students

As discussed above, there were 6 items which showed significant DIF effects and made it necessary to separate them into items for girls and items for boys, and also items for rural and city school students. The analysis was therefore performed with 29 items. All the other items were functioning the same way for all the groups in the study.

There were ranking differences (0.71 logits) between boys and girls on 'construction and engineering', respectively 6th and 19th, and in 'the latest designer clothes' ordered as 24th and 10th respectively (1 logit). 'Cultural products' also were easier for girls, but there is a difference of more than 1 logit between girls in the urban and rural schools also. The item remains in the low preference zone, ranked 21st for country girls, 27th for city girls, and 28th for boys. Further differences were found on preferences for 'agricultural matters' where the item was 22nd for country students, and differs with more than 1 logit with the other students. This item showed differences (0.64 logits) between city boys (26th) and city girls (29th). Gender differences in preferences for real-life contexts that can be used in mathematics were exposed mostly in relation to the expected gender roles, i.e. the activities connected to those items are considered as male or female activities in Albanian reality.

The Trends in Mathematics and Science Study (TIMSS) (Mullis et al. 2008) revealed that a bigger proportion of males plan to study engineering and computer and information science with a biggest proportion of girls choosing to study health science and social science. A study by Ceci and Williams (2010) reports on a meta-analysis of studies discussing gender differences in youth career choices. The study showed that adolescent girls clearly prefer to be medical doctors, veterinarians, biologists, psychologists or lawyers versus engineers or physicists. Similar results were obtained by Kaiser-Messmer (1993) as cited earlier. Thus the gender difference expressed in the 'construction and engineering' item is on line with the other international trends. In Albania there are many more male students in different engineering faculties than females.

Cultural products in Albania are usually carpets worked on a loom, handmade embroideries, knitting, etc., all made by women. One of the boys of 10th grade in a city upper secondary school answered: "These are things women deal with, not men". The same thing is true about 'the latest design clothes' where girls tend to pay

more attention to clothes and fashion than boys. Over the last 20 years in Albania one of the work sources for women has been in factories sewing clothes for export to the Western countries. Men are employed in these factories mostly as mechanics for maintenance of the machinery.

'Agricultural matters' were placed higher in rural school students' list of preferences compared to students from the city schools. This is understandable if one knows that the main source of living and work for many Albanian families in the rural areas is agriculture. There is, on the other hand, a view that agriculture is not a very profitable activity in economic and also not esteemed in social terms.

There were no other items that showed significant DIF effect. Based on DIF measures boys find were slightly more likely to express an interest in secret codes, sending and receiving messages, government financial matters, managing finances, politics, and crime fighting and military matters. Girls on the other were slightly more likely to express an interest in social and human issues, such as the level of development of the community, health matters, being productive in a job, environment, music, responding to emergencies, epidemics and planning journeys. This seems to fit with the results mentioned by Mullis et al. (2008) in gender differences. But it has to be kept in mind that the differences shown in this paragraph are not significant according to Rasch analysis.

Students' motives for preferences

When students were asked to provide some motives for their preferences for real-life situations to be used in mathematics, two fields were mostly mentioned: the field of higher education and that of future occupation. Students often discussed their preferences in connection with their future, as the girl L explained:

> *L: Of course I do (connect everything to my future), because we must work since it is very difficult nowadays to assure our future. When I think of a lot of students finishing university and having difficulties in finding jobs, it's normal that the future becomes important for me. Because you need to assure your life, then your family's life, you will have a role in your life, you won't be a parasite that does only harm to society (girl, grade 8).*

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The girl expresses her concern for the future, the importance of having a job for a safe life, and being a responsible citizen. Another girl (A, grade 10) argued like:

A: Last year we were talking about what my older sister should study at university, so I started thinking about my future as well. What kind of studies would be best for me that would help me have a good future, have a good job? And also what economic possibilities do my parents have to help me in that. Why? Because I would have liked for example to follow my studies in England, but my parents can't afford that.

