Possible Directions In The Strategy Of Continuous Education Of Primary Teachers *

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Summary:
Modern concepts of education include the continuous development of primary teachers in all areas of natural, social and mathematical sciences. The obtained results were selected and differentiated facilities for further education of teachers within the model of professional development. Analysis of teachers’ knowledge was made on the basis of results obtained using surveys. The study involved 60 primary teachers from Serbia. A descriptive analytical method, as well as a method of modeling was used. Survey was the research technique used. Results show that teachers are not sufficiently connecting and jointly implementing the contents of natural sciences and mathematics, because they lack a sufficient level of knowledge. It is necessary for them to further educate in the field of integrating the content of natural sciences and mathematics, scientific method and its applications (particularly in mini-projects) as well as in the application of quantitative experiments. This would affect the quality of teaching, their professional competence, as well as it would affect their lifelong education.

Key words:
Strategy of continuous education, primary teachers.

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1. INTRODUCTION

Modern concepts of education emphasize the importance of early education for children in the natural sciences and mathematics. Children in early age should be taught the content of mathematics and science in an integrated form. In the Serbian educational system students learn science content in an integrated form of (classroom instruction) and in subject teaching of (chemistry, physics, biology). Teaching mathematics is taught from the first grade. Teaching science and mathematics carries a burden caused by the lack of adequately educated teachers. The phenomenon of negative selection is generally present in the selection of teachers of natural sciences it is reflected in the selection of teachers among the available personnel, as well as in selecting students for teacher education profile. In the integrated teaching of nature, as well as in teaching mathematics, the situation is more complex. Integrated teaching of natural sciences, as well as initial teaching of mathematics education, is particularly demanding in relation to the academic education in the field of natural sciences. It does not have to have exceptional depth, but it should be a very broad education. It should be organized so that it enables a comprehensive overview of the contemporary situation in the broad area of science, mathematics, engineering and technology. Education should be strongly supported by education in the field of history and philosophy of science and mathematics, to enable comprehensive view of nature in the unity of phenomena and processes that are taking place in it (see [24]).

Integrated teaching of science and mathematics classes are usually planned in the initial education. Future teachers of integrated teaching of nature need to gain the necessary education in a very broad and complex didactical-pedagogical-psychological field. The problem of teachers for teaching integrated science and mathematics in initial primary education is usually solved by teaching classes implemented by teachers. The academic education of future primary school teachers in the field of natural sciences and mathematics is not at the satisfactory professional level. It comes down to two semesters of practical teaching in science (only at the Faculty of Education in Sombor it is held in three semesters starting from the school year of 2010/2011), and mathematics teaching. Some contemporary concepts of integrated teaching (for example in Hungary), this problem are trying to overcome by including occasionally subject teachers, a long side with primary class teachers teaching integrated science and initial primary mathematics.
In France, under the "La main a la suffering" program a comprehensive support to the primary class teachers is organized in the implementation of integrated teaching of natural sciences, where, as a help to the teacher, students are involved in teaching process, mostly students of natural sciences (professor departments); and students of technical and engineering faculties. Also there is an electronic support "on distance" organized through certain electronic mail address at which the teacher can get the necessary instructions for the implementation of integrated science teaching. All these are just a necessary interim solutions, because the integrated teaching of nature and initial primary teaching of mathematics are particularly demanding in terms of selection of content, methods and forms of learning. One of the possible methods for providing adequate staff for the integrated teaching of natural sciences and teaching of basic mathematics education is the improvement of teachers of some natural sciences as mathematics teachers through post graduate studies. This concept is present in the UK. Postgraduate studies can be organized as specialized studies.

In many European countries, the primary school teachers improve their expertise through the courses that are accredited by the education authorities specifically for integrated teaching of natural sciences and basic teaching of mathematics. Post graduate studies and training through relevant seminars, make sense only in the educational systems in which there is a developed line of professional development of teachers with defined protocol licensing. Quality assurance of education in natural sciences and mathematics, which is prerequisite for the development of scientific and technological advanced society, inevitably involves the question of education, training and competence of teachers (see[17]), to implement the content of natural science and mathematics content (see [8]). Without professional training of teachers in various fields of natural sciences, mathematics and other fields of science and art it is impossible to implement effective reforms in education (see [3]; [5]; [6]; [21]).

