THE GAP BETWEEN MATHEMATICS EDUCATION & LOW-INCOME STUDENTS' REAL LIFE: A CASE FROM TURKEY

Oğuzhan DOĞAN*, Çiğdem HASER**

* Yeditepe University

** Middle East Technical University

The purpose of this study was to trace the reflections of cultural differences based on social class in the elementary mathematics education in Turkey. Critical discourse analysis was conducted to examine these possible reflections. By researching mathematics education from a critical perspective, this study aimed to contribute constructing a starting point for socially responsible mathematics education. Elementary mathematics curriculum, textbooks, classroom practices, and teacher interviews were the main data sources. The discourse analysis of mathematics education contexts implied that elementary mathematics discourse replaced the 'real life' in mathematics problems with the life of middle and upper middle classes and ignored the low-income students' cultural backgrounds.

Keywords: Elementary Mathematics Education, Cultural Differences, Real Life Problems, Critical Discourse Analysis

THEORETICAL FRAMEWORK AND PURPOSE OF THE STUDY

The difference in educational outcomes of students coming from different race, ethnicity, class, gender, and language backgrounds were commonly researched and discussed in international education community. For many years, researchers have highlighted that public education systems did not produce equal outcomes for all students. Significant differences in students' achievements, graduation rates, and university attendance were continually observable among groups classifiable by race, ethnicity, class, gender, and language background (Gregson, 2007).

These highlighted differences have directed critical education researches to examine how class, race, and gender are represented and struggled over in schools, in education programs, textbooks, and teaching practices. The deficiencies in the representations of class, race, and gender in education materials were underlined as one of the blockades to their accessibility to high quality education (Gutstein, 2006). This paper specifically focuses on the representations of different social classes in elementary mathematics education discourse.

'Class culture', in the context of this study, was used to examine whether different cultural/social practices of different social/socio-economical classes were valued in a different way so as to provide a ground for inequalities in the mathematics education or not. 'Class culture' issue was examined with the help of the concept of 'cultural capital'.

The literature on cultural capital and its relationship to educational inequality was inspired largely by the work of Pierre Bourdieu. As described by Bourdieu

(Bourdieu, 1977; Bourdieu and Passeron, 1977), cultural capital is the vehicle through which background inequalities in students' life are translated into differential academic rewards. The cultural capital theory argues that the culture transmitted and rewarded by the educational system reflects the culture of the dominant class. To acquire cultural capital, the student must have the capacity to receive and decode it. The acquisition of cultural capital depends on the cultural capital transmitted by the family. Consequently, the higher the social class of the family, the closer the culture it transmits is to the dominant culture and the greater the resultant academic rewards (Bourdieu, 1977; Bourdieu and Passeron, 1977).

'Cultural capital' concept's major insights on educational inequality is that students with more valuable social and cultural capital become more successful in school than do their peers with less valuable social and cultural capital. This perspective is very useful in attempts to gain a better understanding of how class influences the transmission of educational inequality (Lareau & Horvat, 1999).

In the light of cultural capital literature, the main purpose of this study was to investigate how social class differences are addressed in elementary mathematics education in Turkey. Parallel to this aim, this study intended to extend the understanding of the relationship between mathematics education and social/cultural differences and of teachers' views about this relationship.

METHODOLOGY

In line with the purpose of the study, the following research questions were formulated:

- To what extent are elementary mathematics curriculum, elementary mathematics textbooks, and elementary mathematics classroom practices in Turkey free from cultural values?
- How are the different cultural values and practices of different social classes reflected and addressed in the elementary mathematics curriculum, textbooks, and classroom practices?
- What are the perceptions of mathematics teachers about the relationship between mathematics education and dominant cultural values?

Since how power relations are produced, maintained, and challenged through texts and the practices is one of the main concern of CDA (Locke, 2004), it was used as a research methodology of this study. The study employed critical discourse analysis in investigating these research questions and included curriculum documents and implementation, textbooks, and teachers interviews as data sources.

This study investigated the elementary mathematics curriculum (from 6th to 8th grade), elementary mathematics education textbooks (from 6th to 8th grade), an elementary mathematics classroom [one 7th grade classroom (28 students at the age of 13)], and views of an elementary mathematics teacher.