She tells of the importance of a stable economic situation for her future, and sees it as connected to higher education followed by a good job position, a trend which is found in many other interviews. The girl explains the rules of the field (or the 'game') where in order to achieve in life with a good occupation, one has to do well at school. Two kinds of capital that influence her dispositions, and decisions, are important here: the economic capital her family possesses, but also cultural capital as expressed in her parent's wish to see their daughter successful and in safe economic conditions in the future by choosing an appropriate higher education. One expression of this is the question the girl asked "What kind of studies would be best for me that would help me have a good future, have a good job? And what kind of economic possibilities do my parents have to help me in that?" instead of just "What would I like to study in the future". In shaping her experiences and dispositions, her family and the capital they possess influence the possibilities she can consider for her future: "I would have liked for example to follow my studies in England, but my parents can't afford that". Such examples of dispositions toward a safe future are found in other interviews also: "I wanted to be a lawyer in the future, but there are too many of them now, I must find something else…in order to be able to find a job in the future" (L, boy, grade 8). As Bourdieu (1977) indicated, habitus shapes what one perceives as possibilities. In the boy's case, the the legal profession is seen as an occupational field he would like to work in the future. But it seems that he is aware of the difficulties of the field also: many 'players', or lawyers, competing for the stakes of the field, such as ensuring a job in it. Since this does not fit with his idea for a safe future, then he does not think of this as a good possibility for him anymore.

There are other studies about Albanian students that also indicate a general trend of seeing a good and stable future as connected closely to higher education (World Bank 2005). Thus it can be said that being educated is considered as capital

which can ensure a higher status and income in life, or economic, cultural, symbolic, and social capital. One element that further supports the above statement is students' dispositions to dislike real-life situations connected to activities that bring about different or opposite effects. Activities presented in the items about agricultural matters, lotteries and gambling, and cultural products are perceived as having low or even negative profit both in income and societal status. During interviews students talked about farming as hard and tedious work, giving a low status and being prejudiced in society. One girl interviewed (G, grade 8) explained this latter tendency of the Albanian society as influencing her dispositions, and her habitus as a result, in the context of farming:

> G: [Agriculture] it is not for girls, I won't deal with it when I grow up. I don't even think I will ever need it…It is lowest in income, lowest [status] for example in the city those who deal with agriculture are called 'yokels' ('hicks').

The item was easier to endorse for country students, and for city boys as compared to city girls. It can be surmised that agriculture is nearer to students from the country schools as something they see or even do themselves in their families. It fits also with the gender role expectations in Albanian reality.

The fit with gender roles, influencing students' habitus, showed in lotteries and gambling, and cultural handmade products also:

> A: … girls for example they don't have any problem with lotteries since they don't…during their life they won't have the possibility to deal with lotteries and gambling (boy, grade 8).

> B: Hmm, I do not use those [lotteries] myself…(chuckle) I am not one of them…those are more used by boys (girl, grade 10).

> L: I don't like to work with cultural handmade products because it is not…it doesn't offer you many possibilities (girl, grade 8).

> E: I am not so much interested upon those [cultural handmade products]. They don't seem…Women at home deal with these (boy, grade 10).

In students' words, females' improbability for dealing with lotteries is seen as a taken for granted rule of the 'game' or of the field. Students explained their dispositions, as part of their habitus, for not wanting to learn about lotteries and gambling by bringing examples of their own experience, or more often their friends', families' and neighbors' negative experiences. Gambling was seen as negative

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because it could damage economic capital, but also social capital or the relationships one has with friends and family: "They lose their time, their money which is important for them, and maybe they lose their friendship as well, because they don't accept people like that" (E, boy, grade 10). As for the cultural products, besides the gender issue expressed by E above, the girl L points to the activity as not providing possibilities for her, in terms of economic and cultural capital.

In the middle range preferred real-life situations are issues about emergencies and disasters, epidemics, crime fighting, environment, and governmental issues which do not belong to students' immediate experience. During an interview, an 8th grade girl, G, mentioned the "spread and decline of epidemics" as relevant. She referred to it as something she did not have information about at first, therefore not that important to her. But then in her biology textbook she learned that "AIDS is a sickness that risks all. It is also connected to our school lessons, for example in biology textbook we had a lesson about it, about the HIV virus which is worrying". This is an example of how students can possibly be influenced in their dispositions, and habitus, by discussing important topics at school in connection with different subjects. During interviews some students related the items of the questionnaire with national or international examples such as the volcano in Iceland in 2010 as a disaster that could be calculated in terms of damages it caused, or the flooding that happened in Albania in 2010 as a result of excessive rain.

