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ANALYSIS THE COMPETENCES AND CONTENTS OF "MATHEMATICS AND ENVIRONMENTAL EXPLORATION" SUBJECT SYLLABUS FOR PREPARATORY GRADE

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Abstract: In this paper, we analyze some aspects related to "Mathematics and Environmental Exploration" subject syllabus for preparatory grade approved by Minister of National Education of Romania. The analysis aim the place of the subject syllabus into the Framework Plan; the syllabus structure and the argumentation of studying this subject; the syllabus general and specific competences; the relationship between competences and contents. Regarding the place into the Framework Plan this subject is part of curricular area "Mathematics and Natural Sciences". The name of the subject integrates two scientific fields Mathematics and Environmental Science for which is allocated 4 hours per week. The analysis of the syllabus, showed that it was developed according to "a new curricular design, focused on competences" (2013, p. 2), model-based on outcomes learning (Spady, 1994 as cited in Catană, 2010) and associated with student-centered approach (Catană, 2010). The analysis of general and specific syllabus competences show several aspects: to be specific to the two integrated disciplines, they require some reformulations; not all specific competences have been correctly derivate from the associated general competence. By analyzing the proposed contents, we observe that there is no information indicating whether themes are chapters' titles, topics for lessons, if they are wider or narrower than a lesson. The paper, along with observations, presents suggestions for improving the "Mathematics and Environmental Exploration" subject syllabus for preparatory grade.

Key words: curriculum, primary education, integrated education

1. Introduction

In the framework for PISA (2012) mathematical competence is defined as "an individual's capacity to formulate, employ and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts and tools to describe, explain, and predict phenomena. It assists individuals to recognize the role that mathematics plays in the world and to make the well-founded judgments and decisions needed by constructive, engaged and reflective citizens". Catană argues that mathematical competence is "the ability to develop and apply mathematical thinking in order to solve problems in (and in) everyday situations" (2010, p. 194). This involves the ability to use mathematical concepts, representations and mathematical models (formulas, construction, graphics, etc.), to formulate ideas, theories, opinions, involving logical and special thinking. According to EU recommendation (2006), through the National Education Law (2011), the mathematics' competence key domain is associated with science and technology competences, these involving the ability to use knowledge and specific procedures to find explanations about the environment (Catană, 2010, p. 194). Mathematical knowledge are of several types, of which: concepts and methods usually used in life (operations with numbers, methods to calculate surfaces and volumes, methods of estimation and measurement, etc.); mathematical representations (information expressed in a table or graphic form), etc. Mathematical skills allow application of procedural knowledge in concrete situations.

Regarding the phrase "environmental exploration", mention that one of the meanings attributed to the verb "to explore" is to analyze from all points of view, to research, to study, to investigate (NODEX,

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2002). Mih (2010), quoting Kotler et al. (2006) argue that "explore means to gather preliminary information on which to define a problem and to advance certain assumptions". This sense is maintained when the object for exploration is the environment of a part of its. In literature, it is stated that the "environment" is a combination of natural and artificial elements that surround a person or a human community, an animal, a plant or a species (Mac, 2003). In Romanian language, literally translated from Russian, was introduced the phrase "surrounding environment". In the literature, this is considered as a pleonasm.

In this paper, we analyze some aspects related to "Mathematics and Environmental Exploration" subject syllabus for preparatory grade approved by Minister of National Education of Romania, order no. 3418 / 03.19.2013. We mention that in this article we will use the MEE abbreviation for "Mathematics and Environmental Exploration" subject.

We initiated this research from the finding that, since 2012, primary education in Romania has been a paradigm shift in the design of curricula documents and in the educational process' organization.

Objectives were as follows:

1) Analysis the place of MEE into the Framework Plan;

2) Analysis the MEE syllabus structure and the argumentation of studying this subject;

3) Analysis the general and specific competences of the MEE syllabus;

4) Analysis the relationship between competences and contents of the MEE syllabus.

2. The place of "Mathematics and Environmental Exploration" subject into the Framework Plan

Through Minister of National Education of Romania order no. 3654/29.03.2012 it has approved the Framework Plan for the primary education, Preparatory Grade, First and Second Grades (www.edums.ro/Legislatieinv%20primar%20pl%20cadru.pdf). According to this framework plan, since 2012-2013 school year, in the Romanian education was introduced preparatory grade. There has been a significant shift by lowering the compulsory school age to 6 years. Thus, at present, in Romania, compulsory primary education has two paths: that of students who are enrolled in preparatory grade and that of the children whose compulsory education began with the entry into first grade. In 2012-2013 school year, preparatory grade activities were conducted under the new Syllabus Framework, while students from other primary grades as planned earlier through Syllabus Framework approved in 2003, 2004 and 2005.

A second important change in the educational Framework Plan is the one related to the subjects. We note that some subject as "Religion" has kept the previous name, while other disciplines have new names as "Communication in Romanian Language" instead of "Romanian language and literature", or "Personal development". Some subjects are studied by two together for example: "Mathematics and Environmental Exploration", "Music and movement", "Visual Arts and practical abilities" and "Physical education and sport". We note the presence of new disciplines as "Society Education" and "ICT (computer game)".

