МАТЕМАТИКА И МАТЕМАТИЧЕСКО ОБРАЗОВАНИЕ, 2008
MATHEMATICS AND EDUCATION IN MATHEMATICS, 2008
Proceedings of the Thirty Seventh Spring Conference of
the Union of Bulgarian Mathematicians
Borovetz, April 2–6, 2008

EDUCATIONAL GOALS – THE FUNDAMENTAL STARTING POINT IN THE SELECTION OF PROBLEMS FOR THE WRITTEN ASSESSMENT OF THE STUDENTS *

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The fundamental starting point in the process of lesson planning is the educational goal (also known as learning objective or teaching goal). Therefore, before developing a lesson plan, we should ask ourselves what are the educational goals. However, experience shows that in the selection of assignments and problems for the written examination of the students, it is necessary to start from the goals which are planned to be achieved with all the educational topics, subtopics or domains of the educational goals and program for a particular class or year.

1. Goals – The Concept. With the goals we describe and express the changes that we expect in the educational growth of a student at the close of the class, as a result of the teaching and learning.

In order to achieve the desired educational goals, first it is necessary to determine the content which the students must master. In the selection of the content, it is necessary to think about the following questions: where and how to secure the content that will suit the lesson plan, students' abilities, and the time necessary for presenting the content. The second step in fulfilling the educational goals, is determining which activities will be appropriate.

Therefore, in the lesson planning process it is not enough simply to identify what to expect as a result of the teaching and learning. Instead, teachers must also consider what skills and activities can help students to master the educational goals.

The lesson objectives of the lesson plans have the following characteristics:

– **The educational goals do not exist independently from its two actors – the teacher and the student.** This follows directly from the fact that the lesson plan is a result of teaching goals set by the teacher and learning goals to be mastered by the students through mutually intertwined concrete and abstract activities

– **Each educational goal represents its own merit.** All of the changes expected from the educational growth of each student could become his/her goals as long as it is determined that they represent some type or worth, or merit.

– **The goals are based on motivations.** That means the motivation is what acts upon the student in the learning process, point him/her to a particular direction and

*Key words: Educational goals, cognitive goals, emotional goals, psychomotor goals, goal of the test.

keep him/her towards some specific educational goal. The same applies in reverse; the acknowledgement of a clear educational goal of a particular lesson plan gives a clear goal towards which the students are working.

– **Goals are achieved with concrete content and activities.** For the operational implementation of the educational goals, in addition to identifying the desired result of the teaching and learning process, it is necessary to specify with what content or activities it is possible to get to that result.

– **The goal is a planned, expected and desired result.** The goal may or may not be the same as the achieved result from the process of teaching, in reality. That means that after the introduction of an example in a particular teaching topic, if the true result is closer or bigger from the desired one, then we have been very close to, or we have achieved the desired goal for that class.

– **The goals of the teaching process are content and value open.** This characteristic of the goals comes from two reasons. First, the educational goals are reached within a shorter or longer time period, therefore their achievement is variable. Second, the educational goals should be achieved with students with individual differences. Therefore, in the process of learning, it is necessary to assess continuously the achievement and capacity of the students, the corresponding corrections and not to define the same goals for all the students.

2. Division of the instructive-educational goals. The instructive-educational goals of the teaching class could be divided by their content, or rather by the nature of the expected changes among the students in the durations of the class. In the literature, different starting points and methods can be taken in classifying the changes, and from there, different divisions among the instructive-educational goals are possible, based on their content. In our theory and the practice up to now, the commonly known division of the instructive-educational goals is onto: **educational** (informational, material); **functional** (formal, developmental); **instructive** (exact meaning of the word).

The above division is common in our theory and practice and it is the most widely used one for now.

Nowadays, the use of another method in the division of the instructional-education goals, according to the content, is gaining popularity. In this method, the starting point is the human personality or the structure of the personality, or even the type (nature) of the changes that occur in the process of learning and, according to those, we can divide the goals into: **cognitive** , **affective** (emotional), and **psychomotor**. This division is very similar to the well-known trinity of Pestalotzi: Head – Heart – Hand (think, feel, and act). The American psychologist Benjamin Bloom is largely responsible for the popularity of Pestalotzi's trinity, as he and his co-workers, worked out the famous taxonomy of the instructional and educational goals.

3.1. Cognitive Goals. Cognitive in this context we understand as learning that means receiving of knowledge, organizing and use of information (complete knowledge). These goals can be devoted into two subgroups. The firs subgroup consists of knowledge acquired on the level of remembrance, recognition and reproduction. Respectively, this subgroup of cognitive goals is very close or similar to that group of goals that in past practice were indicated as educational goals.

