HANDS-ON METHOD IN TEACHING OF NATURAL SCIENCES AT PRIMARY SCHOOL

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ABSTRACT

The author shows implementation of the French academy of science - project, La main a la pate at the science lesson – Air in the third grade of primary school. The paper shows the differences between traditional and contemporary paradigm. It points out methodical scenario as an important part of child centred pedagogy. The author also presents results of the research on extracurricular activities in primary schools in central Croatia and enhances the need for elective subjects in primary school.

Key words: implementation, La main a la pate, methodical scenario, learning by discovering, hands on, creativity

Introduction

Most Croatian schools during 20th century worked in traditional ways of educating. Students were sitting at their desk in three rows, looking at the back of each other’s heads. During the lesson pupils listen, write and sit still at their places. Traditional system in the Republic of Croatia is based on national plans and programmes.

Through traditional ways of education (teacher centred education) with teacher as a means of transferring knowledge it is not possible to develop and meet new competences necessary for democratic society and the demanding competition of the 21st century. Contemporary democratic school demands new forms of knowledge, skills, development of new student competences which enhance development of innovative thinking, creativity, problem solving, learning by doing, development of divergent and critical thinking, ICT literacy and entrepreneurship.

Implementation of the French Science Academy project - La main a la pate in to the educational process allows development of new skills, knowledge and competencies necessary in the 21st century.

Student centred education 1

Traditional paradigm requires strict lesson articulation during 45 minutes. Teacher transfers his/hers knowledge and has the main role in educational process. Educational process consists of: introduction, introducing the lesson goal, learning about new contents, practice and revision. Students are passive observers and are active only during practicing 5 – 10 minutes of the entire lesson. The curriculum allows teacher creativity, freedom to choose goals of educational process, contents, media, methods and strategies as well as the evaluation of the whole process. Evaluation is usually formative and related to action research.

Methodical scenario realised by the teacher through curriculum enables application of action research. Action research unites three processes: reflective teacher learning, research of
educational praxis and operation (action) in development of quality of educational process (Mušanović, 2008).

When **applying of methodical scenario** the teacher becomes creative in educational process because he makes a scenario through a series of phases and situations in which students are active, creative and develop divergent and critical thinking, solve problems and learn by experience – **the lesson is fully student oriented**.

### Differences between traditional and contemporary paradigm

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<th>Traditional paradigm:</th>
<th>Contemporary paradigm:</th>
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<td><strong>Scenario method</strong></td>
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<td>Pupil centred lessons</td>
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<td>● Aim announcement</td>
<td>● 1. phase – situation</td>
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<td>● New content.......... 20 min.</td>
<td>● 2. phase - situation</td>
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<td>● Generalisation........ 5 min.</td>
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<td>● Revision................ 5 min.</td>
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<td>● Practice................. 5 min.</td>
<td>Lesson duration – based on agreement</td>
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<td>● Evaluation............... 5 min.</td>
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<td>Lesson duration – 45 min.</td>
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**Implementation of the workshop by Cecile de Hosson (2005.):**

«Imagine how to build a small car that moves forward as far as possible using imposed materials « on a school lesson - Air

**Curricular goals:**

- Enabling students to acquire knowledge about air and its characteristics
- Students will learn that air surrounds us and that we breath it in
- Students will apply their knowledge on air and its characteristics to model a small car

**Besides realising these goals as a part of planed methodical scenario students will:**

- Learn to plan their work
- Engage in discussion on activities and report on their carrying out
- Get used to team work and cooperation in joint activities
- Train their mind and reflective thoughts about science content (comparison, analyzing, abstraction, synthesizing)
- Become able to learn by himself/herself, solve problems and learn by discovery
- Develop divergent and critical thinking
- Learn how to write for himself/herself (to memorise, act and understand)
- Learn how to write for the others (to transfer, ask explain and synthesise)¹

¹ La main à la pate
• Nurture the basic human values such as truth, love, peace, tolerance and nonviolent problem resolution

Activity duration; 3 school lessons (135-140 minutes)

Educational process

I phase

1st situation:
Teacher creates pleasant surroundings. Students sit in a circle. Every student can say a sentence or two about what he likes best in the nature. Students listen carefully to each other’s and only when one finishes talking the other can start. Teacher is seated in the circle together with the students and participates in the conversation (Matijević, 2000 in Bertić 2000.).