Subject "Mathematics and Environmental Exploration" is part of curricular area "Mathematics and Natural Sciences". Through the Framework Plan for preparatory, first and second grades are allocated 4-5 hours per week, while the subjects syllabus sets 4 hours per week in preparatory and first grade and 5 hours per week in second grade. We found that in practice teachers for primary education allocate 3 hours per week for mathematics contents and one hour, those relating to environmental exploration. Into the previous Framework Plan, subject "Mathematics" had allocated 3-4 hours per week in grades I and II and teacher had the possibility to choose the number of hours, while for the subject "Environmental knowledge" an hour per week. Thus, through this new Syllabus Plan, the teacher has not the opportunity to choose the number of hours.

Through the new Syllabus Framework, the study of MEE starts in preparatory grade and continues up to the second grade. We ask if, in grades III and IV, the subject "Mathematics and Environmental Exploration" will maintain that status or will be divided in two disciplines.

3. General observations on "Mathematics and Environmental Exploration" subject syllabus

The presentation note of the MEE syllabus emphasizes motivation of studying this subject, structure and paradigm shift in syllabus design and teaching process in primary school. It also specifies that the syllabus is developed according to "a new model of syllabus design, focused on skills" (2013, p. 2). This model can be associated with outcomes-based learning proposed by Spady in 1994 (cited Catană, 2010). The same author says that this model involves a student-centered approach.

The structure of the MEE syllabus include the following: Presentation Note; General Competences; Specific Competences and Examples of Learning Activities; Contents; Methodological Suggestions. In this structure, compared with the previous syllabus, we note two significant changes: replacing Framework Objectives with General Competences and Benchmarks with Specific Competencies. In Romanian Education System gradually from 1998 in middle school, high school and higher education has been a paradigm shift in the aims of education by passing from an instruction based on objectives to one based on competences development. That is why these new changes come in a natural way to ensure continuity in competences' training starting from primary school students to university students.

In Presentation Note are listed the main reasons that led integrated approach to mathematics and natural science elements in the same subject syllabus. It says, "a holistic learning is more likely to be interesting for students at this age and is closer to their universe of knowledge" (MEN, 2013, p. 2). B. Nicolescu (1999) states that, a holistic approach is focused on the whole and from this perspective, we can understand that should be studied: ocean without fish or without constitutive water droplets; forest without trees and shrubs that form it (as cited Dulamă, 2011a, p. 10). From epistemological point of view, the study of these two disciplines can be justified rather through a transdisciplinary approach. B. Nicolescu (1999) consider transdisciplinarity - as indicated by the prefix "trans", being which is simultaneously between disciplines, inside the different disciplines and beyond disciplines. Transdisciplinary approach aims at the understanding of the current reality in a uniform manner. Both epistemological and curricular, transdisciplinary approach involves merging disciplines in perspective of representation and solving complex problems of contemporaneity. In the opinion of this author, transdisciplinary approach means that we should treat at the same time the whole and parts, unity through diversity and diversity through unity, without neglecting mutual relations.

The second supporting argument for an integrative study of two disciplines in MEE is the most powerful being in accordance with learning theories: "contextualization learning in surrounding reality increases depth of concepts understanding and procedures used" (MEN, 2013, p. 2). Third argument: "allows a more efficient time using and increases interactions flexibility" (ibidem, p. 2), which supports the harmonization of two areas (Mathematics and Science) is not a convincing one.

The study of MEE can be sustained by the theories of Jean Piaget. He states that development of intelligence is the individual ability to adapt to new life environments, that are constantly changing (Piaget, 1952 as cited Mih, 2010, p. 56). According to Piaget, individual cognitive development is dependent on certain universal processes and specific individual experiences. Kids build and rebuild their understanding of reality through a continuous process of active reflection on actions, events and people that come in contact. This process is structured around four concepts: mental schema, assimilation, accommodation and equilibrium (ibid, p. 56). Piaget defines mental schema as physical and mental actions that child use to understand and know the reality. The schemes are ways of organizing and primary processing of information available to child at a specific time.

Because the schemes are based on action, they are not concepts but mental operations applied to a specific area of activity (ibid, p. 56). That schemes are operators structures or groups of operations

(ibid, p. 57). According to Piaget, the child assimilates the external environment acting upon it, and the actions they perform are schematic. The use of schemes available for integrating new information into their own cognitive experience is called assimilation, and the adjustment of their mental schemes depending on the characteristic of new objects / events that child comes in contact is called habituation (ibid, p. 59). Piaget's theory provides us with arguments to support the study of mathematics in the context of enviromnent exploration by the child considering the fact that he uses mathematical apparatus in order to know reality (environment) and to adapt to it. However, for optimal use of this mathematical apparatus is required for a person to acquire mathematical concepts in a systematic, rigorous way, to overcome the concrete-operational stage (from 7 to 11/12 years) and reach the stage of formal operational (from 11/12 to 15/16 years) (Piaget, 1952 as cited Mih, 2010). Misunderstanding child psychology, including its cognitive development, by the authors of curricula, textbooks and additional syllabus, cause a forced approach, not integrated of that two domains. Therefore, we consider mathematics learning in primary school should start from the real life/ environment contexts, within which there are identified mathematical concepts (interdisciplinary approach), but they should be studied then intradisciplinar to ensure its acquisition (Figure 1).