Based on the opinions of some authors (see[12];[15]), we can distinguish three important dimensions of teacher competence:

- professional competence - means the level of general knowledge, ability to plan, ability to perform tasks, participation in projects, evaluation and assessment and vocational and professional training;

- pedagogical-didactical - means the mediation of scientific knowledge in the classroom) and

- work skills-competence.

Some dimensions of teacher competence, such as the area of professional and pedagogical competence, may be intertwined in a field related to competence education for life and his professional training. According to the European Commission to improve education and professional development of teachers, held in Lisbon in 2000 year, a quality teacher should have:
knowledge of the subjects taught, and other subjects also, an interdisciplinary professional knowledge and pedagogical and psychological knowledge (teaching skills, understanding of social and cultural context of education and schools). Key principles for teacher competences for lifelong learning (European framework, Lisbon 2000) in the final form are the following:

- Communication in the mother tongue;
- Communication in foreign languages;
- Natural mathematical competence;
- IT competence;
- Interpersonal, social and civic competences;
- Entrepreneurial competencies, taking the initiative expressing culture, history, art.

The goal of educating students of younger ages in natural sciences and mathematics is to develop their intellectual capacities, such as independent learning, problem solving, development of critical thinking. In order to achieve this it is important that, where possible, connecting the teaching of integrated natural sciences and mathematics teaching. This can best be achieved by applying the scientific method, which is used in problem solving, project and inquiry teaching. Important role in the realization of the scientific method in connecting the teaching of integrated natural sciences and mathematics have the quantitative experiments (see [10]). Through the scientific method students actively observe the world around them, think about what they observe, separating important from the unimportant and find similarities and differences in various phenomena. The results of observations and thoughts are expressed simply, clearly and precisely at the same time using some mathematical operations, tables, charts and schedules appropriate to their mental and physical abilities. It is necessary to respect the principle of consciousness and didactic activities of students in the learning process, which involves understanding the essence of the observed content, perception of the reasons and purpose of learning content, creation of a situation in which they will think, perform experiments, discuss, ask, and etc. The best didactical way to develop scientific methods to the junior school pupils is emphasizing that all the terms of the nature and mathematical concepts, perceive, understand and build on the pictures, objects and phenomena from the real world (see [7]). In the connection of teaching mathematics and natural sciences by using the scientific method, the teacher is expected to have:

- professional and didactical knowledge about scientific method, in order to successfully implement it in the student's discovery of nature,
- knowledge from various fields of natural sciences,
• knowledge of the various mathematical disciplines,
• knowledge of problem solving, project teaching, inquiry teaching.

Using the scientific method the primary school teacher should teach students to understand the physical (real) world is suitable for research, as well as our own actions can shape it, to recognize that with their actions, they could get answers to their questions about nature. The teacher should create an atmosphere in which by the application of scientific method, students are to meet with different objects, natural and technical phenomena, examine them, hold back, feel that they simultaneously resisting them and surrendering to them during various random attempts, or at experimenting (see [13]). That way they are developing logical thinking and the very object of research is both an obstacle and an opportunity for questions and reasoning, answers, and for finding out the truth. Through the scientific method the teachers should bring closer the world of science and technology to the students assist them in acquiring a basis of scientific literacy in natural sciences and mathematics, as it being an important economic resource and a factor of sustainable development of the society (see [2], [17]).

The application of scientific methods in connecting the teaching of integrated natural sciences and mathematics consists of the following stages:

1. Defining case studies (problems and topics for the project) - Students move from initial ideas, ideas that include the contents of the vague contours of the field of teaching, and they place in the forefront the research problem, some provocative secret that intrigues them, and introduces them to the complexity of the subject research matter. At this stage begins the motivation of students, the moment when they actually find what actually induces and directs them. By identifying students’ prior knowledge about the specific content of natural sciences and mathematics, adopted concepts, content and terminology are being revised. Problem (research task) the teacher should put in the form of a question, so that the sole process of learning (discovery) would be providing meaningful responses to questions. When choosing a research subject, the teacher should know exactly what goal he wants to achieve. The best themes are the ones that connect the content to be taught in a case with the current problems and needs of the environment in which the student lives. These topics are interesting to students, and the results or solutions can be applied in practice. Subject, scope and depth of study must be appropriate to the student age.

