

Preliminary report

Some social implication of mathematics education in the Republic of Srpska (B&H)¹

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Abstract. Our intention in this paper is to open a discussion with different people, who have influence on principle-philosophical attitudes on mathematics teacher education policy, about social and political aspects of mathematics education in the Republic of Srpska (an entity of Bosnia and Herzegovina) school systems.

Key words and phrases: social and political aspects of mathematics education

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1. Introduction

The goal of this paper is to offer a conceptualization of the social implications of mathematics education. Our intention is to encourage the academic community to open a dialogue on the following issues:

1. Why professional development must become a priority in the realization of the goals of mathematics education?
2. What are the goals of professional development?
3. What principled and philosophical orientation should be adopted to be the basis for the design of the professional development?
4. What should teachers learn in order to teach mathematics?
5. What should the academic community of mathematicians, researchers in mathematics education and mathematics teachers do in order to improve the quality of mathematics education?
6. What can mathematics teachers learn by studying their own practice?
7. What can be learned from research in mathematics education?
8. What do mathematics education researchers know about advances in professional development?

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Working Group WG3 at the CERME 2 conference (2001), among others, dealt with the following issue:

How significant are the social and political conditions of teaching mathematics in schools? '

while the working group TG 12, during the conference CERME 3 (2003), among others, addressed the following issues:

- What kind of indicators should be provided to show the social and academic community that the quality of education of mathematics teachers is an important national strategic goal and that the community should invest in such kind of education much more energy and money?
- We do not have such indicators, but we should provide open discussions with different people, especially with people who have influence on the choice of principle-philosophical attitudes in education policy of mathematics teachers in us, to realize the intentions expressed in the previous question?
- What is the meaning of the term 'indicators' in the field of mathematics teacher education research?
- What kind of indicators can be provided within that field?

Mathematical training can be viewed from several complementary perspectives (see Ernest [10]). Among these aspects apart from the cognitive and semiotic aspect, a special attention has been lately given to social context. From the cognitive perspective, mathematical training refers to 'the adoption' of the facts, skills, concepts and conceptual structures as well as, general problem-solving strategies. Semiotic capabilities in mathematics education according to Ernest [10] include the following: the ability to read mathematical context, finding meaning in this context, the identification of objects that appear in it, discovering the purpose and objectives of the concepts that are involved in the context, linear and vertical mathematization of the context as well as the interpretation of the results of vertical mathematization. Treffers [32, 33] explicitly formulated the idea of two types of mathematization in an educational context; he distinguished 'horizontal' and 'vertical' mathematization. Broadly speaking, in the Realistic Mathematics Education Theory, these two types can be understood as follows. In horizontal mathematization, the students come up with mathematical tools which can help to organize and solve a problem set in a real life situation. Vertical mathematization is the process of reorganization within the mathematical system itself, for instance, finding shortcuts and discovering connections between concepts and strategies and then applying these discoveries. Thus horizontal mathematization involves going from the world of life into the world of symbols, while vertical mathematization means moving within the world of symbols.)

The social aspect of mathematics education (e.g., [1, 2, 10, 25, 28, 35]) should be connected with a generally accepted conceptualization of cultural, social and political context of mathematics education.

2. Literature review / Theoretical background

"Socio-political turn" in mathematics education [21] is well illustrated by intensifying research and the diversity of issues in the field of 'research in mathematics education' in the

past few decades, by introducing of social, political and critical perspectives in this research field. This implies the following:

- consideration of bond (connections) between equity in mathematics education and social justice [6, 18, 30];
- understanding connections between fairness and social justice in mathematics education [6, 18, 30];
- consideration of the political dimensions of mathematics education [15, 23, 24, 35];
- relations between sociology and mathematics education [22, 27];
- socio-cultural perspective [3];
- relations between democracy and school mathematics [31];
- influence of mathematics education [13, 29];
- ethno-mathematics [8, 26];
- philosophical analysis of mathematics education [9];
- postmodernism in mathematics education [9], and
- history of mathematics education and the history of research on that education [14].
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Although these programs have different foci and often contradictory conclusions emphasizing different implications, they all have some common points of view:

1. There is a strong rejection of the previously dominant view that mathematics is a unique, objective and impartial discipline insensitive to human interests.
2. Also, discussions have always been held about aspects of mathematics and mathematics teaching in the social and cultural context in which they arise and in which they are used.
3. Modification of the dominant traditional approach to the implementation of mathematics teaching some more modern principle-philosophical orientations in many social and academic communities around the world.
4. Bringing into question the generally accepted assumption that mathematics teaching should follow the prescribed methodological procedures established during the earlier accumulating of teaching experience, and that applies equally to all students, without spotting specifics, with approximately equal programs (across all levels of education).

Modernity and topicality of these aspects of mathematics education is recorded in published books on these topics (e.g., [1, 6, 12]); in defended doctoral dissertations (e.g., [7, 19]); and at the conferences of the International Association “Mathematics Education and Society” (MES), which have been regularly held every three years from 1998: MES 1 (1998) - MES 7 (2013). Conferences of that association provide forums for discussing social, political, cultural and ethical dimensions of mathematics education. Also, at the upcoming 13th International Congress of Mathematics Education, ICME 13, which will be held in Hamburg, a topic study group TSG 33 will deal with equity in mathematics education, while a topic study group TSG 34 will deal with social and political dimensions of mathematics education.