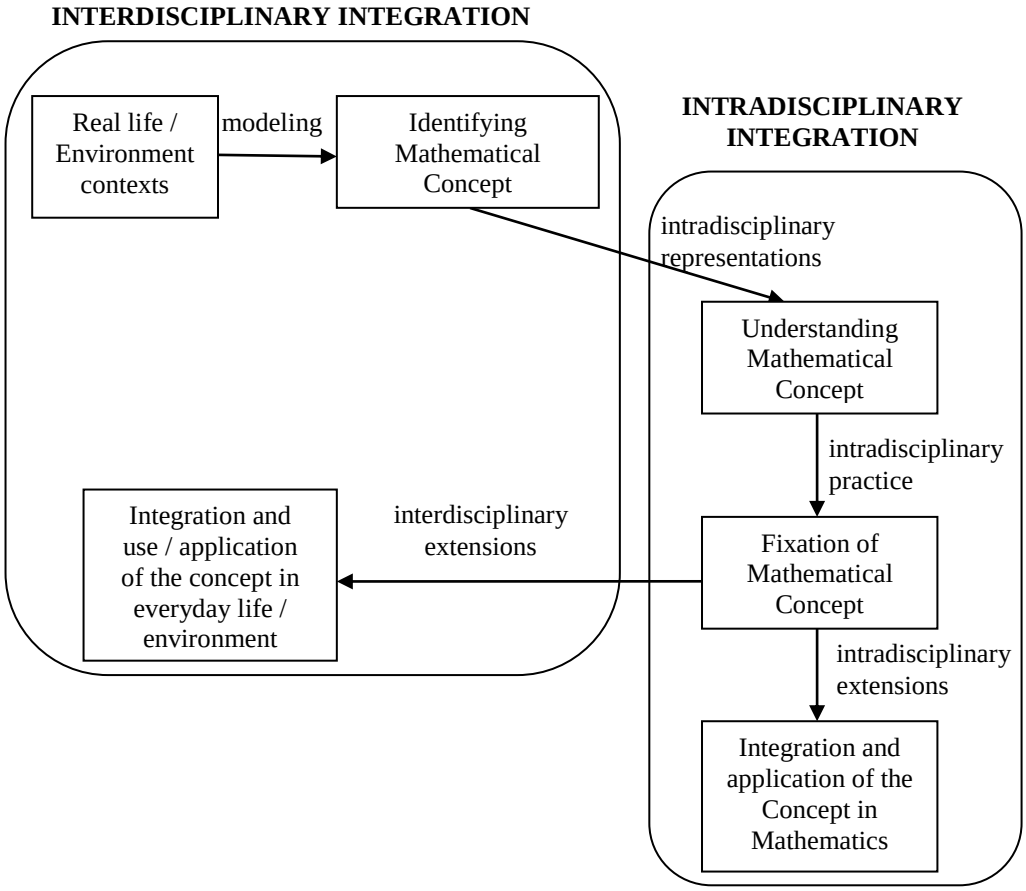

Figure 1. *Integrative approach in formation of mathematical concepts*

Based on these observations, we identified two problems that may arise in instruction and MEE syllabus do not clarify them. They appear because the MEE syllabus is designed for a permanent integration at any topic of those two scientific fields. The first problem is that children may lose attention in details related to formats, losing sight of the scientific content. The second problem is related to those learning tasks who integrate more contents and/or skills that are new from both mathematics and environmental science. Educational psychology pleads do not learning a new skill until all its subordinated skills are not learned (Noveanu et. Al., 1983, p.102).

Introducing some general landmarks about the way of integration of that two fields into the MEE syllabus is absolutely necessary. Into the MEE syllabus it is only one example of integrated activity for preparatory grade. This example don't clarify several aspects: the allotted time for activity, the

type of activity (transmission and assimilation of new knowledge, fixing activity, mixt activity etc.), the assessment aspects etc. (MEN, 2013, p. 28). In carrying out teaching activities of preparatory grade, an alternative that would reduce the drawbacks mentioned above could be by treating separately the subjects, and through an allocation of hours per week / month / semester being performed integrated activities. Thus, teacher should be able to achieve both interdisciplinary activities (with a greater emphasis on the science) and integrated activities (with a greater interdisciplinary and applicative emphasis of concepts).

4. Observations on General and Specific Competences

According to the preparatory grade MEE syllabus, "competences are structured sets of knowledge, skills and attitudes developed through learning, that allow solving specific problems or problems of a general field in various particular contexts" (2013, p. 2). In this definition can be found some attributes of competence included in the National Education Law (2011, p. 2): "A multifunctional and transferable overall of knowledge, skills / abilities." Different definition of this concept in official documents can confused primary teachers in their designing and organizing teaching activities for developing students competences because they do not understand what is actually a competence.