Second group of cognitive goals is related to capabilities and skilfulness, which, accor-

ding to Blum, is devoted to five categories: understanding, application, analyze, synthesis and evaluation. Hence, it's a matter of variety of intellectual and other skills and thoughtful abilities for practically application of the acquirement, as well as for its independent imbibes by the students, and finding in new circumstances and environment, or in solving problems. In other words, the second group of cognitive goals is the same that in classical didactics is determined as functional or development goals.

In fact, cognitive goals comprise educational and functional goals.

3.2. Emotional (affective) goals. Emotional (affective) goals are those in relation with establishing of personal emotional relation of the students toward the environment in general, other people, job, and themselves. Hence, it's a matter of so called socio – emotional doctrine, learning how to react in certain circumstances; doctrine for acquiring valuable orientations (convictions, attitudes, concerns) and the way of their manifestation which is always emotional, respectively followed by emotional reaction with different directions and intensity.

Emotional goals relate to human as emotional and social being. That is way, this goals are often called as socio – emotional goals. In fact, they are very similar to instructive goals, as determined by the classical didactic.

3.3. Psychomotor goals. Psychomotor goals are those "goals that are connected to establishment of one or other kind of motor, manipulative action and neuromuscular coordination." (M. B. Clarin). They exist in the entire educational process, in all the subjects because they consist of writing, speaking, and other senses while various observations, use of all types of tools in different types of observations, work in laboratories etc. These goals are the most dominant in the physical and technical education. Some also refer to these goals as senso-motorical.

4. Planning the written examination in mathematics. In order to make a good choice of math. problems for the written examination of the achievements of the students, it is necessary to conduct appropriate planning which passes through the following stages:

– defining the goals of the written examination of the students,

– determining the percent representation of the teaching topics represented among the problems selected for the written examination,

– determining the percent representation of the learning goals, and lastly

– Connecting the learning goals with the teaching topics in a table – so called schematic plan of problems for the written examination of the achievements of the students.

4.1. Defining the goal of the exam. The fundamental questions, which must be the focus while defining the goal of the test are:

– Which students will be tested/examined?

– What will the results of the test be used for?

– What teaching topics will be included (all – comprehensive, or some – topical)?

Example 1. This Mathematics test is meant for student of X grade, and it serves to asses the level of success of the teaching topic: "Fractions."

Example 2. (External examination of the knowledge of mathematics among the students of X class year). This Mathematics test is meant for the students of X class year and it will be used to assess the success of the educational goals. Simultaneously,

the achieved results of this testing serve as one of the criteria for entry/application to schools of higher education.

4.2. Determining the proportional representation of the educational topics or subtopics. After it is determined which educational topic(s) will be represented on the written examination, the next step is to determine the proportional distribution of tasks/problems for that particular topic.

Note: The values gathered through such an appraisal, should be understood as orientation, not final, as they could be modified in order to meet the goals of the examination.

Example 3. We are planning a written examination of the students on one particular topic. The topic has 4 subtopics. In the table below is the approximate distribution of classes in each educational subtopic from the total of classes necessary to teach the topic "Fractions."

Educational Subtopics (5^{th} grade)	Expected number of classes for each subtopic	Representation of the subtopic with problems (in %)
The term "percent"	11	31.43
Decimal fraction	7	20
Operations with decimal numbers	8	22.86
Rounding of decimal numbers	9	25.71
Total	35	100

Advice for the teacher. In concretely choosing the educational topics and determining their representation on the examination (in percentages), "Educational Programs" for Mathematics should be used, along with the existing textbooks and math workbooks.

While planning the written examination of one topic or subtopic, then the representativeness of each topic should be determined by the class time spent on that topic or subtopic from the total number of time spent to teach that topic or subtopic.

4.3. Determining the percent representation of the educational goals. In order to achieve an accurate and complete written examination, it is necessary in that examination to encompass the educational goals. However, those educational goals are not the theoretical ones, but those that prevail when the lesson plans meet the written concept of the educational goals, set standards, and the actual abilities of the students.

The approximate representation of each educational goal is to be determined in relations of all the goals together. This means that when we are talking about the representation of the educational goals in the text, we are thinking about the cognitive (SOZNAJNI) goals.

To simplify the selection of problems, we can divide the cognitive goals into three levels:

A – Knowledge: in order to examine the achievement of these goals the proper problems is selected with which the student demonstrates memory and reproduction of the taught material. That material could be from different types of content, from concrete facts to entire theories. The OPSHT symbol on this level is the memory about particular facts. With the problems on this level, the student is expected to identify or locate the

information, or to recognize details, main ideas, steps of progression, comparison, cause-effect relationships, characteristics etc. The answers at this level could most commonly be found in the text. In searching for those, the students are simply supposed to reproduce what has already been said/taught.