2. Finding the principle of the solution, stating the hypotheses-are focused on the role of a regular shift in the conversation - the role of speaker, listener and observer - in this respect, and the change of perspective - the perspective of "I", in which the student is when he
wants others to understand, the perspective of "you", which is when he wants to understand others and "we", which is when he wants to monitor the course of research.

3. Decomposing the tasks (problems) of the research - readiness for learning occurs after the students’ insight that the problem can not be solved by using the resources available (see [14]).

4. Formulating sub hypothesis - student himself defines his individual point of view, and the view of the problem or accepts the challenge of discovery.

5. Process of the problem-solving, and the task of the research (collecting data, sorting data, quantitative analysis, qualitative analysis) - This phase is based on the more basic tasks and didactical tools that structure the scientific method: building a personal relationship towards the research problem, course content (individual determination of the standpoint); showing and sharing the personal viewpoints with others, problem approach, solving methods, elaboration of everything ("I do it like this!"); examining how classmates think of ways to approach problems and to what ideas and solutions they come up with ("How are you doing it?"); sorting the introduced concepts and classification of everything that others did and thought, and what seems convincing to everyone (and abstraction and concepts) and comparing the obtained solutions, their concepts and methods with variants from other departments as well as with variants of experts, arranging, performing quality criteria. What ideas and what methods are best in practice? ("This, we solve together").

6. Drawing conclusions and answers to sub-hypothesis - a vital role in drawing conclusions has the task of recording the results obtained, and all changes in generating the scientific method. Based on these notes students, using their knowledge should make certain conclusions. While noting teachers must require students to respect the procedures of recording, because in that way they are gradually training and preparing them to conduct the daily record of exercises held in subject teaching, in different subjects such as chemistry, physics, biology and others. The role of the teacher is great in enabling students to a variety of ways on how to present their results. Teachers should help present their results using different methods, such as, for example: graphs, tables, schemes, drawings, and more.

7. Important conclusions and the answer to the main hypothesis - at this stage the teacher should allow students to tell others about their ways of learning. The objective of this phase is to discover ways that give results with students and with which they can successfully solve the problems (see [19]).
8. General conclusion - application of the conclusions to new situations in the implementation of this phase the student diary is of great importance. Students should as possible more authentically and honestly chronologically describe their way of solving the problems, confirming of the hypothesis, and the adoption of certain matter. In this critical look at themselves they tell all of what they have not previously discussed, which in this case motivates and encourages them to express themselves like that and not some other way, or to approach a problem in that way, and not in some other way (see [14]).

9. Evaluation of activities - in evaluating student achievement in the application of scientific method, the teacher should evaluate each stage of the scientific method. In the evaluation students should be included too.

Through the application of scientific methods teachers should help students understand how scientists study nature and how it is possible to use the acquired knowledge of mathematics to present the results and how to use knowledge of mathematics in the collection of results, drawing conclusions and presenting results (see [11]). Knowledge of students in science and mathematics does not consist in the possibility of resorting to certain rules, knowledge that can be simply reproduced is not primary, but the procedure in accordance with it is primary, the ability to participate in practice, and it is possible just by using the scientific method (see [7]). What the students implicitly know and what they do and think, is the subject of teaching, and not just what they should think and do in the opinion of the teacher and the content of textbooks, teachers are losing their monopoly of knowledge, because students have also something new to say.

2. RESEARCH PROBLEM

The primary school teacher is a key partner in enabling students to connect knowledge of natural sciences and mathematics in solving problems and in research activities. The quality of the professional qualifications of primary teachers and their didactical expertise depends the quality of knowledge that students will acquire (see [1]). The rapid development of science, new knowledge discoveries, which are used in engineering, technology and everyday life, require lifelong education of teachers in natural sciences, mathematics and didactical teaching of integrated science and didactics of teaching mathematics (see [23]). New competencies are required from primary teachers to successfully connect the teaching of integrated natural sciences with teaching of mathematics. The required competencies have become an integral part of global, European and national documents regulating education policy (see [22]).
Questions that we want to get a response to in this study are: How much are primary school teachers enabled in connecting the teaching of natural sciences and mathematics? Do they connect the mathematical content with the content of natural sciences in their work of implementing the curriculum content and to what extent they do it?