In the syllabus it is also noted that general competences "peg out knowledge and behavior purchases for student in the entire primary cycle", but the definition of general competences is missing. Another document is Teachers' Training Support Course for preparatory grade (POSDRU 87 / 1.3 / S / 63113) entitled "Interdisciplinary organization of learning offer, in order to form key competences at primary school students". Here it is an equivalent statement with framework objectives: "general competences are defined on the subject and they are formed during schooling; they have a high degree of generality and complexity" (2013, 19), but also the definition is missing. We notice that MEE actually combine two different subjects and syllabus competences are formulated for a 3 years period. Probably they will not be kept for the entire primary cycle, because for developing specific competences in mathematics and sciences, since third grade, the disciplines should be treated separately.

This syllabus also not included the definition of specific competences. It only mentions that "are derived from general competences, represent stages in their acquisition and are formed during the school year" (2013, p. 2). A similar entry exists in support of the aforementioned course. We believe that the statement "they are steps in acquiring them", is wrong. Dulamă (2011b p. 33) points out that these types of competences forming two competences classes located on different hierarchical levels. So specific competences are located on a lower hierarchical level, being subordinated to the general competences.

After the content criterion, Dulamă (2011b, p. 33) states that both general competences, as well as specific competences existing in the curricula are actually specific at the same discipline or subject, so they are disciplinary competences. That is why competences should be formulated to be available both scientific fields, which is difficult to achieve in practice, because each subject has their own disciplinary competences.

Analyzing the formulation of MEE syllabus' general competences, one (General competence 2) includes specific geographical terms and phrases (objects located in the surrounding area) (16.66%), one is related to both disciplines (General competence 3) (16.66%), four competences only concerns mathematics (General competence 1, 4, 5, 6) (66.66%), although specific competences and learning activities aimed exemplified both. Some formulations seem rather objectives than competences because are focused on specific contents and are very precisely like General competences 1 and 5. We believe that the general competences formulation can be improved to ensure the integration of the two sciences.

Considering the criterion of generality, Dulamă (2011b p. 33) suggests that these two categories could be called *general competences* - those that are more comprehensive, applicable to a larger number of cases in a given category, which covers to a broadly - and in opposition to this, *particular or individual competences* - those which have a narrow delineated. Dulamă (2011b p. 33) noted that it

would be easier and more accurate evaluate individual or particular competences while general competences assessment is questionable, in fact, the level of general competences that a person has.

In the literature, we found another approach of competences typology. Voiculescu F. (2010) distinguishes between general and specific competences using as a criterion for classification the register of activities, which is wider or narrower. The *general competences* are those, which determine the successful implementation of a broad range of activities in fields and / or different nature. *Specific competences* are those, which determine the successful implementation of a small registry of activities in a delimited specialized field. We appreciate the classification criterion used, but because for general competences, activities are in different domains, referred to the *a-disciplinary competences* (*nondisciplinary, transversal, transferable, transdisciplinary*) which are developed in a particular situation, but can be transferred in another situation (after R. Nelson Bolles, 1996; cited Dulamă, 2011b, p. 36). Transversal competences are that can be transferred from one subject area to another, from one discipline to another and / or from one context to another, different that in which they were formed (Dulamă, 2011b, p. 36). In conclusion, in MEE syllabus could be formulated three categories of skills: transversal competences, general competences and particular competencies, the last two being specific to the subject.

Regarding the formulation of first competence *Us*ing *numbers in elementary computations* to be clear about what elementary calculations it is about, we suggest completing it thus: "Using natural numbers in computations that involve mathematical operations: addition, subtraction, multiplication and division". Although accurate formulation of general jurisdiction load operations, completion is required, because the math there are also other types of numbers and other types of operations as : power, square root etc. For the second competence *Highlight*ing *geometric characteristics of objects located in the surrounding area* we suggest to exclude the word "geometry" because the orientation and movement in space - to which in the formulation of specific competences derived from this competence reference is made – are not geometrical features. Neither "movement" nor "orientation" that appears in formulation of specific competence 2.1. *Orientation and movement in space relative to benchmarks / directions* are geometrical features. The movement is changing the position of a body relative to a benchmark / other body (Compendium of physics, 1988). To guide means to arrange in a specific position to a specific milestone (a cardinal, a direction, an object) (NODEX, 2002). Regarding the forth competence formulation *Generat*ing *simple explanations by using logical elements*, we suggest to give up at "by using logic elements" because any explanation should be a logical one. In the fifth competency formulation *Solv*ing *problems from sorting and representation data* we suggest to give up the indication "from sorting and representation data", which limitate the categories of problems that might be proposed to be solved. This detail could be included in the formulation of specific skills. In the sixth competency formulation: *Us*ing *conventional standards for measurement and estimation*, to avoid a pleonasm should abandon the word "conventional" in the phrase "conventional standards." The *standard* is a "size, weight etc. officially accepted in science, technics or economic relations and serves as the base unit in a measurement system"; "a perfect model of a measure-type, made with great precision and officially accepted to serve as a basis for comparison" (DEX, 2008). We suggest using the concept of environment in competences formulation but renouncing at expressions like: surrounding environment, close environment, familiar environment.

