The role of Fermi problems in the concept of developing mathematical literacy among students

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The article deals with mathematical literacy in relation to mathematical knowledge and mathematical problems. It presents also the Slovenian project NA-MA POTI, which started in 2018 and aims to develop mathematical literacy at the national level, from kindergarten to secondary education. The concept of mathematical literacy identifies two cornerstones of mathematical literacy: 1) mathematical thinking, that is, understanding and using mathematical concepts, procedures, strategies and communication as a basis for mathematical literacy; and 2) problem solving in different contexts (personal, social, professional, scientific) that enable a mathematical approach. The latter also highlights mathematical modelling, which generally involves interpreting real-world observations using conceptual (mathematically structured) language. Fermi problems represent a special type of mathematical modelling problems. They are generally defined as problems that are at first sight unsolvable, are authentic and are not structured in the same way as school problems, require reasoning about the necessary data for solving and evaluating them, require mathematical knowledge, and allow the development of problem-solving strategies. Fermi problems, when properly introduced into the learning process, have the potential to develop students' mathematical literacy on both cornerstones. Teachers have a key role to play in this process, as they need to acquire appropriate competencies in mathematical literacy themselves first in order to be able to organise and implement appropriate learning situations in their teaching. The aim of the empirical part was to develop a scheme for assessing the quality of Fermi problems created by prospective primary school teachers for their implementation in mathematics lessons. For this purpose, we analysed examples of Fermi problems for fifth graders designed by prospective primary school teachers The problems were evaluated according to the characteristics of the modelling process: the complexity of the mathematization, the complexity of determining the data needed for the solution, the number of cycles in modelling, and the linguistic relevance of the problem. We defined as qualitative

those Fermi problems which can be identified as having a high complexity of determining the data needed for the solution, have a high level of mathematization, are linguistically appropriate, and have more than one cycle. We argue that Fermi problems with such characteristics have a great potential in the process of developing mathematical literacy in students at basically all levels. We want to encourage prospective primary school teachers, as well as other stakeholders, to create their own Fermi problems. We believe that a given scheme for evaluating the quality of Fermi problems can guide teachers in creating their own problems or in deciding which problems are appropriate for classroom implementation according to the objectives.

Key Words: mathematical literacy, problems, Fermi problems, modelling, teaching mathematics, prospective primary school teachers