**The aim of this study** is to analyze primary teachers' knowledge about the possibilities and ways of connecting the content of integrated natural sciences and mathematics. Based on the analysis we want to choose and to differentiate activities for further professional development of teachers in the field of connecting the teaching of integrated natural sciences and mathematics. Based on the set goal we develop research tasks:

1. Analysis of connecting the teaching content of mathematics and natural science,
2. Analysis of implementation of an integrated approach to teaching natural sciences and mathematics in teacher classroom practice,
3. Analysis of teachers’ knowledge about the application of scientific methods in connecting the teaching content of mathematics and natural science in different types of teaching (project, problem solving and inquiry),
4. Selection and differentiation of content for the improvement of teachers in the field of application of the scientific method in connecting of the teaching content of mathematics and natural sciences.

**The general hypothesis of the research**: Primary school teachers have gained knowledge about modern didactical methods of connecting the contents of natural sciences and mathematics and they using them in teaching practice.

**Subhypothesis**: 
- Primary school teachers have sufficient knowledge about the application of scientific methods in connecting the content of natural sciences and mathematics;
- In line of teacher professional training principles, primary school teachers need to deepen the existing and acquire new knowledge about how to connect the content of natural sciences and mathematics in the problem solving, project and inquiry teaching models.

In this study we used the analytical descriptive method and the modeling method. Analytical and descriptive method was used to explain the current situation in the field of connecting content of mathematics and natural sciences on the basis of the answers gained from the survey, while the
modeling method was used for selecting and structuring content for connection and implementation of natural sciences and mathematics in the model of professional development of teachers. The research technique and the instrument was survey, designed for this research. The survey had a total of 24 questions. The survey contained questions of open and closed form (multiple choice and alternate choice). The study included 60 primary school teachers from Vojvodina. The average number of the years of employment of teachers surveyed was 18.2 years. The survey was conducted in the academic year of 2011/2012.

3. RESULTS OF THE RESEARCH AND DISCUSSION

Connecting the content of different subjects (horizontal correlation) is a requirement that has been long known to the teachers and is explicitly stated in the instructions for the implementation of the courses. However, despite this fact, not a small number of teachers surveyed (26.67%) reported that they in their work do not link the content of mathematics and natural sciences. It is extremely a worrying fact, because students are thus deprived of a systematic approach to the content, and the effectiveness of the teaching reduces also. The reason for this behavior of teachers should be sought in the fact that teachers during their initial education did not adopt a satisfactory level of knowledge about how to connect the content of natural sciences and mathematics. Specifically, based on analysis of past and current curriculum of teacher education at universities in Serbia, it is concluded that not enough attention is given in training students, future teachers on how to connect to the content of mathematics and natural sciences. This assertion is supported by the fact that only 53.33% of teachers are considered able to connect to the content of natural sciences and mathematics during the initial education, on the other hand 46.67% think it is not trained to connect these contents during the initial education. The reason for the under-representation of integration of natural sciences and mathematics in the teaching practice of teachers should be sought in the fact that in Serbia there is a small number of training seminars for teachers who deal with this issue, and that most teachers, because of the bad economic situation in the country do not have the opportunity to visit seminars, which further hinders training of teachers (see [9]). Another problem is the lack of clear didactical guidelines and requirements for the compulsory connecting of teaching content of mathematics and natural sciences within the defined standards of student achievement for the courses such as World Around Us, Primary Science Teaching, and Mathematics. It is encouraging that a large number of teachers (73.33%) periodically connect natural sciences and math. This reflects the awareness of most teachers of the importance of connecting these contents, but also to the need to help teachers professionally and methodically, through further
development, integration and implementation of the contents of natural sciences and mathematics.

Surveyed teachers that are connecting the teaching contents of natural sciences and mathematics state that the implementation of integrated teaching is best realized through: preparing the math tasks for the content of natural sciences that students will acquire, calculate the distance of the places on the map using the scale, calculating the time, calculate the speed of movement in certain period of time, using measurements in the natural science teaching (measurement of water temperature, plant growth, long shadows, the classrooms plan ...).