Therefore, general competences of MEE syllabus could be formulated as it is shown in table 1:

Table 1. *MEE syllabus general competences and their reformulation*

General competences of MEE syllabus	General competences reformulated
1. Using numbers in elementary computations	1. Using natural numbers in computations that involve mathematical operations: addition, subtraction, multiplication and division
2. Highlighting geometric characteristics of objects located in the surrounding area	2. Highlighting characteristics of environmental objects
3. Identifying phenomena / relationships / regularities / structures from the close environment	3. Identifying phenomena / relationships / regularities / structures from the close environment
4. Generating simple explanations by using logical elements	4. Generating simple explanations

5. Solving problems from sorting and representation data	5. Solving problems
6. Using conventional standards for measurement and estimation	6. Using standard and non-standard units for measurement and estimation in the environment

Without making an exhaustive analysis, we highlight some aspects related to the formulation of specific comptences, the congruence and their derivation from general competences. Analyzing the terms used in specific competences, we note few mistakes. The term "concentru" (roughly translated as "cocenter") although frequently used in romanian primary education, doesn't exist in explanatory dictionaries of Romanian language, is not used in Mathematics and we didn't identified a similar term in other language. It should be replaced with "natural numbers from ... to …", "natural numbers to …", "a natural numbers less than or equal to ..." or "natural numbers in the range ...". We note here that in romanian mathematics the natural numbers start from 0 while in some other countries first natural numer is 1. In Table 2 we translated specific competences by replacing term "concentru" with one of the above expressions. For specific competence CS 2.1 we propose to give up the word "phrases" because the words listed are not phrases. We suggest rewording CS 2.2. as "Identification of geometrical shapes (square, triangle, rectangle, circle), of geometrical solids (cube, cuboid, sphere) and some characteristics of them in environmental objects". Here we can renounce at the word "plane" because the "geometrical shapes" expressing they are in plane. We appreciate as incorrect formulation of 3 and 3.1 comptences because the used verbs do not don't express correct derivation and relation of subordination. Verb "to identify" (used in the formulation of general competence 3) means to establish; to establish the identity of a person or thing; to recognize; to consider several notions, objects, beings etc. different as identical (DEX, 2008). Verb "to describe" (used in the formulation of specific competence 3.1) means to present, to portray, to depict (in words) someone or something (DEX, 2008). In NODEX (2002) stated that "describe" (aspects of reality) is to represent in writing or orally, listing details. We suggest replacing the verb "to identify" of the thrird general competence with verb "to describe" because to describe something, supposed first to identify that something and decide who are its attributes (essential and non-essentials). We propose to replace SC 3.2. "Showing care for correct behavior in relation to the familiar environment", which is not derived correctly from general competence 3, with "Description of appropriate and inappropriate human behaviors to the environment". To include in the list of specific competencies one that is related to the behavior exhibited by the scholar, this can be derived from GC 4. This could be SC 4.3 "Explanation of positive and negative human behavior to the environment". This competence should include assessment of own behavior towards the environment and its argumentation. We see some inconsistency between the formulation of the fifth competence which refers to "Solving problems from sorting and representation data" and formulation of specific competencies 5.1. and 5.2., which refers to "objects" and "materials". To ensure congruency and a correct derivation, suggest supplementing general competence as: "sorting and representation of objects and data" or waiver of this formulation, as we suggested earlier. We notice a mismatch of specific competence 6.1 with the sixth general competence. The SC 6.1 specifies "using of unconventional measures" while general competence specifies "using of conventional measurement units (standards)". If it is desired to maintain this specific competence, then general competence should be modified as was suggested in Table 1. To be specific for both subjects, we suggest supplementing SC 6.1 in the end with "objects length". Also in the specific competence SC 6.2 should be specified "standard units" because all the units appearing there: week, day, seasons etc. are standard.

We analyzed specific competences to determine if they refer to Mathematics, Environmental Science or both fields of knowledge. This analysis considered also the examples of activities from syllabus. In Table 2, we present the results of this analysis. For this we used the following three notations: P if the subject is principal targeted through the specific competence, S if the subject is secondary targeted by specific competence and T (from tangential) if elements of subject are achieved through the specific competence only as a working tool, without students have any cognitive advantage in the field.