Participant School and Classroom

The study was conducted in a public school in the second semester of 2009 – 2010 academic year. Although the participant school was not far from the city center, the district was composed of Gecekondus (poor quality houses constructed without any proper plan and infrastructure and occupied by very low income families) and lower middle class and middle class apartments. According to school's Strategic Planning Report, most of schools' students were living in Gecekondus near the school district. The families were coming from rural areas of Ankara and near cities, and they maintained their close links to their home towns. While most of students' fathers were working at temporary jobs with minimum wages, their mothers were generally house wives.

The socio-economic conditions of the students in the participant classroom reflected the socio-economic conditions of the district in which school was placed. Most of the fathers were working as driver or construction worker with minimum wage. Only three of the mothers were working as officers (office staff in a state institution), the others were housewives.

Data Collection

There were three main data sources for the investigation of these research questions. The first data source of the study was the curricular materials in elementary mathematics education, such as elementary mathematics curriculum, guidelines/booklet /guide book, textbooks, and teachers' reference books for 6th, 7th, and 8th grades published by the Ministry of National Education. The second data source was the practices and interactions including explanations, examples and questions, teacher-students interactions, homework, and projects in a mathematics classroom which were observed in the second semester of 2009-2010 academic year. The third data source was pre- and post-interviews with the participating teacher. Mathematics teachers' views about relationship between critical issues and mathematics teaching were explored through these interviews.

Data Analysis

The analysis of the data started with the construction of a sample code list after the classroom observations were completed. The content of the curriculum and textbooks was analyzed with this preliminary code list. This code list was composed of textbooks and classroom examples which had reference to daily life situations. This pre-analysis resulted in some improvements in the code list: Three main categories emerged in this pre-analysis. Classroom observations were coded with this improved code list. It appeared that this improved code list was sufficient to analyze the context of the classroom observations. A part of this code list was provided in Table 1.

Up to this point, all data of the study was coded by only the researcher. After the construction of this final code list, the whole data was coded by both the researcher and another elementary mathematics education researcher to address the reliability

concerns. The general objectives, specific learning outcomes, the vision of the elementary mathematics curriculum and sample activities and lesson plans in the curriculum, the homework projects, the examples and questions in the textbooks, the content of the classroom activities and teacher-students interactions were analysed with this final code list by two researchers.

While coding, the researchers read each material individually and coded the critical expressions in the documents. After coding individually, they compared their codings to see whether they were parallel or not. The researchers reached over 85% agreement in assigning codes. When there were differences between the results of coding, researchers discussed the existence of a critical meaning in the statement and decided whether to include these statements in data analysis or not. The controversial statements about which researchers did not convince each other were not presented as a finding of this study. These controversial statements constructed 4% of total data coded.

Theme	**Codes/Categories**	**Examples**
Class Culture	Family Life	Mert, his wife and their two children participate different activities such as theater, cinema, and exhibitions every weekend. Cansu takes a lot of photos in her visit to Çanakkale Cemetery on summer holiday with his family Esen family redecorates their house that they newly bought
	Adult Life	Mr. Ali cares for his health. He decided to buy a summer house to escape from stressful pace of everyday life Mr. Okan wanted to get a camera and investigated the prices of different trademarks and models of cameras Mr. Hasan wants to rent a car before for his summer vacation
	Children Life	The following paragraph describes the help of 6.grade students to a poor school. Pınar is going to French course in half of the month Sengul will buy fruit juice, chocolate and candies from shop for her birthday party

Table 1: Code List for the Analysis of the Data

The pre- and post-interviews with the teacher were also analysed with the help of the second coder. Additional to emerged categories (listed in the table as family, adult, and children life), analysis of teacher's interviews was composed of her comments about these categories. The questions in the pre-interview were basically about teacher's general views about the relationship between mathematics education and dominant political, cultural, and patriarchal views and values. For example, one of the pre-interview questions was about the relationship between politics and mathematics education: "When you consider mathematics education in general, such as the explanations in curriculum, examples in textbooks or activities in your classrooms, how do you assess the neutrality of these contexts in terms of political and cultural views?". Post-interview questions, on the other hand, basically addressed teacher's views about my specific inferences from the curriculum, textbooks, and classroom observation analyses. For instance, one of the post-interview questions was about the gap between mathematics problems and students' cultures: "Context of some of the textbook examples seemed considerably far from the students' real life, for example, students were expected to behave as a manager in a bus company in one of the examples. What is your perception of such examples? Can you assess your examples in the classroom in terms of this perspective?".

