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#### **TRAINING PRIMARY SCHOOL TEACHERS FOR TEACHING THE MATHEMATICS AND ENVIRONMENTAL EXPLORATION SUBJECT**

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#### ***Abstract***

In 2012, in Romania, it was approved the *Framework Plan for Primary Education, the Preparatory Grade, the First and Second Grades*. An important change was the introduction of the *Mathematics and Environmental Exploration (MEE)* subject. The novelty consists of the integrated study of mathematics with elements of natural sciences within the same subject. The following issues have been outlined: How did teachers adapt to these profound changes in the curriculum? What should be done to improve teacher training for integrated content approach? In this paper, we analyse the training that the teachers benefited from in order to teach the *MEE* subject, as well as their needs in the integrated approach of this subject. We collected data using the survey method based on a Google Drive questionnaire. The survey was voluntarily and anonymously completed by 131 teachers for primary education. Respondents consider the decision to introduce the integrated study of Mathematics with Environmental Exploration into primary education as a fairly good one, giving it a score of 3.31 on a scale from 1 to 5. Although more than 75% of the teachers benefited from more than 25 hours of *MEE* integration training through different training programmes courses, they mostly need printed materials (lesson projects, *MEE* didactics books, methodological guides).

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**Keywords:** Mathematics and Environmental Exploration (MEE) subject, primary education, teachers, training.



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## 1. Introduction

Within the European Union, in 23 countries (including Romania) out of the 34 countries considered, math teacher training programmes approach the issue of integrating mathematics with other disciplines (EACEA P9 Eurydice, 2011). In Romania, through the Ministry of National Education Order no. 3654/29.03.2012, it was approved the *Framework Plan for Primary Education, the Preparatory Grade, the First and Second Grades* (M.E.C.T.S., 2012). Its purpose was to facilitate the achievement of the primary education child's profile, correlated with the domains of key competences specified in Art. 68 of the *National Education Law* (M.E.N., 2011). The *Framework Plan* has new elements: changing the name of some subjects (*Communication in the Romanian language*), integrated study of some subjects (*Mathematics and Environment Exploration - MEE, Music and Movement, Visual Arts and Practical Abilities, Physical Education and Sport*); introducing new disciplines (*Personal Development*). The syllabus for the *MEE* subject (M.E.N., 2013a) was designed for three classes (*the preparatory grade, the first and second grades*), according to a new competence-based curriculum design. The integrated approach of these disciplines was supported by the following arguments: a holistic learning is more interesting at this age, being closer to the children's way of knowing; contextualizing learning in reality enables understanding concepts and procedures; it enables didactical time efficiency and favours interactions (M.E.N., 2013a, p. 2).

## 2. Problem Statement

Changes in the educational paradigm - the transition from objectives to competences - in the Romanian education system and the integrated approach of some subjects studied independently previously have led to a series of changes in the design of school curricula, textbooks, and of the didactic activity. All these caused some problems to primary school teachers. The following issues have been outlined: How did teachers adapt to these profound changes in the curriculum? What should be done to improve teacher training for integrated content approach?

## 3. Research Questions

In this research, we answer the following questions: What are the modalities (university courses/subjects, training programmes) through which the teachers achieved knowledge about the integrated study of *MEE*? What integrated activities teachers organised before the implementation of the new *Framework Plan*? What is the teachers' opinion about (characteristics, difficulties) the *MEE* integrated approach? What are the materials and activities required for increasing the competence level of the *MEE* integrated approach?

## 4. Purpose of the Study

By analysing the answers to these questions, we seek to provide decision-makers from the Ministry of National Education and researchers in the field of Educational Sciences some information regarding the

implementation of the new curriculum of primary education and syllabus of *MEE* subject from primary school teachers' perspective.

## 5. Research Methods

### 5.1. Data collecting and processing

In order to collect the data, we used the investigation method through a questionnaire realised using the Google Forms application from Google Drive. We collected the primary school teachers' opinions about their training for the integrated study of *MEE* subject and about their training needs. The questionnaire included nine items: two items with dual choice, an item with multiple choice, six items with choosing an answer on a five point Likert scale. The questionnaire was carried out in March 2017 on Facebook and by email. The collected data were processed statistically and represented in charts by means of the Excel programme and the research material consists of the answers expressed in the questionnaire.