Table 2. *General and specific competences of MEE syllabus*

General competences	Specific competences	Subjects	
		Mathema-tics	Environmental Exploration
1. Using numbers in elementary computations	1.1. Recognizing and writing numbers from 0 to 31	P	T
	1.2. Comparing numbers from 0 to 31	P	T
	1.3. Ordering numbers in the range 0-31 using positioning on number line	P	
	1.4. Performing additions and subtractions in the range 0-31 through adding/subtracting with 1 to 5 elements from a given set	P	T
	1.5. Performing repeatedly additions and subtractions by counting and objectual representations in the range 0-31	P	T
	1.6. Using names and mathematical symbols (sum, total, difference, =, +, -) in solving and/or composing problems	P	T
2. Highlighting geometric characteristics of objects located in the surrounding area	2.1. Orientation and movement in space relative to specified landmarks/directions using phrases such as: in, on, over, under, beside, in front, behind, above, below, left, right, horizontal, vertical, oblique	S	P
	2.2 Identification of some geometrical shapes (square, triangle, rectangle, circle) and of some geometrical solids (cube, cuboid, sphere) in environment	P	P
3. Identifying phenomena/ relationships / regularities / structures from the close environment	3.1. Describing phenomena/ processes / repetitive structures from the close environment in order to identify some regularities.	P	P
	3.2. Showing care for correct behavior in relation to familiar environment	-	P
4. Generating simple explanations by using logical elements	4.1. Formulation of observations on close environment using common language, representations through drawings and the logical operators ”and”, ”not”.	P	P
	4.2. Identifying relationships ”if…then…” between two successive events.	P	P
5. Solving problems from sorting and representation data	5.1. Sorting /classification of objects/ materials etc. based on a given criterion	P	T
	5.2. Solving problems involve additions or subtractions with 1 to 5 units in the range 0-31 with objects support	P	T
6. Using conventional standards for measurement and estimation	6.1. Using nonstandard measures to determine and compare lengths	P	T
	6.2. Using some measures units to determine / estimate the duration of familiar events	P	S
	6.3. Realizing some equivalent exchanges by using unconventional representation in easy game-problems as incomes-expenses type with numbers from the range 0 – 31	P	S

In table 3 we have made a centralization of each number of specific competences targeted for each of the two subjects of MEE. Analyzing Tables 2 and 3, we notice that Mathematics is targeted principally in 88.2% of the total specific competences while Environmental Exploration is targeted, mainly at a rate of 35.2%. We also noticed that both disciplines are targeted simultaneously by four competences. Principal - secondary combination is realized by four competences, of which one is for Environmental Exploration. The combination of principal – tangential is realized for seven competences, each time

Mathematics has the main role. Both Mathematics and Environmental Exploration are not covered at all in the case of a single specific competence.

Table 3. *Number of each specific competence type targeted for Mathematics and Environmental Exploration, respectively*

Subject	Number of specific competences targeted			
	Principal	**Secondary**	**Tangential**	**Not at all**
Mathematics	15	1	0	1
Environmental Exploration	6	3	7	1

5. Observations on the relationship between competences and contents

Catană points out that "a discipline like mathematics requires a logical structure of its content elements". These "will form a coherent, a complete, a convex, a well articulate system, with specific limitations selected by the following criteria: scientific relevance, specific competences targeted, the material intrinsic value, formative potential of topics and possible approaches, the frequency of their use in everyday life, importance in the discipline and for further studies, grouping possibilities in relation to proposed specific competences and teaching - learning methods" (2010, p. 201). From this perspective, in the following we will analyze, the proposed learning contents of MEE syllabus for preparatory grade.

The Presentation Note states: "The learning contents consist of purchases inventory required for literacy student with basic elements of the two integrated areas" (2013, p. 2). They are grouped in the following domains: Numbers; Geometric figures and solids; Measurements; Data; Life sciences; Earth Sciences; Physics Science (2013, p. 2) (Table 4). In the second column of the Syllabus table it is specified the grade, but there is no information indicating whether themes can be considered chapters' titles, topics for lessons, if they are wider or narrower than a lesson. This imprecision and lack of rigor leaves to the textbooks/ curriculum auxiliaries' authors and to teachers the decision of: *what* contents, *in what* order, and *how* to deal with the math contents and environmental exploration integration, *how long* and *how deeply* to study with students. These aspects increase the difficulty of designing and organizing educational activities.

Syllabus contains large contents (collection and grouping data; human body; plants and animals, the universe; forces and motion; forms and energy transfer, etc., and subtitles that target large information assemblies (body hygiene; food hygiene; Earth; Sun and Moon). This thing determines their superficial approach, which will determine implicitly a surface understanding and a memorization, rather than deep learning.

Referring to "Numbers" domain, we make the following observations:

a) Nor examples of activities or learning contents specify introduction or not of tens at preparatory grade, only at first grade;

b) Reading, writing, comparing and ordering natural numbers are intrinsically connected and conditioned by understanding of decimal positional system. Teachers are thus placed in difficult situations. If they teach students to do scientifically correct (considering tenth as reference), they will have understanding difficulties, because children under 7 years old are in the pre-operational stage. If they teach students to do empirically (by counting) this will not bring any benefit for mathematical thinking because cannot foreshadow some structures of thinking that will later be needed for addition and subtraction.

c) At preparatory grade, addition and subtraction in the range 0-31 by exceeding order, made by counting and with intuitive support bring no mathematical thinking benefit, being only a way to discover the result, without even any confirmation, the result obtained is understood by students.