RESULTS

The main issue investigated in the study was whether different socio-cultural practices of different social classes were valued in a different way so as to provide a ground for inequalities in the mathematics education or not. Possible findings would also answer the question "Whose lives were presented in mathematics education discourse?"

The analysis started with the curriculum's emphasis on (i) the importance of the relationship between mathematics education and students' real/daily life and (ii) the importance of the solving real-life problems. The vision of the curriculum indicated that mathematics should be taught based on concrete and finite-life models. In addition, raising students with the ability of using mathematics in their daily life and appreciating mathematics as an important tool in real life was defined as the prior objectives of curriculum. I concluded that 'solving real life problems' was placed at the heart of elementary mathematics teaching. However, I also concluded that the questions 'what is real life' and 'whose life will be served as real life' were not satisfactorily answered in the program. I pointed out that these unanswered questions would imply that lower social classes which had a limited/restricted voice in both social life and educational organizations can face with the risk that their silence will continue in mathematics classrooms.

The analysis of curricular materials showed that this risk turned into reality in the context of the textbooks. The daily life problems in the textbooks were analyzed under three main headings: (i) The problems based on life/activity of whole family; (ii) The problems based on off-class activity of children/students; and (iii) The problems based on life/activity of an adult character. Based on the findings describing

a families', children' or adults' life, I tried to draw a profile of 'daily/real life' in the problems. This constructed daily life profile was examined for whether it reflected a 'daily life' of specific social classes or not.

The analysis of textbooks specified that 'the family' in the problems were the ones who participate in different activities such as theatre, cinema, and exhibitions. At every weekend, characters visited grandfather, grandmother, or eldest of the family in national holidays, travels different resorts/seaside during the summer vacation, and builds/bought a new house or redecorates the existing one.

'The child' in the problems was the one who would go to different courses through the year, such as a language course or a musical instrument course, or a sport course, participate different out-door activities with his/her friends such as going to swimming or taking a trip, go to shopping for his/her birthday party, have a computer and a bookcase, and s/he would organize with his/her small size classroom either a trip to touristic destination or a campaign to help for a poor school.

Finally, 'the adult' in the problems was the one, who would care for his health either by buying a summer house to escape from stressful pace of everyday life or becoming a member of a sports club, and investigate the prices of different technological devices. In line with these descriptions, I concluded that the 'real life' in mathematics problems was replaced with the lives of middle and upper middle class individuals.

The replacement of 'real life' with the middle-class social life in the textbooks could be considered as the consequences of the asserted deficiencies in the curriculum. When all the expressions about 'real life' in the curriculum and the replacement of 'real life' with the middle-class social life in the textbooks were considered, it seemed that it hid complicated realities, especially for the working-class students.

Moreover, observations of classroom practices implied that the questions solved in the classroom were very similar with the textbooks' examples in terms of the class culture they represented. The families who saved up money to make investment, who loaned a credit from a bank to meet your needs, who went for a holiday or who paid their automobile insurance were not similar to the families of participant students. However, detailed description of classroom practices indicated that the focuses of problem solving procedures were mainly centred on the basic calculations and the cultural contexts of the problems were near to vanish. Classroom observations implied that although the influences of class culture were reduced in the classroom with respect to textbooks, there was still no reference to the lives of participant students in the classroom activities.

Lastly, teacher interviews pointed out that participant teacher's views about class culture issue were parallel to her views of politically neutral mathematics. Although my analysis of textbooks and classroom practices provided counter examples, the teacher believed that different cultural values and practices were respected similarly in schools. In the light of teacher's responses, I also tried to discuss the warnings of

cultural capital literature about the possible inequalities that the difference in cultural resources would bring to classroom whether teachers are aware of these inequalities or not. Teacher's answers also underlined two reasons for limited usage of real life examples in the classroom: (i) Her view that the effects of real life examples is generally overestimated and applicable to only successful students; and (ii) Her view that finding a common concept for all students in the classroom is very difficult task.