### 5.2. Participants

The questionnaire was filled in voluntarily and anonymously by 131 teachers for primary education. Regarding the educational level, 64.2% of the teachers have a Bachelor's Degree, 32.1% of them have a Master's Degree, and 1.5% (2 respondents) have a Ph.D. Just 2.3% have graduated only a Pedagogical High School. Regarding the didactic degrees (which are stages of the teaching career), more than three quarters (77.1%) of the respondents have the first didactic degree (which is the highest), 10.7% have the second didactic degree, 7.6% of them have the definitive didactic degree, while 4.6% of them are debutants. Related to the years of teaching experience, 61.8% of the respondents have over 20 years in teaching, 23.7% have between 11 to 20 years, 9.9% have between 5 to 10 years teaching experience and only 4.6% have under 5 years teaching experience. Regarding the school where respondents teach, 64.1% of them work in urban area schools and 35.9% in rural area ones. Respondents have the qualification and the didactic experience that allows them to make pertinent appreciations of the questions investigated through the questionnaire. As nearly 36% of the respondents teach in rural schools, the collected information also reflects the situation of areas with less material resources

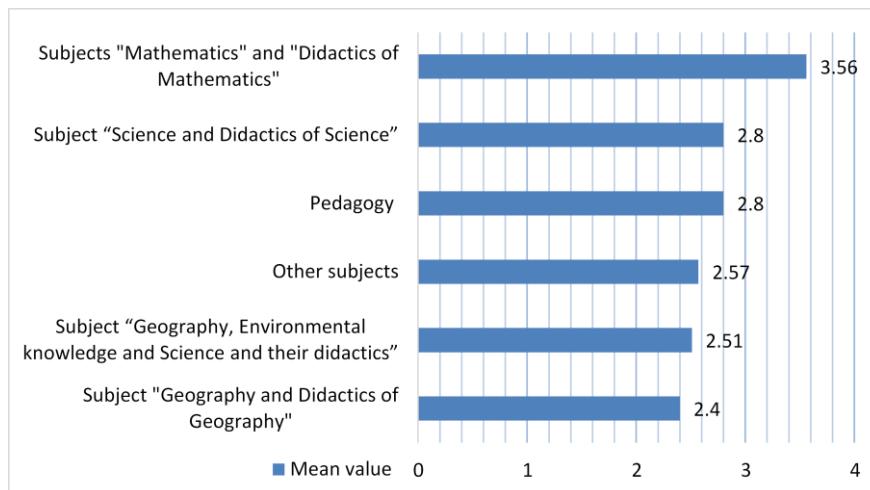
## 6. Findings

By administering the questionnaire, we obtained the results below. Regarding the ways in which the teachers achieved knowledge about the integrated study of *MEE*, the first place in the hierarchy is occupied by individual study (average 4.26), followed by training programmes (average 4.17), a position justified by the fact that teachers, before taking a preparatory grade class, underwent a training programme within the project "Interdisciplinary Organisation of Learning Offers for Forming Key Competences to Pupils" (M.E.N., 2013b).

Respondents assert they obtained information about the integration of *MEE* through formal activities, such as meetings with teachers, an annual activity hold in Romania in September (average 3.88) and in the pedagogical groups to which they belonged (average 3.74), activity organised each semester.

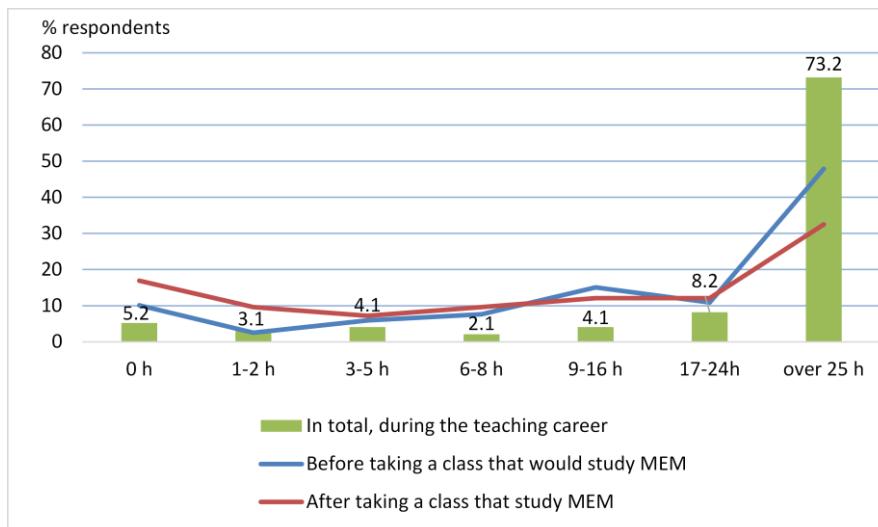
They also claim to have obtained information in informal contexts such as discussion in the teachers' room (3.32) or through other activities (3.28). The fact that the least knowledge about the integrated approach of MEE was acquired through formal studies (1.94-3.04) is explained by introducing the integrated approach in primary education starting with 2012 (M.E.N., 2013a) and only after this year the high school, Bachelor and Master courses approached the theme of MEE integration, while over 85% of respondents had more than 10 years teaching experience.