Concerning the "Geometric figures and solids" domain, we make the following observations:

a) In the environment exploration, children observe also non-geometrical figures and shapes and they are excluded from the list of contents. For integration of the two scientific fields, we consider that it

would be more correct the topic "shapes and solids". For clarification, could specify in the title "two-dimensional shapes" and "three-dimensional figures".

b) In the subtitle "Landmarks / directions in space ... ", emphasize that, at this age, children learn to orient themselves using objects as landmarks. The listed words are directions, no landmarks, that's why the word "landmarks" should be eliminate.

Referring to the "Measurements" domain, we make the following observations:

a) Because the sixth general competence refers also at the estimations, a more accurate title of this topic it would be "Estimations and measurements".

b) The subtitle "Length. Nonstandard units" need to specify which these nonstandard units are (eg step, hand, pencil, a piece of paper, a string).

c) Specific competence 6.2. "Using some measures units to determine / estimate the duration of familiar events "operating with concept of duration. However, in contents of sub-theme "Time" this concept doesn't appear explicitly, fact which should be corrected.

Regarding the "Data" domain, the syllabus should specified categories of data studied by students for each grade, because teachers should know the significance attributed to the data concept and data typology. Data are "each of the numbers, sizes, relationships etc. which serve to solve a problem or are obtained from a research and to be subjected to processing" (DEX, 1998). Statistics are "quantitative data largely affected by a lot of causes" (Iosifescu et al., 1985, p.18). Regarding the time, preparatory grade can work with months, seasons, months days and weekdays. Regarding the size, it can operate with dimensions of the environment objects (length, width, height) and with distance between them, with parameters of some environmental components (air temperature, amount of rainfall, snow cover etc.).

The fact that students learn to collect and group data is a positive one, but for learning this in scientifically way, syllabus should specify the methods and criterions of grouping them. *Statistical data processing* is "a set of operations including checking, systematization and processing of statistical data observations obtained" (Iosifescu et al., 1985, p. 61). *Statistical grouping* is " the operation of decomposing a statistical populations or populations, referred generis as groups, on the basis of characteristics (quantitative or qualitative) whose variation justify such groups" (Iosifescu et al., 1985, p. 61). These are: a *simple statistical grouping* after a single feature; *a combined statistical grouping* after several features; *a statistic typological grouping* after features that highlight types of phenomena (classifications and nomenclatures); *a analytic statistical grouping* which highlight the mutual relationship between two or more features, some of which act as factor, others are features result (Iosifescu et al., 1985, p. 62). These authors point out that there is a close connection between groups, tables and statistical series.

Referring to the "Life Sciences" topic, the contents titles gives to authors of textbooks/curriculum auxiliaries and to teachers a great freedom in choosing the volume and the depth level of information. To be more clear for teachers what children should learn at "Body Hygiene", the title should be completed with "and its components parts" because each of them requires specific hygiene. The topic relating to food and food hygiene is also too broad.

Regarding about "Plants and animals" it would be necessary to specify which categories (lower plants, flowers, plants of temperate zone, herbaceous plants, shrubs, trees) and what species of plants and animals should be studied by students. In terms of living conditions, emphasize that each species is adapted to specific environmental conditions, so it would be very difficult for scholars to understand the relationships between living organisms and their environment, which is the subject of Ecology science. We suggest tightening of these issues, especially because examples of learning activities are not optimally related to subjects and competences.

The MEE syllabus stated that it was structured to promote "didactic approach centered on incipient competences development of young student in order to build the basis for further in-depth learning," (2013, p.3), but to achieve this goal, the syllabus authors should take into account that in understanding and learning are very important previous knowledge of children. Mih (2010), referring

to the cognitive paradigm, says "acquisition of new information is largely influenced by the prior knowledge set and by the relationships between information reception and structures and existing semantic networks in the subject knowledge base" (p. 38). The fact that some students would study in preparatory grade lower plants and other flowering plants, as some would study insects and some mammals could cause big problems of building understanding and knowledge in the following grades according to cognitive constructivist paradigm. Therefore, for authors of textbooks and teachers should be very clear what and how many concepts have to introduce in a topic; when and in what order they will introduce and how to achieve the conceptualization process.

Regarding to the "Earth Sciences", first question refers to the first item ("The intuitive elements regarding Earth"). What are the intuitive elements about Earth? In the syllabus, we do not find examples of learning activities that help us to understand what students should study: shape, size, physical properties, chemical properties, Earth movement. On the theme "Nature water presence in various forms (rainfall, rivers, lakes, sea etc.)", notice that rivers, lakes, seas are not forms of water, but hydrographic units. Neither precipitation (rain, snow) are forms of water, but meteorological phenomena. From the content "Universe. Earth, Sun and Moon: recognition in simple models" formulation we can only deduce that students should recognize the three celestial objects in various models and there is no need to acquire knowledge about them.

From competences training theories (Dulamă, 2010) and from the syllabus reading we deduce that a competence can be formed by using various contents in various learning activities, but should not ignore the fact that each specific competence integrates "a structured set of knowledge, skills and attitudes" (National Education Law, 2011). In conclusion, to support students in forming a certain specific competence, teacher should know what are its necessary knowledge, skills and attitudes. These acquisitions should be provided by the syllabus to ensure the knowledge base construction for each student and represent the foundation of forming and developing next competences.