CONCLUSION

To conclude, the overall context of elementary mathematics education replaced the 'real life' in mathematics problems with the life of middle and upper middle classes. 'Real life' problems in mathematics textbooks were not prepared to serve appropriately for working class students and they provided middle class students a cultural advantage. The congruence between the life of middle class students and the life presented in mathematical problems could make these problems easier for them in comparison to their lower class peers. When it was considered that middle and upper middle class students already had economic advantage, this cultural advantage would increase the achievement gap between lower classes students and them. It could be claimed that more working class students would be compelled to failure in this unequal cultural and economic conditions. The possible failure was not the only result of this middle class domination for working classes students; they would also have very limited opportunities to comprehend their live conditions through mathematics and so limited chance to take action against these conditions. While mathematics education had the possibility to make them aware of their lives, this possibility was vanished in the realm of middle class culture.

Based on the findings of this study and with reference to current critical mathematics education literature, the following implications could be stated for teachers, teacher educators, curriculum developers, textbook writers, and policy makers.

First of all, the emphasis of the curriculum on the importance of 'real life' and 'problem solving' should be protected; however, there should also be specific directions about integrating the life, culture, and problems of different social classes - especially the lower classes- which had a limited/restricted voice in both social life and educational organizations. Although transforming curriculum is necessary for transforming curricular materials, such as textbooks and workbooks, it will be not sufficient. Textbooks are one of the bridges between curricula and students (and also teachers). Therefore, there is a need for special consideration/attention to address their deficiencies. Integrating the daily life of working class students into mathematics textbooks and focusing on their social and economic problems in mathematics problems will also be helpful for conducting socially just mathematics.

Neither reforming curriculum nor revising textbooks would promise the positive changes in classroom practices. Transforming classroom practices is strongly linked to the change in teachers' perceptions about the relationship between mathematics education and critical issues. Teachers' perception of neoliberal view of education as

a ‘common sense’ and their perception of mathematics education as politically and culturally neutral would be one of the reasons of the reproduction of social inequalities through mathematics education. Therefore, educating in-service and pre-service mathematics teachers about class- and culture-sensitive mathematics would be a barrier for this reproduction. Although mathematics teacher curricula emphasis teachers’ content, pedagogic, and pedagogical content knowledge, there are not sufficient courses or content in other related course addressing the role of mathematics education in social justice. Teacher education programs should cover possible links between mathematics education and cultural diversity, gender equity and social justice. Teacher education students, as future teachers, ideally could be able to use strategies for identifying their students’ social and cultural environment to make them cope with their problems.

This study tried to portray current standings of mathematics education in terms of class culture. Although I pointed out some alternatives above, a comprehensive answer of what could be done to establish improvements in these issues was not the scope of this study. In the light of critical mathematics education literature, there can be an attempt to construct a class- and culture-sensitive mathematics curriculum. Investigating the possible impacts of such program on students’ attitudes towards mathematics and towards these critical issues will greatly enrich the related literature.

REFERENCES

Bourdieu, P. (1977). *Outline of a theory of practice*. Cambridge: Cambridge University Press.

Bourdieu, P., & Passeron, J.-C. (1990). *Reproduction in Education, Society and Culture.* London: Sage Publications.

Gregson, S. A. (2007). The Equity Practice of a Mathematics Teacher in a Secondary School Committed to College Preparation, Community Connection, and Social Justice. *Paper presented at the American Educational Research Association Annual Conference*. Chicago.

Gutstein, E. (2006). "The Real World As We Have Seen It": Latino/a Parents' Voices On Teaching Mathematics For Social Justice. *Mathematical Thinking and Learning, 8: 3, 331-358.*

Lareau, A., & Horvat, E. M. (1999). Moments of Social Inclusion and Exclusion Race, Class, and Cultural Capital in Family-School Relationships. *Sociology of Education, 72, 37-53*.

Locke, T. (2004). *Critical Discourse Analysi*s. London: Continuum.