HOW TO TRAIN TEACHERS TO SUPPORT PUPILS´ ORIENTATION FOR TECHNICAL STUDY PROGRAMS

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Abstract: The paper presents description of the conceptual analysis of a lesson, so-called AAA methodology - as a mean through which a teacher` professional competences and teaching mastery can be developed, independently on his/her majors, consequently this methodology is applied on the analysis of a lesson of the subject technology, which is a compulsory subject taught at upper level of primary schools in Slovakia and there is point out how a training in the use of this methodology can influence the ability of teachers to make teaching of their subject to be more attractive and interesting for their pupils..
Keywords: AAA methodology, conceptual analysis of a lesson, teaching mastery, teacher´s professional competences, teaching technology, technical education, pupils= professional orientation.

1 Introduction

In the concept of the National Program for the Development of Upbringing and Education *Learning Slovakia* (MŠVVaŠ, 2017), great attention is paid to the need to reconcile the interconnection of vocational education provided by secondary vocational schools with the requirements of employers. The connection of vocational training with the implementation of technical education and the related professional orientation of pupils in primary schools remains out of the focus. At the same time, the lack of interest of young people in the study of technical fields does not only concern the subsequent study of secondary school graduates, but it is already manifested in the primary school environment. The need to strengthen technical education at primary and secondary levels of education was also one of the key priorities of the state education policy of the Slovak Government. The key role in the process of directing the professional orientation of primary school pupils to technical fields is undoubtedly played by teachers of the subject of technology, which is included in the State Educational Program as a compulsory subject (ŠPÚ 2015a; ŠPÚ 2015b). In this context, the demand for the development of the professional competences and teacher mastery and the demand to introduce innovation in the teaching of the subject of technology are emphasized in relation to technology teachers.

However, the requirements of developing professional competences and pedagogical mastery and introducing innovations contributing to increasing the effectiveness of teaching in school practice do not only concern technology teachers. They are put on teachers of all subjects. This implies that the methodologies and practices set out below are concretized for developing the professional competences of technology teachers and introducing innovations in the teaching of technology, but the theoretical foundations of these methodologies and practices are applicable in the field of teaching any subject or focusing on teachers of all subjects (Hašková, 2019).

2 Theoretical basis of conceptual analysis of the lesson

One of the tools that can significantly help a teacher to develop his/her professional competencies and teaching mastery, and at the same time which s/he can use as a supportive tool for introducing innovation into his/her teaching practice, is a conceptual analysis of the lesson. This analysis is based on the methodological steps of the three As, which are *Annotation - Analysis - Alteration* (Janík et al., 2016).

Annotation is a description of the teaching process (lesson), or any of the learning situations that occurred within the lesson. It contains the most important information on the course of the described situation (lesson or part of it), which can include the objectives pursued, the topic covered, the specific content of teaching, activities carried out by the teacher, activities carried out by pupils, description of situations arising during these activities etc. Annotation provides (or should provide) a recipient (reader, evaluator, examiner, assessor himself) all information needed to create a picture of the situation as a complex whole and for the consequent analysis of the described teaching process or the learning situation (or for understanding of the analysis presented).

Analysis is an interpretation, justification, explanation of the learning process (learning situation) described in the annotation. It points out the strengths and weaknesses of the monitored (evaluated) situations with respect to the stated objectives and contents. During the analysis we ask about various aspects of the analysed lesson such as:

How can the context of the situation be characterized?
What is the teacher's intention? What does the teacher do?
What do pupils want? What do pupils do?
What did the teacher think of it / how did he see it / how did he "feel" it?
What did pupils think / how did they see it / how did they "feel" (understand) it?

The answers to these questions should contribute to increasing the specificity of the reflection process.

Alteration (possible alternatives) is focused on making proposals to change, modify, improve the carried out (monitored/assessed) teaching process (learning situation). Alteration does not mean a change in the "meaning" of the whole teaching process (learning situation), it is only a change of certain components of that whole, as a result of which the component may achieve a significantly different (higher) value (quality). An integral part of the alteration is the discussion, which is connected mainly with considering both the advantages and possible problems of the proposed alteration implementation into the practice (in the classroom).

From the theoretical point of view, the conceptual analysis of the lesson can be seen as an application of the Korthagen 5-component ALACT model of the ideal teacher self-reflection process (Fig. 1) with the components (Korthagen et al., 2001):

1 – Action,
2 – Looking back on the action,
3 – Awareness of essential aspects,
4 – Creating alternative methods of action,
5 - Trial (basically a new action, i.e. the de facto start of a new recursive cycle).

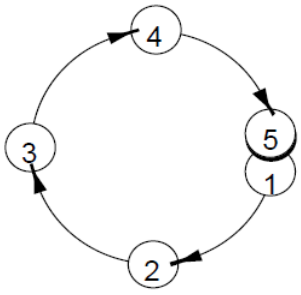

Figure 1. Schematic representation of the ALACT model [Source: Korthagen et al., 2001]

The questions raised in the analysis step of the presented three-step AAA analysis of the lesson are based on the questions presented in the ALACT model in relation to the reflection of the monitored action (looking back on the action).