Table 4. *Contents of MEE Syllabus for preparatory grade*

Domains	Contents
Numbers	**Natural numbers from 0 to 31:** recognition, formation, reading, writing (with digits), comparison, ordering: from 0 to 10; from 10 to 20; from 20 to 31 **Addition and subtraction** in the range 0 -10, through counting **Addition and subtraction** in the range 0 -31, without or with order crossing, through counting/ with intuitive support Simple addition and subtraction **problems** with 1 to 5 units in the range 0-31 with intuitive support
Geometric figures and solids	**Spatial orientation and location in space.** Landmarks /directions in space: in, on, over, under, beside, in front, behind, above, below, left, right, horizontal, vertical, oblique
	Plane figures/ 2D. Square, rectangle, triangle, circle: denomination; contouring
	Solids/3D. Cube, cuboid, sphere: denomination
Measures	**Length.** Nonstandard units
	Time. Day, week, month: denomination; ordering **Seasons.** : denomination; ordering
	Money. Leu (paper money of 1 leu, 5 lei, 10 lei) Equivalent value exchanges in the range 0 – 31
Data	**Collecting and grouping data**
Life sciences	**Human body.** Component parts and their role. The senses. Body hygiene Food as a source of energy: the food importance for growth and development; food hygiene
	Plants and animals. Component parts Food as a source of energy: the food importance for growth and development Living conditions (water, air, light, heat)
Earth sciences	Intuitive elements about **Earth**
	Nature water presence in various forms (rainfall, rivers, lakes, sea etc.)
	Nature phenomena: rain, snow, wind, lightning, thunder
	Universe. Earth, Sun and Moon: recognition in simple models
Physics sciences	**Forces and motion.** Observable effects of forces: push, pull Bodies movement and shape changing: deformation, fracture

	Forms and energy transfer Electricity: devices that use electricity and safety rules in handling electrical appliances Waves and vibrations: sound producing

4. Conclusions

Analyzing the place of the ”Mathematics and Environmental Exploration” subject in the Education Framework Plan for preparatory grade, note the following issues: is part of curricular area “Mathematics and Natural Sciences”; the name of the subject integrates two scientific fields - Mathematics and Environmental Science; it is allocated 4 hours per week. Official documents do not specify how the distribution between the two subjects is, or how to proceed with those 4 hours. In school practice, we observed that 3 hours have allocated at Mathematics and one hour at Environmental Exploration.

The analysis of the syllabus, showed that it was developed according to “a new curricular design, focused on competences” (2013, p. 2), model-based on outcomes learning (Spady, 1994 as cited in Catană, 2010) and associated with student-centered approach (Catană, 2010). As a novelty, compared with the previous syllabus, we note two significant changes: replacing Framework Objectives with General Competences and Benchmarks with Specific Competencies. These new changes ensure continuity in finalities formulation from primary school until university education.

Regarding the integrated study of the two disciplines, we consider that the syllabus argument “contextualization learning in surrounding reality increases depth of concepts understanding and procedures used” (MEN, 2013, p. 2) is in accordance with the constructivist theories of learning.

The analysis of general and specific syllabus competences show several aspects: to be specific to the two integrated disciplines, they require some reformulations; not all specific competences have been correctly derivate from the associated general competence. We propose to introduce in syllabus three categories of competences: transversal competences, general competences and particular competences, the last two being specific each discipline.

By analyzing the proposed contents, we observe that there is no information indicating whether themes can be considered chapters’ titles, topics for lessons, if they are wider or narrower than a lesson.

This imprecision and lack of rigor leaves to the textbooks/ curriculum auxiliaries' authors and to teachers the decision of: *what* contents, *in what* order, and *how* to deal with the math contents and environmental exploration integration, *how long* and *how deeply* to study with students. These aspects increase the difficulty of designing and organizing educational activities. Including of large contents in syllabus along with the formulation of subtitles that target large information assemblies determines their superficial approach, which will determine implicitly a surface understanding and a memorization, rather than deep learning.

We suggest a restriction of these issues, and a more rigorous and systematic details in order to be very clear for each topic: what and how many concepts, when and in what order to introduce and how the conceptualization process will be realized.

From competences training theories (Dulamă, 2010) and from the syllabus reading we deduce that a competence can be formed by using various contents in various learning activities, but should not ignore the fact that each specific competence integrates “a structured set of knowledge, skills and attitudes” (National Education Law, 2011).

Regarding the relation between competences and contents, for supporting students in forming a certain specific competence, teacher should know what are the necessary knowledge, skills and attitudes integrated. These information should be provided by the syllabus to ensure knowledge base construction for each student that represent the foundation of forming and developing next competences.

In the next study, we aim to analyze MEE syllabus learning activities and methodological suggestions, some textbooks and curricular auxiliary for assessing to what extent they provide the context to competences forming and development at preparatory grade.

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