From the analysis of the disciplines studied in formal contexts, at which respondents achieved knowledge about the integration of MEE (Fig. 1), *Mathematics and Methodology of Mathematics* (average 3.56) are ranked first, followed by *Sciences and Didactics of Sciences*, *Pedagogy*, and other disciplines. Although in *Geography and Environmental Science* the study of reality is carried out according to the integration principle (Dulamă, 2011, 2012), the respondents consider they achieved less knowledge about the integrated study of MEE, probably because, during primary education, the mathematical tool was less used in environmental investigation.



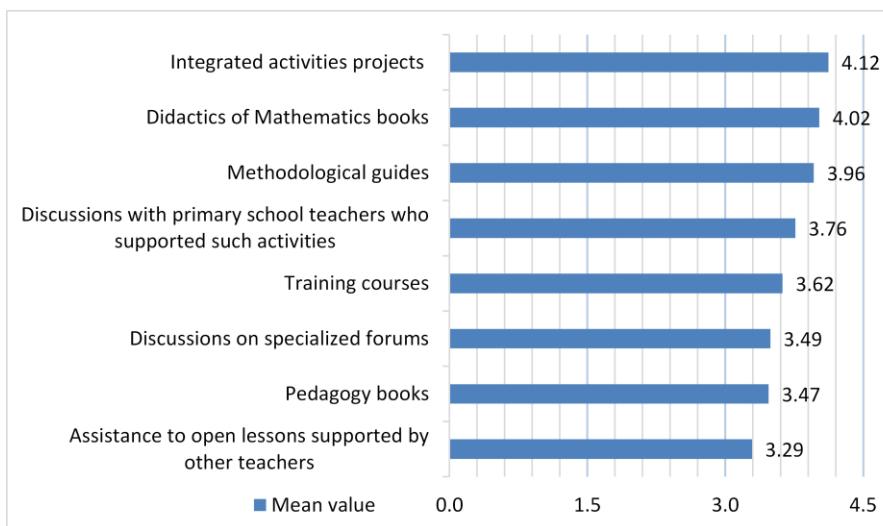
**Figure 01.** The disciplines at which the respondents achieved knowledge about the integration of MEE

95% of the respondents (Fig. 2) declare they participated in training programmes in which they acquired knowledge about the integration of MEE. However, over 8% of the respondents received up to 2 hours of training. Most of these programmes were organised through Teacher Training Centres (56.5%), their main mission being the training of Romanian teachers and such centres benefit from budgetary allocation from the Ministry of National Education. 55.7% of the respondents benefited from programmes offered through SOP HRD (Sector Operational Programme on Human Resources Development) projects with European funding. 45.8% of the respondents participated at courses organised by specialised inspectors and 42.7% of them at courses organised in pedagogical groups. Regarding the moment they participated at the courses / activities, respondents say that it was either before taking a class that would study MEE or after taking up such a class, so it is explicable that teachers were strongly motivated to get information through individual study and from various informal or non-formal sources.



