

A Model Suggestion in Order to Write Real Life Mathematics Questions in The PISA and TIMMS Character

Murat ALTUN

Uludağ University, Faculty of Education, Secondary School Mathematics Education

Even though the detachment of school mathematics from life has attracted researchers' attention for a long time, there has been an increase in the concentration on the subject since the 2000 as they have been taken into account the PISA results while examining the countries educational policies. While the problems in school mathematics focus on the basic skills of advanced mathematics, mathematical literacy problems, that is life-based problems, focus on the use of basic mathematical knowledge and skills (Steen, Turner and Burkhardt, 2007). Even though there is no definite mark between these two types of problems, while most of the routine problems in textbooks can be solved by recalling learned information, life problems are the problems that measure what can be done with the acquired knowledge, which requires the integration of knowledge and skills. Briefly, PISA applications are like saying "Keep what you have learnt for yourself, tell me what you can do!"

The problems in school books are often not real, but are those problems that are about the assumptions of the truth, and these questions are very easy to write. What has been addressed in this study is the preparation of the second type that is the life problems. The ability to write life problems regarding the PISA requires a good recognition of the characteristics of such questions as well as taking into account the general objectives of mathematics teaching. In addition to the classifications according to the (i) Subject areas (quantity, uncertainty, space and shape, change and relations), (ii) Contexts (personal, social, occupational, scientific) and (iii) Process skills (formulating, executing and interpreting and evaluating) available in OECD's own publications (2016), the articles that address the difficulties involved in writing the questions present serious opportunities in this regard.

Real life questions or problems differ from the conventional question structures by their being **contextual**, allowing for **flexible thinking, argument building and defense** requirements, **decision making and modeling skills**. These characteristics also suggest that in the background of life questions, education system should be constructivist. An education system through a constructivist approach with its nature of teaching students the skills to discuss ideas individually or as a group, deepening their thinking, and ultimately allowing them to produce the skills, naturally allows the skill by which life problems are questioned. The implicit conclusion drawn here is that it is important and necessary, even imperative, to implement the education system in a constructive form in writing real life questions.

The first three of the five phases of the 5E model (Bybee, 1997), which shows the way of implementation of the constructivist approach in teaching, (1) Drawing Attention, (2) Exploring, and (3) Explanation are interconnected and interrelated phases, where the activity presented at the "Exploring" stage is a phase allowing for thinking flexibly, generating an argument and defending it, or even insisting on it in its defense in the learning process, if it is necessary, modeling it. **Modeling** occurs as a result of the abstraction process as the most basic method in the production of mathematical knowledge. Constructivist education improves the modeling skills of students as it involves the abstract abstraction process by its very nature. Applications involving the acquisition of the details of the concept in the last two steps of the 5E model "Deepening" and "Evaluation" are implemented and serve at this stage for the real life questions to have a certain quality.

These statements reveal that establishing a constructivist approach in the education system constitutes a strong basis for the teacher to write real life questions. These statements also reveal that

there is a background to the proposed model, and that this background "the education system should be in a constructivist character".

Real life questions are contextual. Contexts are starting points in writing question, and different dimensions of human life can be taken into account when creating the contexts. These real life situations can be classified as follows:

- 1) Situations that involve all kinds of decisions for the future
- 2) Situations that require the creation of mathematical modeling
- 3) Situations that involve the construction of mathematical knowledge
- 4) Drawing conclusion from contextual information, graphics, scales, banners, tabulated tables, etc.
- 5) Comprehension and interpretation of science
- 6) Clarifying the past and revealing the truth
- 7) Situations that explain natural phenomena

Taking this detail into account when writing a real life question or problem requires gathering information from scientific data sources, if necessary. The questions written by considering these sources are generally two or three-optioned closed-ended questions. In the first option, a question with numerical applications, which can easily be solved with the aim of introducing the student to the subject, is given. Students encounter the real life questions in the following options.

In addition to the methods regarding writing questions presented above, a practical method is to convert the questions in textbooks into real life questions. On the basis of this method is the "resistance to the demands of the question, resistance to the problem". "An empty pool is filled in 8 hours by the first faucet and in 24 hours filling by the second faucet. The question of "How many hours does it take fill the pool if both faucets are turned on together at the same time? " can eventually lead the real life questions with the ensuing discussion after the opposition with the following statements;

- Why should we fill it?
- Why should we calculate the filling time?

One example may be like this: "Ms. Ayfer heard the news on the radio that there will be water cut for 3 days starting at 17:00 that day. She decided to fill the water tank as a prevention measure for water cut. According to her past experiences, she knows that one of the two water sources of the house fills the water tank in 8 hours and the other source in 24 hours. It is 13:00 o'clock now! Does she have enough time to fill the water tank by using both sources?" There is no need for each question to be converted into a real life question, but this method is a rich source for writing questions.

A 30-40-hour training organized on the basis of both contexts and routine problems may be sufficient to improve the skill of writing real life questions.

Key words: Mathematical literacy, Real life problems, Constructivist education

References

Bybee, R.W. (1997). *Achieving scientific literacy: from purposes to practices*. Portsmouth: UK, Heinemann.

OECD. (2016). *PISA 2015 Assessment and analytical framework. Science, reading, mathematics and financial literacy*. Paris: OECD Publishing.

Steen, L. A., Turner, R., & Burkhardt, H. (2007). Developing mathematical literacy. *Modelling and applications in mathematics education*, 285-294.