INTERACTIVE LEARNING IN PROGRAMMED TEACHING OF THE SUBJECT "BASED OF NATURE SCIENCE" AT FACULTY OF EDUCATIONAL SCIENCE– R MACEDONIA

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Abstract: *The basic aim of interactive learning in programmed teaching is the transmission of activities from the teacher to the students, management of students' learning, enabling students to learn together and evaluate the learning processes.*

The paper emphasizes the need for teachers' active participation in the creation of programmed materials for the respective subject matter of "Elements of nature science", i.e. using pedagogical workshops in the organization of the teaching process with the application of interactive methods. Beside this theoretical approach to programmed teaching and interactive learning, we have also done a methodical shaping of the teaching unit ***"****Photosynthesis****"*** *according to the model of interactive learning in programmed teaching and use ICT tools.*

Key words: ICT tools, programmed teaching, interactive learning, educative workshop, based of nature science, photosynthesis.

1. Theoretical context of the problem

Teaching is an interactive process through which learning and teaching are accomplished.[1] This means that during the teaching process situations are created in which the student as an individual comes into direct contact and relationships, perceives classmates' and teacher's activities and responds to them. If we want to discuss about the quality of interaction in the classroom, we should always bear in mind that it implies some kind of exchange and it is multifaceted in terms of the participating entities, but also of the material that is taught (teacher-student, student-student, student-group of students, students-content, objects, and processes). Long ago Flanders (1963) promoted the teaching approach which he called "jug and cups" where the teacher is the jug containing all necessary knowledge to be poured into "glasses" (students), following a specific curriculum. Flander's interactive style means that the teacher speaks, i.e. teaches during two-thirds of the lesson. And everything would be all right if knowledge was enough to live a full and happy life. The time we live in requires training of a person who will be able to live in the present, provide and shape the future, and thus develop oneself and others in the spirit of humanism and democracy. So, today, teaching quality towards which science and practice aspire means interactive teaching which involves providing conditions for the transfer and development of knowledge, skills, abilities and attitudes towards the achievement of the previously indicated goal. In this context it must not be understood that teaching interaction should be reduced to routine application of interactive methodical procedures through which students will be shaped according to some pre-set templates or just to guidance without any preset goal.

[1] Although teaching is essentially an interactive process, hereinafter the expression - interactive teaching will be used to highlight teaching dominated by learning and teaching through collaboration.

Many countries, in their quest for the establishment of standards in education, attest to the importance of the aid to be given to children when they acquire not only knowledge but also skills, understanding and attitudes needed to apply knowledge in different situations. These efforts are usually directed at the request of a balance between several dominant styles of teaching interaction (teacher-student, student-student) in which the teacher is in the role of a "breeder", "sculptor" or "guide".

Interactive teaching is not only closely linked with only one role of a teacher or one approach to teaching, but it implies a balance between roles, styles and approaches, appropriate learning goals of students, their prior knowledge, abilities and skills, motivation and interests. In the most general sense, interactive teaching should provide the student's active role in the learning process through the establishment of mutual relations, which gives a social mark to teaching.[2] "Interactivity involves polyvalent guiding of the teaching process that is influenced by the perceived situations (reactions) of students - from rapid progression to apprehended impasse, from additional to supplemental activities, from deepening of the problem and original solutions to conducted problem solving (direct instruction)" [1].

Our long-standing teaching practice experience in working with students and mentoring students during their pedagogical practice has inspired us to find out whether and how can interactive teaching be successfully designed and implemented through programmed learning material, which is the essence of programmed instruction, recognizing the principles of cooperative learning and the principles of programmed instruction.

2. COOPERATIVE LEARNING WITH PROGRAMMED MATERIAL

Two theoretical perspectives give significant support to cooperative learning: the theory of motivation[3]and the cognitive theory[4].

From the motivational perspective setting and achieving group goals is a situation in which the achievement of personal goals is closely linked to the success of the group [8]. In fact, the theory of motivation treats rewards, penalties and purposes as essential tools for success. One of the basic principles of cooperative learning is positive interdependence which entails understanding and students' feeling that their success or failure is determined by their work within the group. Thus, in order to achieve personal goals, students are further motivated to help their classmates in completing the joint result.

According to Damon (1984) [2], in the frames of the cognitive theory, the interaction between students aimed at solving appropriate tasks develops their critical concept. When students discuss and express their personal perspectives and views on the given problems, there is a higher level of understanding of the material that is taught, and the struggle to resolve the potential conflict over cooperation results in a higher level of understanding [8]). Johnson, Johnson and Holubec (1989), [4] have shown that cooperative learning provides a greater contribution to the development of students' elaborative thinking. They more often give and accept explanations leading to a deeper understanding of higher levels of thinking and durability of knowledge

[2]In the broadest sense, social interaction is defined as a relationship of two or more persons whose perceptions and behaviors are bidirectionally or multidirectionally conditioned. (Klaic S. 1989: 282).
[3]The theory of motivation emphasizes the student's incentive for learning.
[4]Cognitive theories emphasize the effect of cooperative work.