For successful implementation of integrated contents of science and mathematics teachers should use the scientific method. 45.00% of teachers do not know anything about the scientific method and its application in teaching. The scientific method is best applied in the preparation of student mini-projects. Only 48.33% of teachers surveyed said they know the characteristics of project teaching (Fig. 1). 61.67% of teachers do not recognize the students' mini projects as one of the best ways to connect the content of natural sciences and mathematics. A small number of teachers occasionally uses mini project, but 43.33% of teachers surveyed do not apply mini-projects. About half of the teachers (45.00%) in the survey said that in teaching mathematics they apply the scientific method of knowledge, in natural science 51.67% and that in the application of mini projects it is possible to connect the content of natural sciences and mathematics.

![Figure 1. Primary school teacher competency (application of quantitative experiments, knowledge of the scientific method and project teaching)](image)

However, none of the teachers surveyed do not apply the scientific method in the implementation of connecting the content of natural sciences and mathematics. About a quarter of teachers surveyed do not apply mini-projects.
projects (Fig.2). A few teachers as the reason for this stated that „they have no conditions to implement mini-projects“ or even that „students from first to fourth grade are immature for such a model of teaching“. This clearly indicates a lack of knowledge in the field of application of project teaching. These attitudes of teachers are the sign that teachers do not have sufficiently developed competencies in the use of modern learning and teaching strategies and in the implementation of integrated natural science teaching and mathematics.

![How primary school teachers organise mini project with pupils](image)

**Figure 2.** How primary school teachers organize mini project

The reason for this attitudes is in the fact that during their initial education and training they are not trained for the use of the scientific method in the application of pupils' mini projects, which indicates that for them the further education in the application of scientific methods in inquiry, problem solving and project teaching models is of great importance, as well as improvement of knowledge on student mini-projects. This is why none of the surveyed teachers did not state as the way of connecting the content of natural science and mathematics the example of a mini projects. These data indicates the great importance of further education of teachers in applying scientific methods in research, problem solving and project teaching, as well as improvement of knowledge on student mini-projects.

Based on the obtained results of the research it is concluded that none of the teachers surveyed do not fully apply the scientific method in connection and implementation of such a content. Among the surveyed teachers there are 43.33% of those who declare that they do apply mini projects in their work with students. They select the type of mini project in the consultation with students' interests, taking into account the abilities of students, time feasibility of the projects or they choose projects if the topics are more complex. This shows that teachers know how to choose a theme for the
projects, but have problems in further implementation of mini-projects, because their knowledge of the scientific method is insufficient. However, these results indicate that teachers do not apply mini projects in connecting the content of mathematics and natural sciences, because none of the teachers surveyed stated that they did not know any example of a mini project in which they would connect contents of natural sciences and mathematics. This incomplete knowledge is also evident from the fact that teachers do not recognize the individual working methods as one of the modes of application of mini-projects (11.67%), while working in pairs, they rarely use in this way of working with students (21.67%) (Fig.2).

Didactical transformation and the adaptation of mini projects to the mental and physical characteristics of students is unknown to the teachers. The impression is that the connecting of content is more technical than substantial. Analyzing the responses of teachers it seems that the connection of content is done more technically then essentially.

Quantitative experiments are very suitable for connecting the content of natural sciences and mathematics. However, only 41.67% of respondents stated that they realize the quantitative experiments with students (Fig.1), while in analyzing the responses of the teachers we come to the conclusion the teachers are insufficiently familiar with the term of the quantitative experiment that has an exceptional role in the implementation and realization of mini-projects. They did not know to define the quantitative experiments, and to state their specificity. Those teachers, who carry out the quantitative experiments, do that in the framework of programs that are truly suitable for them: the solubility of materials, mixtures, temperature measurement, motion (speed), and experiments with plants. Among the responses found, were also those who suggest that teachers do not realize what this experiments really are, because magnetism, heat conduction or formation of wind are not adequate examples of quantitative experiments for students in lower grades of primary school. None of the teachers surveyed did not give quantitative experiment as an example of connecting the content of natural sciences and mathematics. Also, none of the teachers surveyed did not mention such a task in which they intrinsically connected activities of natural sciences and mathematics.