3 Application of AAA methodology to teaching thematic unit *Technical materials and working procedures of their processing*

The following is presented an analysis of the lesson of technology realized in the 6th grade of elementary school (upper level of primary education, Boboňová et el., 2017). The following is presented an analysis of the lesson of technology realized in the 6th grade of elementary school (upper level of primary education). pilot schools of the national project *Supporting the professional orientation of primary school pupils to vocational education and training through the development of polytechnical education focused on the development of work skills and work with talents* (so-called *Workrooms* project), so the teaching took place in the workroom established at the school under this project. The content of the lesson was focused on teaching the thematic unit *Technical materials and working procedures for their processing.* The monitored lesson was attended by eight pupils (due to the maximum number of pupils prescribed in the workrooms for safety reasons). Each of the participating pupils had their own separate workplace (locksmith table with a vise). Duration of the lesson was 90 minutes (two 45-minute lessons combined in one block). The teacher was a student of the master's study program Teaching Technology.

3.1 Annotation

The content of the first part of the lesson was the presentation and explanation of the new subject matter. This was done in the form of a teacher's interpretations and practical demonstrations of particular working elemental operations. The pupils watched the explanation and demonstrations of the working elemental operations such as sawing, filing with a file, nail joining of individual parts of the product. The interpretation also included information on safety and health protection at work.

In the second part of the lesson, the teacher assigned pupils a task of making a model of a ship (Fig. 2), which technical documentation in the form of a technical drawing was made available to them (Fig. 3).

3.2 Analysis

The aims of the lesson were:

- *to train hand saw, nail file and nail joining,*
- *to develop pupils' ability to work with technical documentation (to „read" technical drawings),*
- *to develop pupils' ability to apply acquired knowledge and skills in the production of specific products,*
- *to acquaint pupils with the rules of safety and health protection during the particular working elemental operations (cutting, filing, skinning).*

The aim of the product-specific part of the lesson (ship model) was to acquire the working methods of manual woodworking specified in the performance standard for the subject of technology and to apply these elemental operations in the construction of a specific product according to the technical drawing.

According to the performance standard for the subject of technology (ŠPÚ, 2015c), pupils should apply knowledge from the thematic unit *Graphic communication in technology* and from the thematic unit *Technical materials and working procedures of their processing* when creating a specific product (ship model). Specifically, it was about developing the ability of pupils:

- to determine the dimensions of the object (product) shown from the technical drawing,
- to assign dimensions to the displayed single object (product),
- to implement selected working methods of manual woodworking on the product according to the technical drawing.

In addition, according to the content standard of the subject of technology (ŠPÚ, 2015c), pupils had to develop further their ability related to the other thematic units (*Technical materials and working procedures of their processing*), namely

- to use the correct working procedures: measurement and contouring, cutting, filing, grinding, nailing.

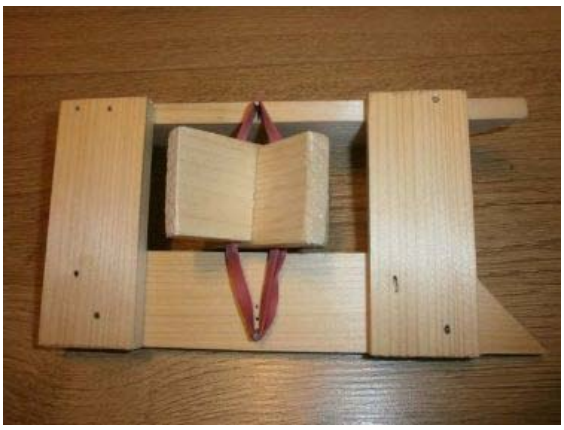

Figure 2. Model of the ship

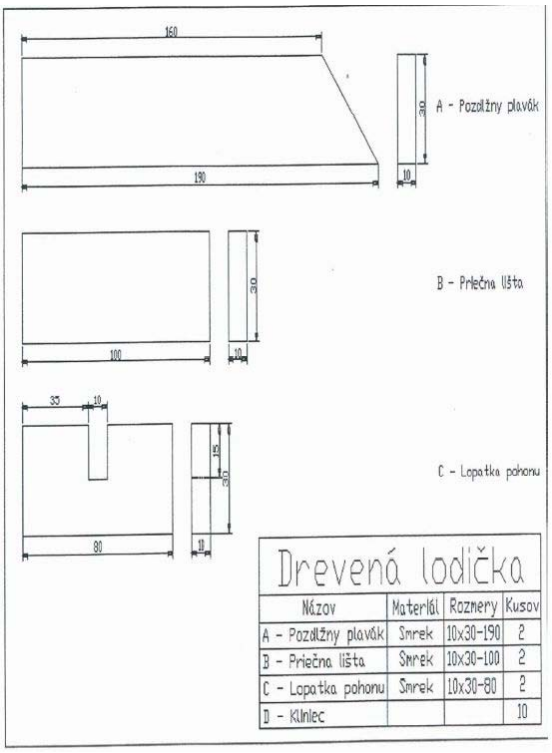

Figure 3. Technical drawing of the ship model

In the first part of the lesson, the pupils watched the teachers` interpretation and practical demonstrations of correct work with the saw and nail file and joining parts of the product with nails.