**Figure 02.** The moment and number of hours on the integration of *MEE* the respondents benefited from

Regarding the materials or activities that teachers need to have a higher competence level in the integrated approach of *MEE*, on first places are situated printed sources with information on appropriate topics (integrated projects, *MEE* books, methodological guides) (Fig. 3). This opinion correlates with respondents' preference for individual study. It is surprising that the discussions with other teachers and on specialised forums outrival the interest in assisting to lessons, which is placed on the last position. This is probably due to the fact that, through discussions, teachers find out more quickly the appropriate answers to their questions or solve misunderstandings. The need for discussion with other teachers (average 3.76) is higher than the need to attend training courses (average 3.62). The fact that all average scores are over 3 shows there is at least an average need for teachers to be better prepared for the integrated approach of *MEE*.

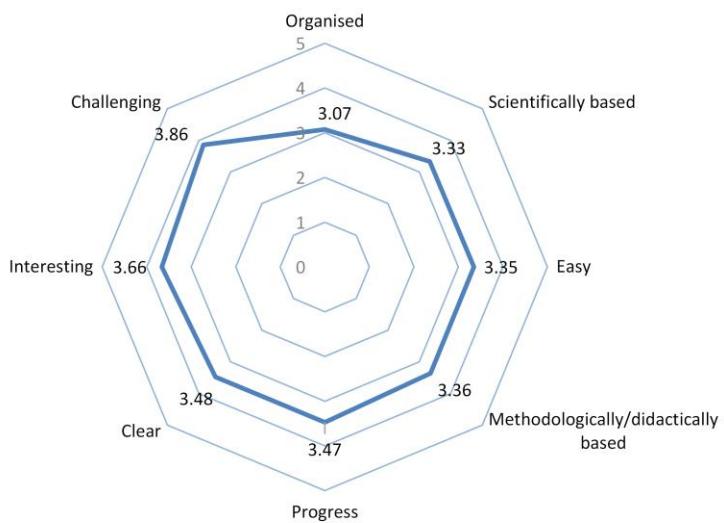


**Figure 03.** Activities and sources needed to increase the competence level in the integrated approach of *MEE*

Regarding the frequency of integrated activities prior to their introduction into the new *Framework Plan*, 33% of the interviewed teachers say they regularly did such activities in primary education and 27.7% during an optional course in primary education. Most teachers assert they realised integrated activities only

during some extra-curricular activities (57.7%) or occasionally (56.2%), and 13% of them realised integrated activities in kindergarten.

Concerning the transition from the separate study of the two disciplines to the integrated approach of *MEE* (Fig. 4), the respondents gave points so that each component obtained the average over 3. The fact that the lowest scores were assigned to the scientifically based and to organise the implementation is explained by the fact that the support offered by the training programmes (SOP HRD 87 / 1.3 / S /) and the scientific papers did not provide all the necessary information for a correct and complete understanding of the theories on which the integrated approach of *MEE* is based and of a way in which it has to be done during primary education.



**Figure 04.** Characteristics of the transition from the traditional approach to the integrated approach of *MEE*

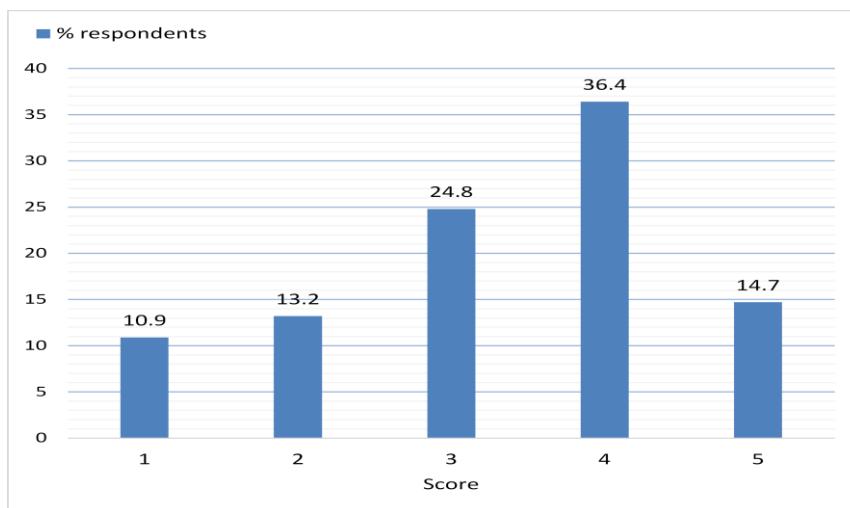
Regarding the teachers' difficulties in the integrated approach of *MEE* (Table 1), the first places according to difficulty are held by planning learning activities and elaborating plans for learning units. These opinions are correlated with the teachers' affirmation that they need such support materials and with the absence of bibliographic sources. Managing the time allotted to *Mathematics* and to *Environmental Exploration* are on the next places as difficulty degree (2.82-2.79), which can be explained by the fact that regarding the time resources there are no specifications in the curriculum (M.E.N., 2013a). In some school textbooks, generally, there is an alternation of three lessons with *Mathematics* topics and a lesson with *Environmental Exploration* topic, and some training courses recommended a similar allotting of time resources. This systematic alternation of activities - three lessons of *Mathematics* followed by an *Environmental Exploration* lesson - indicate a poor design and approach of *MEE* contents because they should be studied together and only in some lessons the objectives/ goals should predominantly focus on one of the disciplines (Dulamă & Magdaş, 2014; Dulamă, Ilovan, & Maroşi, 2015). The problem could be solved through formal methodological guides, such as those mentioned by the respondents.