Multiple educational benefits of cooperative learning have been confirmed in numerous studies [5], [4], [7], [9].

- Achievements / results - higher individual success, more intrinsic motivation, positive attitudes towards education, assessors and other staff, positive attitudes towards individual subjects.
- Critical thinking - increased frequency of higher levels of thinking, deeper understanding, endurance, increased flexibility in solving problems, understanding of concepts.
- Improvement of the cross-cultural relationships - greater stability for analyzing situations from another perspective; relations based on support and acceptance of their peers belonging to other ethnicity, religion and gender, as well as of those socially depressed; the ability to create a learning environment; and a higher level of trust and cohesiveness.
- Personal benefits - greater social support, psychological health, adjustment and well-being, increased self-esteem based on acceptance of self, greater social competences.

Interactive teaching is a form through which effective and efficient acquisition of knowledge and developing of skills can be ensured. It can be organized using a variety of approaches, methods, techniques, and tools. When it comes to interactive teaching through the use of programmed material, some theoretical determinations of programmed instruction certainly need to be clarified.

Although the early forms with elements of programmed instruction can be found in the pedagogical views of Socrates, and its psychological foundations are placed in "Theories of effects" most teachers link the occurrence of programmed instruction to the construction of the first learning machines. Skinner's linear model (B. F. Skinner) and Crowder's branching model (N. A. Crowder) of programmed programmes. It is generally accepted that the theoretical basis of programmed instruction is located in four psychological theories: theory of reliance, theory of gradual formation of mental work, theory of algorithms and cybernetic theory.

While teachers in the Republic of Macedonia often say that the use of programmed materials in teaching is useful in a number of ways (developing independence, cost in terms of time, learning the procedures for solving problems, differentiation and individualization in teaching), yet in practice it is very rarely present. The most common reasons for this situation are the lack of ready programmed learning materials, and teachers reluctantly undertake this obligation even though it is not such a complex procedure from the aspect of teaching methods. The process of development of programmed material intended for the realization of certain objectives of the curriculum involves several stages: 1) the content is boiled down to what is most important (according to the purpose of the teaching lesson); 2) it is structured into "minor" logical sections[5]arranged according to complexity; 3) giving assignments after each sequence / unit; 4) space to perform the task; 5) feedback and guidance for further action (moving to the next step / sequence or, if the solution is inappropriate, reversing). The correct answer is

[5]Units which contain the "information" on the basis of which tasks that the student needs to address / find / execute are set. Students work mostly independently, according to their own pace and they gradually discover solutions.

actually the support for further work, and an incorrect response suggests repeated and closer study of the same or previous units.

According to the manner of sequencing the units, programmed material may be linear, branched, and algorithmic.

In the linear (Skinner's) programme units are arranged in a sequence, one after another. Student processes the units in a certain order and solves tasks. The correct answer allows the passage to the next unit. But if the answer is incorrect, the student re-reads the same unit and answers the question again.

In the branching (Crowder's) system a student passes from one unit to another only if he/she chooses the correct answer out of the several ones offered for the question in the previous unit. Otherwise he/she is referred to the unit in which he/she can gain additional explanation so as to properly perform the task or answer the question.

The algorithmic (Landin's) programme provides guiding the student towards the goal with precise instructions (algorithms).

4. NTERACTIVE WORKSHOP WITH THE AID OF PROGRAMMED LEARNING MATERIAL - Study programme: Faculty of Educational Sciences – Elementary School Teaching)

In the academic year 2011/2012, during the course of the teaching subject Fundamentals of natural sciences - the thematic unit *Physiology of plants* was processed using programmed material with mandatory inclusion of cooperative learning: small groups (3 students) and working in pairs (2X2). 3 workshops lasting two hours respectively were held.

Educational workshops are one of the efficient ways of organizing interactive teaching using programmed material from the subject Fundamentals of natural sciences.

The performance of these workshops progressed through several stages:

- Instruction for work (frontal)
- Example for making a task (teacher – frontal)
- Independent work of students (individual, then in pairs or in groups)
- Feedback (correct answers)
- Additional interesting tasks (for advanced students)
- Guideline for further work (frontal).

Under strict set of planning the workshops (model) and the development of programmed material, they were realized by one author and the other was in the role of an observer. Observation was of a systematic character in order to detect: the degree of interaction between individual students and the material being taught, the extent and benefits of group cooperation and pair work, the quality of the performed tasks, repetition / recalling of the previous sequence (mistakes).