3. Motivation

With a view to gain experience according to elementary schools teachers’ belief on social implication of mathematics education in our school system, the authors constructed interviews with several elementary school teachers in Bijeljina area (North-East part of B&H). From the interviews we chose the following questions because they are significant for the goal of this article:

1. *Is there pressure of public opinion on elementary school teacher to uphold the mathematics education standards?*
2. *Are there the education standards in elementary schools mathematics?*
3. *Do you see the education standards in elementary schools mathematics?*
4. *Do you know who proclaim them?*

Participants. 29 elementary school teachers from different schools in Bijeljina and the surrounding area participated in the interviews. They were from a wide range of social and economic backgrounds. (In the Republic of Srpska, school grades are formally organized in four triads: 1st triad (1st to 3th grade), 2nd triad (4th and 6th grades), 3rd triad (7th to 9th grade), and Secondary cycle (10th to 13th grade). In practice, school system realized in the following four cycles: 1st cycle (1st grade), 2nd cycle (2nd to 5th grades), 3rd cycle (6th to 9th grade), and a lot of different secondary schools with different curricula (10th to 13th grade).)

Procedure. Data used in this interview was collected at schools. Letters, describing the interview with ten groups of questions, were sent to teachers who gave their written consent to the first author of this article. Questionnaires were administered under the supervision by all members of our research team (including several graduate students at Bijeljina Faculty of Education).

Results. The answers to mentioned questions are good indicators of teachers' unsubstantiated belief: All of them are answered with YES on the first and second question but with NO on the third question. So, they did not see a mathematics education standards ever, but they believe that a mathematics education standards exists proclaimed by the Ministry of education (as the answer on the question four).

4. Our observations

The question "What is the connection between mathematics, teaching mathematics and social interests?" is usually responded by using an a priori accepted assumption that mathematical structures actually exist as a logical possibility. It is quite natural that if we accept that the mathematical knowledge is beyond the interests of communities, then social interests may be involved only in mathematical practice rather than in mathematics itself. This Platonic approach seems to see mathematics beyond adopted or desirable social norms. This is, in contrast to the fact that the entire mathematical knowledge is created by people. On the other hand, teaching mathematics, but also the realization of that teaching, is fully immersed in the collective and individually - humanistic activities of each community and its academic members.

Considering mathematics within the socio-political aspect is not only determining mathematical knowledge of people who teach and whom they teach to, but rather as a social system in which that knowledge is created and applied. That social system is related to:

- principled-philosophical orientations of the community incorporated in the curriculum of mathematics,
- educational standards that the social community imposes to the academic community,
- economic and financial capacity that community makes (directly or indirectly) available to the academic community of implementers of that teaching,
- the quality of communication between the social community and its academic community,

- authoritative competence of mathematics teachers that are recognized by international academic community of researchers in mathematics education and respected by local social community,
- personal characteristics of each mathematics teacher,
- the quality of didactic training of people who teach, and
- understanding the process of teaching and student learning within the school and the academic system.

In what follows, we examine our findings related to the first, second and fourth above-mentioned relation in which we are trying to determine the relationship between social community and conceptualization, preparing and teaching mathematics in primary school, in our education system.

What can be said about the principled and philosophical orientations of our community incorporated in the curriculum? What is immediately noticeable is the following: The curriculum of mathematics for each grade of primary school in our country, in the Republic of Srpska, consists of less than two pages of text. These two pages have no marks in the header that they are designed by the Ministry of Education and Culture of the Republic of Srpska, so it is not officially known how they have been created. According to the Law on Primary Education in the Republic of Srpska they should be designed by the Minister at the proposal of the Pedagogical Institute of the Republic of Srpska. It is not possible to determine the necessary competence of persons who, on behalf of the Institute, have prepared a proposal. What kind of instructions our Ministry suggests to mathematics teachers by these two pages?

Are there proclaimed standards of mathematics education in our country? – this is quite appropriate question that every mathematics teacher asks themselves at the beginning of their career. How do we know what the orientations in our community are? Which should relate to the desired outcomes of mathematics teaching in our educational systems, if in any way those orientations have not been officially communicated to the academic community of mathematics teachers in our country? Apart from these standards in mathematics education, our social community should offer teachers the instructional material through which these standards can be reached. Are there concepts and procedures to determine whether proclaimed educational standards in mathematics have been achieved? These issues, as well as other issues regarding the teaching of mathematics, are still not a topic that receives either the attention of the community (for example, the Ministry of Education and Culture of the Republic of Srpska, the Pedagogical Institute of the Republic of Srpska) or the attention of the academic community mathematicians (for example, the Mathematical Society of the Republic of Srpska, University Department of Mathematics and Methods of Teaching Mathematics) and vocational academic mathematics teachers in our country (for example, associations of teachers of the Republic of Srpska).

Communication between the social community and its academic community of mathematics teachers can be described within different aspects. We will concentrate on one of them: to determine the quality of teaching performance in the conceptualization, preparation and teaching mathematics. Our research need to make an insight into the field of aforementioned communication has resulted in the following conclusion: There is no external (i.e., external and independent) determining of any element of success. The question that arises is the following: Why our social community has no need for the determining the level of success in these processes?

5. Future goals

We would like to open dialogue about the content and the quality of these connections in our academic and social community. That is our intention - to open the discussion on how mathematics teachers should negotiate with non-mathematicians colleagues, students and their parents, people who have an impact on the implementation of the teaching process (for example, management within the school and academic education systems), with the colleagues of the same profession at various levels of education, members of interested business associations, and others who, for example, are not content with the goals and learning outcomes that are achieved.

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