B – Understanding: the problems with which we could examine the achievement of the goals on this level are algorithmic. With these problems the student is asked to demonstrate: the use of a particular method, which is specifically requested (for example: to add two fractions, to write a fraction as a decimal number etc); the use of a particular method for which the teacher explicitely has addressed in class (for example: the application of the first condition of congruence for a triangle, using the equalities of corresponding elements on the following drawing, determine the congruence of the given triangles, etc) or the use of a method which could be determined from the way in which the problem has been practiced.

C – Implementation: the problems with which we measure the achievement at this level of goals offer the students the opportunity to solve problems or to examine thoroughly logical problems that they encounter when they read or study. This category of problems marks the ability to use the learned material in concrete conditions and new situations. It is here that the rules, methods, terms, laws, principles and theories come together. One of the goals of education is to enable the students to use the acquired knowledge in various situations which are different from those situations in which the material was introduced. Bloom says that the understanding of some abstraction is not a promise/guarantee by itself that it will be properly applied. Therefore, it is necessary that the students be taught and enabled to master the ability to connect the knowledge, or to be able to apply the abstract knowledge in particular concrete circumstances. When discussing connecting the knowledge, it is necessary to keep in mind that for a student always need to be in a new situations. So, to the third level of the goals belongs another subgroup of cognitive goals (which according to Bloom is divided into five categories: understanding, application, analysis, synthesis, and grading). In this subgroup the categories are: usage, analysis, syntesis and grading. With the problems used for assessment of the goals at this level, the student is expected to:

– To be able to divide the material into its components, which will clearly accentuate its structure. Here belongs the the process of thinking of the whole in parts, discovering the connections between the parts and the cognition of the principles of the organization of the whole.

– To be able to get the integrity by combining the elements. Such a new product can be a plan of operation, or totality of general relations (drafts for comparison of the existing information).

– To be able to estimate the meaning of some content for a certain purpose. Judgments of the student should formulate clear criteria.

Example 4. Definition of the teaching goals. In the table below are given two different ways of representing the goals, or rather two different ways of representing the problems by which the teaching goals would be achieved.

Advice for the teacher: For the written knowledge examination, suggest more assignments or problems connected with the understanding and use of the accumulated knowledge.

Teaching Goals	Representation (%)	Teaching Goals	Representation (%)
A – knowledge	30%	A – knowledge	20%
B – understanding	40%	B – understanding	40%
C – application	30%	C – application	40%
Total	100%	Total	100%

4.4. Connecting the teaching topics and goals (the schemic plan of the test). Practically, in order to determine with how many problems would a particular teaching goal be represented based on the particular teaching topic or subtopic, it is necessary to write out a table in which there is a unification of the educational topics or subtopics with the teaching goals. This unification is known as a "schematic plan of the problems for written assessment of the knowledge on one particular topic or subtopic."

For the execution of the calculations, it is necessary also to determine the total number of problems on the test. After the total number of problems from one topic, that has been determined for a particular written assessment, the chart should be filled accordingly.

For the first row of the chart, the teacher should list the teaching topics, but in the first column – the teaching topics, or subtopics. In the leftover cells of the table, which are located in the intersection of each row and each column, the product of the respective percent representation and the total number of problems on the thematic test should be placed. In the next example, we practically demonstrate how to determine the content of one cell of the table.

Example 5. In example 3, how many problems of the subtopic "Concept of a percent" (T1) should be used for the examination of the teaching goal-application, if the achieved goals from the C level – application is represented by 40% of all the subtopics from the thematic test "Fraction?" It is assumed that the thematic test contains a total of 10 problems.

Solution: According to problem 3, the teaching subtopic T1 is represented by 31.43% from the total 10 questions of the test, or from those, 30% should be for the crosschecking of their understanding (c).

This decimal number is simply for orientation and should not be rounded as a whole number, because that is done later, when the concrete questions are being asked, depending on the eventual problems which could arise in the process of composing/choosing the problems.

Step I: Pick an number of problems for orientation purpose, with which the educational goals are being represented in each subtopic, individually.

EDUCATIONAL GOALS

Educational Subtopics (ST)	A – Knowledge	B – Understanding	C – Application	Total
ST1	0.94	1.26	0.94	3.14 (31.43%)
ST2	0.6	0.8	0.6	2 (20%)
ST3	0.69	0.91	0.69	2.29 (22.86%)
ST4	0.77	1.03	0.77	2.57 (25.71%)
Total	3 (30%)	4 (40%)	3 (30%)	10 (100%)

Step II: Finite values procedure in the stage of composing the final questions.