To successfully connect content in mathematics and natural sciences, teachers must have good knowledge in natural sciences and mathematics. Surveyed teachers their knowledge from the field of natural sciences generally grade as, 'well'(55.00%) or 'excellent' (20.00%), which is a prerequisite for the application of mini-projects with students. That is understandable, because it is involving teachers who in their initial education classes had natural sciences (biological, chemical and physical contents).
Figure 3. Professional training of primary school teacher in integrated science and mathematics

Most of the teachers surveyed (78.33%) expressed a desire to educate in the field of connecting the content of natural sciences and mathematics (Fig. 3). This attitude of teachers is encouraging because it shows a clear intention of teachers to deepen their knowledge about how to connect the content of natural sciences and mathematics through the acquisition of additional knowledge involving the application of mini-projects, and the use of the scientific method. They are motivated, which is a precondition for their inclusion in the system of further vocational education.

4. MODEL OF PROFESSIONAL TRAINING OF PRIMARY SCHOOL TEACHERS IN INTEGRATED TEACHING NATURAL SCIENCE AND MATHEMATICS

Contents that need to deepen the existing knowledge and enable teachers to gain new knowledge on how to connect the content of integrated natural sciences are shown in the tables. They can be divided into general contents and the contents concerning the implementation of scientific methods in connecting the teaching of mathematics and integrated natural sciences. The proposed contents should be realized within the model of professional development of teachers. In order for the proposed facilities to be realized,
teachers, besides theoretical knowledge, need to have also experimental laboratory training. They should individually or in pairs perform different kinds of experiments, particularly quantitative.

**Table 1. Content for further education of teachers in connecting the content of mathematics and the content of integrated natural sciences**

<table>
<thead>
<tr>
<th>General content</th>
<th>The implementation of the scientific method</th>
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<tr>
<td>• Integrated access to the content of the water</td>
<td>• The differences in the acquirement of knowledge of students using the scientific methods and acquiring knowledge with the use of heuristic method;</td>
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<tr>
<td>• Integrated access to the content of the air</td>
<td>• Defining of the scientific method;</td>
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<tr>
<td>• Integrated access to the content of the soil</td>
<td>• Direct and indirect observation, as a source of knowledge;</td>
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<tr>
<td>• Integrated access to the content of movement of (objects and living beings);</td>
<td>• The role of experiment in scientific method;</td>
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<td>• Basic principles of integration of content of integrated natural sciences</td>
<td>• The benefits of applying the scientific method;</td>
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<tr>
<td>and mathematics</td>
<td>• Deficiencies in the application of scientific method.</td>
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<tr>
<td>• Quantitative experiments</td>
<td>• Stages in applying the scientific method (with special reference to the specific phases of the project and problem solving fields of teaching process);</td>
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<tr>
<td>• Application of different mathematical methods in the implementation of</td>
<td>• Application in the research teaching;</td>
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<td>quantitative experiments</td>
<td>• Application in the problem solving;</td>
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<tr>
<td>• Rules for recording results and conclusions in the integrated teaching of</td>
<td>• Application of scientific methods in projects that have different duration.</td>
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<tr>
<td>mathematics and natural sciences</td>
<td>• Use in project teaching;</td>
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<tr>
<td>• Creation and the importance of the book of records;</td>
<td>• Application of differentiation in the scientific method;</td>
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<tr>
<td>• Implementation of various techniques for displaying the results;</td>
<td>• Application of scientific methods in working with gifted students;</td>
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<tr>
<td>• Ways of keeping students in the discussion and enabling them to make</td>
<td>• Application of various types of experiments in the realization of the scientific method;</td>
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<td>independent conclusions based on the results;</td>
<td>• Evaluation of students achievement with the use of the scientific method.</td>
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<td>• The differences in the acquirement of knowledge of students using the</td>
<td>• Methods of training students for the presentation of the results obtained by scientific method;</td>
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<td>scientific methods and acquiring knowledge with the use of heuristic method;</td>
<td>• Methods of involving parents in the implementation of the scientific method.</td>
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<td>• Defining of the scientific method;</td>
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<td>• Direct and indirect observation, as a source of knowledge;</td>
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<td>scientific method;</td>
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<td>• Methods of training students for the presentation of the results obtained by</td>
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<td>scientific method;</td>
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<td>• Methods of involving parents in the implementation of the scientific method.</td>
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When implementing these contents next should be applied:

- Inductive principle – present to the teachers, specific issues, research topics, projects connecting the content of mathematics and
integrated natural sciences, which they should solve using the scientific method;

- Active principle - to encourage teachers to independently perform the experiments, to create students mini projects and to create research assignments on which they will apply the scientific method in the connecting of the content of mathematics and the content of integrated natural sciences.