We expected the programmed material to cause high intellectual engagement to each student individually, and that discussions and cooperation prior to discover in real solutions to tasks, problems, and questions would encourage them in their efforts to go for her through the content.

During the procedure of preparing programmed sequences we strictly kept to tried methodical approaches: Determining sequence targets; Determining specific sequence contents; Establishing logical connections and important concepts in the curriculum content and its distribution in the units; Experimental verification of sequences, their correction or improvement.

We designed the micro-articulation by determining the following: *Introductory* units contain contents students must already be familiar with; Units for *learning* that contain new content that students should learn; *Criterion* or final units given at the end, after learning the programmed material on basis of which the teacher concludes on the efficacy of the prepared program.

In our country a programmed textbook does not exist still, but teachers themselves can perform programming of certain program contents and bring elements of interaction into their realization, i.e. pedagogical workshops, and thus rationalize their work, modernize and give their contribution to modern schools of the future. For this purpose, the following model of an educative workshop was used with certain activities.

Teaching subject: Basics of natural sciences

Teaching theme: Physiology of plants

Teaching unit: Photosynthesis

The aim of the educational workshop: independent acquisition of knowledge about the processes of cell division.

Workshop tasks:

a) Educational: To empower students to define the terms cell, cell types, and cell organelles with special emphasis on chloroplasts.

b) Pedagogical: To encourage students interest for working in steps (units), to develop a sense and ability to independently solve problems and apply the gained knowledge in everyday life.

c) Functional: To develop the ability for observation and logical deduction, creating work related habits in students for independent work.

Teaching methods: Interactive learning with programmed teaching, verbal-textual method, method of students' independent work

Teaching forms: frontal, individual, pair work.

Teaching aids: computer, LCD-projector, instructional sheets (programmed), instructional feedback sheets, instructional sheets with additional interesting tasks.

Workshop structure (steps in the course of work):

1. Joint introductory activities (instruction for work) - 7 minutes.
2. An example of making a task – 4 minutes.
3. Independent work of students (individual, then in pairs) – 25 minutes.
4. Feedback – 5 minutes.
5. Instruction for further work – 4 minutes.

Course of the lesson:

First step: *Joint introductory activities*

Students are given the instruction for working with and using the programmed material.

Study independently the written material you have received! Using it you will get familiar with the terms plant cell, chloroplasts, and photosynthesis. The content is divided into smaller parts that we call units (steps) or simple tasks. Each unit or task contains a part of the knowledge that needs to be learnt. Each unit (task) has:

1. Information based on which the task should be solved;

2. Task;
3. Place for writing down the solution to the task;
4. Feedback;
5. Instruction for further work.

Work according to the sequence, task after task. Start working by reading the information. After that answers the set tasks. With your friend compare the responses or decisions, then check the correct answers with the help of feedback (correct answers are at the end of material, but do not look them up ahead).

If your answer is correct, go to the next task. If your answer is incorrect or incomplete, return to the information and once again read it carefully, and then answer not erasing the previous answer. Use the textbook during work.

Second step: *An example of a done task.*

Joint work of the teacher and students to solve the next task.

The cell is a basic, structural and functional unit of all living beings. Chloroplasts are organelles that are found only in plant cells. The process of photosynthesis is done in them.

Third step: *Students' independent work*

Teaching unit: "PHOTOSYNTHESIS"

Brainstorming

Onscreen questions:

- What is photosynthesis?
- What does a plant need for performing photosynthesis?

Material needed:

- "Basics of natural sciences", Internal lecture notes
- Computer with Internet
- Sheet of paper and a pen

6. Conclusion

Beside traditional teaching methods, modern teaching of natural sciences especially emphasizes programmed teaching that enables activity of all students in all stages of the educational process, and in that way it allows their self-education and self-control.

Programmed teaching as a model of flexible differentiation implies the acceptance of individual ability and pace of work of each student. In the methodological sense it means the programming of teaching contents and the manner of their processing. In it, the contents are reduced to what is relevant, logically structured into smaller parts which are subordinated by their complexity and which each student independently and gradually learns, he/she controls the results and observes his/her progress with permanent feedback information.

From the methodical point of view, the essence of programmed instruction is that learning content is distributed into units and they provide "*information*" resulting in the tasks the students solve. Immediately after solving they receive information whether the result is correct or not. The correct answer is the foundation for further work and incorrect responses suggest a closer study of the same or previous units.

Success in programmed instruction is influenced by the quality of the programmed material organized in sequences. A programmed sequence is a part of the programme for a didactictically shaped member. A sequence can have more or fewer units.

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