EDUCATIONAL GOALS

Educational Subtopics	A – Knowledge	B – Understanding	C – Application	Total
ST1	1	1	1	3
ST2	0	1	1	2
ST3	1	1	0	2
ST4	1	1	1	3
Total	3	4	3	10

Advice for the teacher: The frequent preparation of questions for the written assessment of students' knowledge, whether on a topic or a subtopic, would help to determine the number of problems on each test. The once completed schematic (table) plan for a written assessment of the students can be recycled repeatedly, as long as there are no alterations in the substance of teaching mathematics.

5. Selection of the problems for written examination of the students in math. The second technical step in the composition of the thematic (or sub-thematic) written math. exam is the composition of the problems. All problems together should present the content on which the students are to be examined and graded on. The problems should, therefore, be selected in such a way that they present the content and the intent of the test.

Often, a problem arises in the selection of the problems based on the cognitive level of requirements, or on the levels of the cognitive goals, their representation in written examination of the achievements in a particular topic, as well as the process of composing the problems. The selection depends mainly on the teaching goals and teaching themes. However, after a "schemic plan of the problems for written assessment of student's knowledge on one topic or subtopic is complete" the teacher can very easily select the problems for the written assessment, or the requirement for the respectful representation of the assignments at different levels of the cognitive requirements in the aspect of quantity. In the aspect of quality, it is necessary for the teacher to vary the problems based on their cognitive demands: knowledge, understanding and application (these characteristics are given in item 4.3.). With the regular preparation of problems for written assessment, the teacher could much easier make a selection and rank the problems based on the type of thought that each problem requires from the student.

Example 6. In the table below, we have added problems, based on the cognitive level of the teaching goals, for the written assessment of the topic "Fractions" in fifth grade. Problems by the Educational Goals.

6. Conclusion. The requirements that are set forth to the teachers for the written assessment of the mathematical skills of the students, address the need that the teachers, above all, understand the role of the problems set forth to the students. The results of some research studies conducted in this area, demonstrate that the cognitive level of the problems is a big factor in the answers that the students choose. Therefore, the problems for reminder and recognition usually lead to short answers, contrary to the questions with which thoughts and interpretations are demanded. Mainly, the low cognitive complexity

Educational Subtopics	Knowledge	Understanding	Application/ Implementation	O
ST1	Divide the fractions into simple fractions and complex fractions.	Organize the fractions in an ascending order– starting from the smallest.	Three bikers start a trip from the village to the city at the same time. After a period of time,	3
ST2	0	Calculate the statements a), b)...	For which integer x, is the following correct	2
ST3	Write out the following: a) decimal fractions, b) decimal numbers: .07; 2.3; 153.538	Calculate: a) 4848.8:38 – 9.186) (0.48 +0.36)·5.07	0	2
ST4	Write out which decimal numbers we often call: 1) naturally decimal numbers; b) Mixed natural decimal numbers.	Fractions – write them out as decimals and then round up to two decimal points.	Calculate the area of a triangle if one of the sides is 3.54 cm long, and the other one is 1.03 cm longer than the first side. Round up the result to two decimal points.	3
O	3	4	3	10

of the problem is connected syntactically with the simple answer.

The cognitive level of the math problems that the teachers choose depends also on other contextual, affective, and interpersonal factors. These factors include the wide understanding and information for a teaching topic or area, the relationships between different students in the class, the assumptions of students' previous knowledge, the student goals as well as the goals of the program, as well as some other variables. With the understanding of the cognitive complexity of the chosen assignments, the teachers can better assist their students and meet the contemporary demands and needs for a higher quality of the education.

It is imperative to understand that the problems/assignments are just a mean for prompting different modes of thought, with different complexity. If the assessment of the students were to be conducted literally and on a memorizing level, then their knowledge would be comparable to the information contained in an encyclopaedia.

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ОБРАЗОВАТЕЛНИТЕ ЦЕЛИ – ОСНОВНО НАЧАЛО ПРИ ИЗБОРА НА ЗАДАЧИ ЗА ПИСМЕНО ОЦЕНЯВАНЕ НА УЧЕНИЦИ

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Основно начало в процеса на планиране на урока е образователната цел (наричана още цел на учението или цел на преподаването). Следователно, преди да се пристъпи към планиране на урока трябва да се изяснят образователните цели. Опитът показва, че при избора на задачи за писмено изпитване на учениците е необходимо да се започне с планираните цели, които трябва да се реализират с темите, подтемите и областите на образователните цели и програми за всеки конкретен клас и учебна година.