- The relevant principle - teachers need to be able to select relevant content in mathematics and integrated natural sciences, that can be connected, and used in everyday life, especially when proposing students' mini projects;

- Collaborative principle – in the realization of connecting the content of mathematics and integrated natural sciences group work and cooperative studying should be encouraged;

- The interactive principle – teachers should lead discussions and debates;

- A Critical principle - the teachers should be critical of the scientific method and its application in connecting the content of mathematics and the content of integrated natural sciences;

- Motivating principle - to motivate teachers to self-education and lifelong education in natural sciences, mathematics, didactics of teaching integrated natural sciences, didactics of teaching mathematics in initial education and application of scientific methods in the connection of content of teaching mathematics and the content of integrated natural sciences.

Successful training of teachers in connecting the content of integrated natural sciences and mathematics require the making of an easily understandable set of standards of required professional and pedagogical knowledge. Expertise should be based on knowledge of the concepts and principles that are accepted and common to all natural sciences and concepts that are accepted for teaching mathematics. General scientific concepts and principles are generated from the concepts and relationships within particular scientific fields and disciplines and include the application of mathematics in scientific research. These are high demands for the education of teachers, who need to obtain a highly developed, well-designed and flexible system of scientific knowledge for the understanding of concepts, relationships and connections between the natural sciences. The system of scientific knowledge should lead the teacher to the level of being able to demonstrate in the courses that he will continue to implement. Pedagogical knowledge should be based on the ideas of constructivism and to base the construction of knowledge on the analysis and metaphor, abstraction and conceptual understanding of the content.
5. CONCLUSION

Sharing knowledge means that knowledge is transferred to the right place at the right time and right quality. Using knowledge of the phase in which the added value only when knowledge is used. Knowledge is often poorly used, because to find the right way to use available knowledge (see [16]). It is extremely important role and the director who must recognize the importance of lifelong learning of teachers. Head of primary school to monitor, encourage and facilitate all activities related to learning students that empowers, builds and organizes teachers to effectively distributed knowledge to students (see [20]). During the initial education teachers have not acquired adequate knowledge on the selection, connection methods and ways of realization of the common content of natural sciences and mathematics. Teachers have not acquired adequate knowledge on the application of scientific method, particularly in the area of student mini-projects, which are most suitable for networking and joint implementation of the content of natural sciences and mathematics. They do not have sufficient knowledge of the quantitative experiments in which students need to learn how to evaluate natural phenomena mathematically. It is therefore, within the model of professional development that teachers learn content that will enable them to deepen existing and acquire new knowledge on:

• An integrated approach to the various contents in the field of natural sciences and mathematics
• Selecting and structuring the curriculum content, planning student activities for the application of scientific method in the initial learning of content of natural sciences and mathematics.
• Application of the scientific method in the joint realization of the content of natural sciences and mathematics
• Implementation of student mini-projects in a joint realization of the contents of natural sciences and mathematics (defining objectives of mini projects, selecting topics, more concrete tasks within mini projects, the expected outcome of the planning, building teams for making mini projects, psychological and pedagogical material and technical support to students during the development of mini projects, evaluation of development and elaboration of mini projects);

Primary teachers should be able to apply various quantitative experiments through this model, to learn the students to estimate the size, read measuring instruments, prepare the research protocol, and to...
mathematically evaluate natural phenomena and present it by using scientific concepts and terms, respecting the rules of language expression.

In this way, primary teachers would be able to choose the best way to motivate students to study nature as independently as possible, to acquire functional skills that will be able to use in everyday life and in later education. This will cause also the higher student achievement in natural sciences and mathematics, which so far, as the findings of the Serbian students in Pisa test show were unsatisfactory. Primary teachers will also be equipped for lifelong self-education in the field of connecting and joint implementation of the content of natural sciences and mathematics.

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