



MILAN ĎURIŠ 

Innovative Methods in Education Supporting Formative Assessment of Students within the Subject Technology in Elementary School

ORCID: 0000-0002-4835-7733, University professor, Matej Bel University Banská Bystrica, Faculty of Natural Sciences, Department of Technology, Slovak Republic

Abstract

This article pays attention to formative assessment of students within the subject Technology in elementary school, where the emphasis is put on a feedback and a self-assessment of students. Innovative methods of teaching supporting formative assessment of students within the subject Technology are drafted from the didactic point of view in a university textbook, which constitutes one of the output solutions for given topic in the KEGA project. As a demonstration we would like to point out basic information regarding the teaching methodology for selected content of learning topics as well as example of learning task and its solution.

Keywords: elementary school, subject Technology, formative assessment, innovative methods

Introduction

The subject Technology has specific position in the system of learning subjects of lower secondary education in the Slovak Republic and may not be replaced by any other subject. So as with other subjects in lower secondary education, within the subject Technology the transmissive way of teaching and assessment of students' performance by means of the grade is still prevailing. With regards to practical and applicative character of the subject and in accordance to current educational trends in the field of assessment, the attention is transferred from quantitative assessment of student by teacher to more qualitative assessment and development of self-assessment of students themselves. This requires, also for the reason of recent changes in curriculum of the subject, implementation of new innovative assessment methods and means in the educational process.

In case of application of summative assessment of students' performance (classification) in the elementary school (ES) the students are often put under stress and they learn just to get good grades. Students are often just passive objects in process of examination of their knowledge and assessment. The goal of assessment of stu-

dent should not be just to assess his/her current performance; instead, it should lead to formative assessment and self-assessment of student. The basis of self-assessment is that students themselves are responsible for their learning and they become active part of the learning process. From the didactic point of view it is possible to understand the self-assessment as a competence supporting freedom and independence of student from the teacher. Therefore, the self-assessment and self-control constitute the most important motivation means for student. Formative assessment of students within the teaching process is focused to getting feedback on the progress of student's learning, as well as the feedback on deficiencies and mistakes with the goal for their remedy. Such types of students' assessment doesn't include classification.

As mentioned by several authors (Turek, 2014; Kalaš, 2013 and others), the formative assessment of students should be used in a bigger scale because it improves the quality of knowledge and skills of students. Numerous foreign researches prove that from methodical point of view the correct use of activating assessment strategies and methods supporting formative assessment is often connected to improvement of learning results of students (Shute, Kimy, 2014; Koedinger, McLaughlin, Hefferman, 2010).

Learning tasks supportive formative assessment of students

Solving of learning tasks forms a part of meaningful activities of students during the lesson. By means of such teaching method the teacher fulfils determined specific goals of the lesson. Technical, application and creative tasks in particular have high potential to connect theory with practice, and practical usage of the knowledge. This function of learning tasks within the subject Technology is important for improvement of learning results of students and their inner motivation towards learning. The learning task should stimulate and shape their activities, in order to repeat, acquire and consolidate their knowledge, skills and behaviour, as well as develop their abilities and create own approaches. Learning tasks should further develop students' ability of team work, skills to use the literature and electronic information sources, ability to choose suitable working methods, acquire mental operations necessary for problem solving, etc. Within the teaching process we do not deal with sole or randomly collected learning tasks; instead we deal with creation of programmed collections of tasks, arranged from the simple to difficult, from algorithmic to creative. Learning tasks are included in the whole teaching process by the teacher in a way strengthening their formative function. Learning tasks have significant influence on quality of students' knowledge, its long-term duration and practical usefulness.

The particular knowledge, skills, behaviour, approaches and competences which are to be acquired by students within the subject Technology are determined in specific goals by the teacher. When defining specific goals the teacher emanates from the performance standard, and specific goals become a part of methodical preparation for specific teaching lesson of the subject Technology.

Within the subject Technology we apply Niemierko's taxonomy of educational goals in cognitive field. According to that learning tasks may be divided to tasks for memorizing and understanding the knowledge, tasks focused on use of knowledge in typical and problematic, non-typical situations. In order to cope with learning tasks on the highest level it is necessary to be able to solve learning tasks on lower levels. It is necessary to arrange learning tasks into a complex compilation, containing learning task of various difficultness and variety, so that it develops broadly key and specific competences of students.

Practicing and consolidating of students' knowledge and skills belong among the most important, although often underrated parts of the teaching process. In order to achieve useful practice it is necessary to provide students not only with opportunities to use their knowledge and skills, but also to provide them with timely feedback. It doesn't have to be summative and evaluative, instead it should fulfil formative function and provide students with information that may help them in self-assessment of their progress from the point of view of educational goals, in understanding and correcting mistakes and misconceptions. The goal is to achieve that students better understand the value of acquired knowledge and its meaning in practical life.