Respondents have higher difficulties in assessing knowledge and skills specific of *MEE* to pupils than in forming/developing pupils' characteristic competences for *MEE*. This opinion is also justified by the absence of indications in official documents (M.E.N., 2013a). Despite all the above mentioned difficulties, the respondents considered that the last places according to difficulty are owned by realising integrated learning activities at *MEE* and by the elaboration of the supporting materials (e.g. worksheets, tests, etc.), which indicates a good didactic experience, and preoccupation for pupils' activity. Acquiring the specific notions of *MEE* by pupils was considered to have medium difficulty, with a value close or identical to that of the activities supported by the teachers in classrooms.

**Table 01.** Difficulty degree of certain activities related to the integrated approach of *MEE*

Activities	Mean value
Planning learning activities for <i>MEE</i>	2.87
Elaborating plans for learning units	2.85
Managing the time allotted to <i>Mathematics</i>	2.82
Managing the time allotted to <i>Environmental Exploration</i>	2.79
Assessing pupils' characteristic knowledge and competences for <i>Mathematics</i> and <i>Environmental Science</i>	2.56
Pupils' achievement of characteristic notions for <i>Environmental Science</i>	2.49
Pupils' achievement of characteristic notions for <i>Mathematics</i>	2.48
Forming/developing pupils' characteristic competences for <i>MEE</i> , according to the school curriculum	2.48
Realising integrated learning activities at <i>MEE</i>	2.48
Elaborating materials (worksheets, tests, etc.)	2.45

Regarding the decision to introduce the integrated study of *MEE* in primary education (Figure 5), almost 76% of the respondents find it good at least at an average level (giving it 3 points or more) and over 50% consider it good or very good (giving it 4 or 5 points). Only 24.1% consider the decision uninspired / inadequate or very uninspired. The average score (3.31) indicates that respondents consider the decision of introducing *MEE* subject as a relatively good one.



**Figure 05.** The respondents' opinions on the decision to introduce the integrated study of *MEE*

## 7. Conclusion

Primary school teachers adapted appropriately to the *Framework Plan for Primary Education* (M.E.C.T.S., 2012) through which a new curricular design was introduced, based on competences and having an integrated content approach.

They consider the integrated study of *MEE* as a good idea, challenging, interesting, but less scientifically based, and having a less organised implementation. In the initial training stages (pedagogical high school, university), the questioned teachers obtained the most information about the integrated study of *MEE* in courses of *Mathematics* and *Didactics of Mathematics*, and less in the other subjects, these curricular changes being newer. Although 95% of them declare they were involved in training programmes in which they acquired knowledge of *MEE* integration, their essential training was achieved through individual study and discussion with colleagues. Teachers had difficulties in planning learning activities and learning units, managing the time allotted to *Mathematics* and *Environmental Education*. However, they were able to develop support materials (workbooks, tests, etc.) and realise successfully integrated learning activities.

Based on these findings, in order to increase teacher competence level, improvement is required: allotting more materials and time resources to study the integrated approach of *MEE* within disciplines that target such content to pedagogical high school and university, organising *MEE* - based training programmes, completing the course support for the current training programmes and the content of the activities carried out with integration content topics, developing formal methodological guides which include a theoretical basis, projects of learning units and integrated lessons, and developing official materials for pupils.

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