2nd situation:
Students are seated in the circle while teacher asks questions: What surrounds us? What can we see around us and what we cannot see? Teacher listens carefully to student’s answers but does not say which answer is correct or wrong. Students come to the conclusion that air surrounds us and that we cannot see it. Teacher asks a question and sets the problem: How can we catch air? Students try to catch air with the hand, but they are not able to do so. Teacher takes a plastic bag and catches air. Students see a blown up bag. Teacher asks another problem question: Do we breathe in air? She asks the students to close their nose with a hand. After 10 seconds they start breathing in air form the classroom. The teacher asks another question: Do we breathe out air? The teacher gives the students balloons for them to blow. Students have to breathe in air to be able to blow the balloon. They let the balloon go out of their hands and the balloon flies through the classroom. The students come to a conclusion that the balloon flew because the air went out and pushed the balloon through the classroom.

3rd situation:
Conversation and agreement on the further work of the students. Teacher arranges students in the classroom. Students start working in groups and if anyone wants to work individually teacher allows it.

Figure 1. Conversation in circle
Figure 2. Are we breathing out the air?
**II phase**

4th situation

Asking a problem question: How can we make a car that moves as long as possible?

5th situation

Students look at the material from which they will make a model of a car.

6th situation

Every student by himself/herself creates his own model in his/hers experimental notebook.

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Figure 3. 1st idea

Figure 4. 2nd idea

Figure 5. 3rd idea

Figure 6. 4th idea
III phase

7th situation
After agreeing on a model students create a model of a car.

8th situation
Students tryout models of the car and compete which car will drive the longest.
IV phase

9th situation

Students and teacher are talking while seated in the circle. Teacher explains the concepts of air, gas, pressure and lift. Students conclude which are the characteristics of air and how come a car could move by balloon. Students agree on writing of a mutual text about air.

Analysis of educational process:

The educational process developed through 4 phases and 9 situations, during 140 minute.

In the first phase students actively took part in conversation while seated in the circle. They started sentences with: I think.... In that way students develop critical thinking. Teacher creates the beginning of the educational process and prepares students for problem solving. The teacher introduces to children what they will do.

In the second phase the teacher asks a problem question. She explains how they will work. Students individually work and create models in their experimental notebooks. Students learn how to write for him/her (to memorise, act and understand). Teacher trains children to learn by themselves, solve problems and develop divergent thinking.

In the third phase after making an agreement within the group students make a model of a car. Teacher leads students until the moment of «aha - effect». Every student through individual
work or work in a team finds out how to solve problems in making a model of a car. By comparing models students come to a situation to conclude what they did wrong, make it better and make the car move for as long as possible.

In the fourth phase, while seated in the circle, teacher talks to the students about writing a joint text. **What** did they learn about air? **Which** are the characteristics of the air? **How** to apply their knowledge about air when making a model of a car? **Why** were they able to make a small car? While making a joint text students learn how to write for the others (to transfer, ask explain and synthesise).

Implementation of the La man a la pate project on the lesson air makes it possible to:

- Develop skills for problem solving
- Develop teacher and student creativity
- Learn by discovering

Learning by discovering is the most efficient when it is in a form of led discovery. The teacher sets problems for students but leads them in problem solving. The main goal of learning by discovering (Vizek, 2003) is to help student to ask question, search for answers and solutions.

When solving problems the key competences for the teacher and the students to master are communication competences. While problem solving, the most important situation is “aha – effect” when the student realises how to finish the construction of a model of a car. Student creativity is enabled by experimental notebook which enables the student freedom while constructing without fear. Student is free to create and draw and write down his idea without teacher instruction or a pattern. **Why** learning without fear? Student can after writing the joint text with other students, improve his/her work in the notebook. In this way student learn better and improve his comprehension. Students learn on a principal of attempt and mistake.

**Extracurricular activities in primary schools in the Republic of Croatia**

During the school year 2006/2007 the research was conducted on 65 schools of central Croatia which included 1411 (grade 1 – 4) primary school students (Šiljković, 2007). The results show that girls when compared to boys participate more in all extracurricular activities (except sports). Research also shows that primary school students are the least represented in science extracurricular activities. The reason for such results could be found in the lack of elective subjects for primary school students.
Ratio of proportion of boys and girls attending extracurricular activities according to the type of activity
In 65 primary schools in central Croatia

First grade

Second grade
Third grade

![Bar chart showing activities and gender distribution for third grade.](chart)

Fourth grade

![Bar chart showing activities and gender distribution for fourth grade.](chart)

Conclusion

Implementation of the *La man a la pate* project in the science lesson Air made cooperation and interactive learning possible. It is an active cognitive and met cognitive process aimed to develop creativity and divergent and critical thinking. It allows student to become autonomous thinkers and workers, allowing them to acquire new competences and skills necessary for lifelong learning in the 21st century.

The results of the presented research (Šiljković, 2007) of primary schools in Croatia, primary school students are the least represented in science extracurricular activities. Implementation of the New national curriculum would help to diminish that inadequacy. It would
reinstate introduction of elective subjects for the students to choose form depending on their interests.

References