Teaching methods supporting formative assessment of students

The problem of formative assessment of students is being precisely solved theoretically and practically within the project KEGA č. 017UMB-4/2017 named *Formative assessment of students within the subject Technology in lower secondary education focused on cognitive field (2017-2019*, chief of the project prof. PaedDr. Milan Ďuriš, CSc.). Among numerous published scientific and technical articles focused on the topic it is necessary to mention those outputs that correspond to given topic; namely: *Electrical technology and electronics for elementary schools. Compilation of job sheets for the subject Technology* (CD-ROM). *Graphic communication in the subject Technology. Compilation of job sheets for 6th and 7th grade of elementary schools* (CD-ROM). *Teaching strategies and methods supporting formative assessment within the subject Technology* (university textbook).

Above mentioned university textbook contains practical demonstrations of teaching methods supporting formative assessment of students. These practical demonstrations use the compilation of job sheets proposed by us with focus on electrical technology and electronics, as well as on graphic communication. It also contains the compilation of assessment criteria for assessment of students' activity within the given topic by use of ICT. It further contains the form for assessment of activity relate to given topic, monitoring sheet of practical activities focused on affective field. Further there is a demonstration of knowledge test focused on electrical energy, electrical circuit and home electrical appliances. When creating these learning tasks we have come out of the content and performance standard for the subject Technology in 6th to 9th grade of ES. As for me-

thodical appliance of these tasks it is inevitable to pay attention to specific cross-sectional topics related to the learning content elaborated in job sheets.

When working with job sheets specialized in the graphic communication there are specific learning tasks focused on development of higher levels in acquired knowledge and practical skills leading to development of space imagination of students, as well as their creative thinking within the technical education. Particular learning tasks in job sheets (specialized in electrical technology and electronics) are focused on problem solving, development of practical skills and scholastic activities of students, searching information on internet and solving of short-term problem home works within the student's project.

For the purpose of control and examination of knowledge and skills of students, as well as their assessment, the textbook includes self-assessment control lists for the student and tests, which may be used by the teacher for summative assessment (classification) and formative (elaborative) assessment of students.

The part of methodical procedure within the teaching process supporting formative assessment of students is constituted by basic information on methodology related to individual topics. For the topic Technical electronics we are presenting following example.

Basic information related to methodology of education of the given learning content

Grade	8 th
Thematic unit	Technical electronics
Contents standard, topic	Microchip, microchip scanners
Classification of the task according to its operational structure	The task requiring simple thought operations and conceptions
Inter-subjective relations and cross-sectional themes	Informatics; Personal and social development
Specific goal for cognitive scope	<ul style="list-style-type: none"> – Student is able to explain what is a microchip; – Student is able to search via internet and describe in own words the usage of microchips and chip in everyday life (for ex. payment card, ID card, etc.).
Specific goal for affective scope	<ul style="list-style-type: none"> – Student is able to understand himself/herself and others; – Student understands the demand of responsible and safe behaviour when using the chip cards and realizes possible risk connected to loss of such cards.
Specific goal for psycho-motive scope	<ul style="list-style-type: none"> – Student applies acquired digital knowledge by means of searching information on the internet.
Teaching approach	<ul style="list-style-type: none"> – Traditional teaching along with application of elements for problematic teaching, i.e. problematic teaching.
Type of the lesson	<ul style="list-style-type: none"> – Basic or special type.
Teaching methods used	<ul style="list-style-type: none"> – With regard to selected teaching approach, including methods supporting development of creative thinking of students.
Learning tool	<ul style="list-style-type: none"> – Collection of job sheets – Electrotechnics and electronics for elementary schools.
Organization forms of teaching	<ul style="list-style-type: none"> – Classroom, technical room with ICT equipment; – Frontal teaching, individual approach towards student (the teacher selects organization forms according to possibilities and equipment of school rooms).

As a part of motivation process the teacher is able to look for examples of microchip usage in real life by means of discussion with students. The teacher points out the importance of protection of personal and delicate data on microchips, which are likely to be abuse in case of lost or stolen chip cards. The teacher discusses with students about types of personal data which may be issued on a chip card and about means of safe usage of chip cards.

ÚLOHA č. 13 Čipové karty



S čipovými kartami sa v dnešnej dobe stretávame denne. Podľa obrázkov zisti, na čo zobrazená čipová karta slúži a ako sa používa. Pomôž si internetom. Na obrázkoch zakrúžkuj, kde je umiestnený čip.



Picture 1. Assignment of learning task nr. 13 (chapter nr. 4 CD – ROM)



Picture 2. Solution of learning task nr. 13

Conclusion

The university textbook with proposed and elaborated teaching strategies supporting formative assessment of students is assigned for students who prepare themselves for the profession of teacher of the subject Technology in elementary school. The textbook contains theoretical and practical information on topic of formative assessment of students which constitutes one of the modern approaches in students' performance assessment in the current didactics. Within the assessment process the student is active in larger extent compared to traditional assessment. The student gets immediate feedback on accuracy of his/her progress in learning and his/her performance is not classified by grade, but instead, it is assessed, for ex. in words, by the teacher. For the purpose of consolidating and understanding of knowledge each chapter includes at its end control questions and tasks. Since the textbook constitutes a singular publication dealing with given topic in Slovakia, we may assume that it will become a suitable didactic tool also for teachers teaching the subject Technology in elementary schools in Slovakia.

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