CONCLUSIONS

In general it can be said that there is an image that students reveal about the field of mathematics education, and education in general, in secondary school. This image fits with that of a field where they obtain useful knowledge to help them gain more cultural and social capital, to ensure economic capital and a good position in a future field of occupation, and a good position in society. Towards such topics, students display positive dispositions. Other topics that are perceived as not leading to the same direction, obtain low interest or even resistance to be learned.

Preferred topics such as mobile communication or development indexes can be used in teaching, as topics that carry mathematical treatment and possible critical engagement. As discussed in Kacerja (2011), other important matters to be taken into account, and that can influence students' preferences in such lessons, are the difficulty of mathematics, the complexity of the calculations, and the amount of new information brought.

For the contexts that are preferred the least it is still possible to find some stimuli in order to make them likable for the students. Here the idea is that not only the most preferred contexts could be used in mathematics, the other less preferred could be used as well, but in a cautious way. One characteristic of habitus is that it reveals certain outcomes only in certain conditions related to certain structures, which means that the same habitus can give different results depending on the stimuli it finds (Bourdieu and Wacquant 2002). Being aware of the reasons why some contexts are not preferred can help in finding a possible way to find the right stimuli for students so that habitus can produce the desired results. This could help all the actors in the process: textbook writers, curriculum makers, teachers, and test formulators etc. Emphasis in this matter is also supported by the work done on the topic of interest as an important component of students' motivation in learning (Krapp 2002a; Krapp 2002b; Schiefele 1991; Renninger et al. 2002; Hidi 1990). One of the less preferred item for example, C1 'lotteries and gambling', could be introduced in a way that emphasises the remote chance of winning with gambling. This was tried in another part of the Albanian study where slight differences were noticed in students' reactions toward the context since they focused more on learning a lesson for life from their mathematics lesson (Kacerja 2011). Some of the topics could also be used in integrated ways between some of the teachers, for example recreation and sports could be introduced by a collaboration of the teachers of mathematics and those of physical education so that each expert could contribute to it, and students could experience the use of mathematics.

As it looks from the results of this study, it is easier to talk to students about the mathematics of computers or other topics that are highly preferred, actual matters, with which students deal every day. For other matters that Albanian students perceive as less relevant, such as environmental matters or government finances, in

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order to interest students about their mathematics, some more work is necessary. In the case of environmental matters for example, to make it relevant, one could first raise students' awareness by using local examples to make present the issue as socially vital as it really is, and to bring it closer to students' experiences. Students themselves were able to discuss about local examples to illustrate some of the contexts during interviews. As discussed in the introduction, consistent with the recommendations of other researchers on the use of real-life contexts in mathematics lessons, it is important that lessons or tasks give students the opportunity for being involved in critical discussions about the matters at hand. This is even more important given the role of education in Albania as capital for students towards occupation and future life.

The gender and school location differences exposed by the study presented here draw attention toward potential misunderstanding or biases when using real-life situations in mathematics teaching. Deeper insights about this matter are found from interviews with students to realise the motives behind their thinking in this direction (Kacerja 2009; 2011). Understanding the local context, that of the school and the community, and its influence on students' reasoning and behaviour helps in formulating appropriate tasks or lessons using real-life situations in mathematics.

Ernest (2003) discussed the importance of a balanced curriculum in terms of students' interests, mathematics educators' evaluations of content, and the state's requirements for certifications in order for students to understand the relevance of mathematical activities. The work presented in this paper can be seen as concentrated upon one of the stakeholders of the learning process, and it has the aim of assessing students' interests on real-life situations to use in mathematics. As Ernest (2003) suggests, there is the need for an active participation by all the stakeholders in order to achieve a balanced curriculum. This means that with the current study it is not in any way assumed that students' interests alone should be taken into account when discussing curriculum.

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