In the second part of the lesson the teacher made available to all pupils the technical documentation of the ship model (technical drawing) to be produced, the boat construction material (spruce wood with a cross-section of 10 x 30 mm)., sandpaper, nails) and a sample product of the specified model. The pupils also had tools for measuring and contouring (steel gauge, angle).

In order to produce the model, the pupils gradually used all of the teachers' previously demonstrated work tools. The teaching activity of individual pupils was continuously monitored and guided and corrected by the way in which they performed the particular working elemental operations.

At the end of the lesson the teacher assessed the work of the pupils and compared the particular models produced by them.

The main problem of teaching technology is that this subject teaching should be practically oriented, for which it is necessary for schools to have the premises with the appropriate equipment, and the material and technical facilities necessary for its teaching (which is not common practice and in most of schools the teaching of the subject of technology is therefore of a theoretical nature). The school, where the evaluated student carried out his teaching practice, was equipped within the project *Workrooms* with all the essentials necessary for realization of practically oriented teaching of the subject of technology (hand saw, file set, locksmith hammer, meter, angle, miter box). The teacher used them to instruct the correct workflow of working with these tools and the pupils used them to work on the assignment.

In the beginning of the lesson there were no motivating factors and the teacher omitted to repeat basic information about processing of technical materials. At the same time, he could build on the knowledge determined by the educational standard of the subject of technology, where pupils are acquainted with the basic terminology of processing technical materials. As a result of these shortcomings, at the beginning of the lesson the pupils were only passive listeners.

During the explanation the teacher:

- pointed out the correct use of the gauge and the angle (correctly placing the gauge on the material, indicating the necessary dimension at one point, transferring the appropriate dimension along the entire cross section using the angle),
- explained the data contained in the technical drawing (developing the reading ability of the technical drawing and the ability to determine the particular dimensions of the parts as well as developing the pupils' spatial imagination, i.e. their ability to imagine how the product should ultimately look),
- explained the correct technological procedure for sawing using a miter saw (correct and safe attitude when sawing), paying particular attention to the correct position at the work table (or the material for right-handed and left-handed pupils),
- clarified the bonding of the individual parts of the product to be made with the nails (correct alignment of the nails to create the necessary strength joint),
- draw attention to safety at work during each demonstration of the particular elemental operations.

Pupils worked with interest and enthusiasm when working with the particular tools. While working on the assignment, it was possible to observe that the pupils had a fairly well-developed technical imagination related to the drawings of the objects displayed through the technical drawings. On the other hand, there were also many serious problems with. The pupils failed to use the correct measures, to determine the correct dimensions of the individual parts, to convert the dimensions from millimetres to centimetres, and to mark and then outline the required dimensions to the material. However, they had the greatest problems with hand-sawing, where the splitting of material occurred quite often.

At the end of the lesson, the resulting products (Fig. 4 and Fig. 5) were exposed and the teacher evaluated them verbally, using a mutual comparison of the successful and unsuccessful elements of each model.

Figure 4. Results of pupils' work I

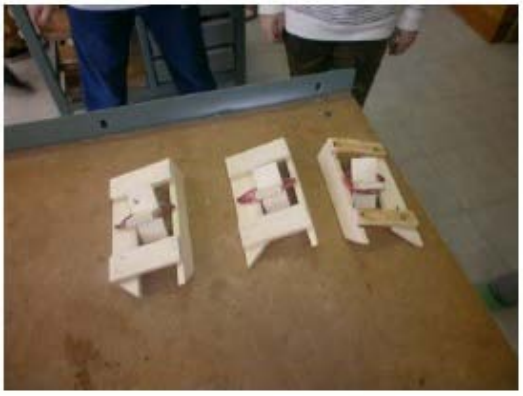

Figure 5. Results of pupils' work II

3.3 Alteration

The following modifications of the lesson were proposed within possible alterations:

- ***Incorporation of motivational elements into the introductory part of the lesson***

As stated in the analysis, there were no motivating factors at the beginning of the teaching unit. The teacher could “tune” the pupils to a greater concentration and active participation in the interpretation and explanation of the new subject matter through the knowledge that the pupils acquire when learning the technical materials (“tuning” the pupils, for example through a motivational interview pointing the already acquired knowledge to practical activities of everyday life).

- ***Incorporation of motivational-activation elements into the introductory part of the lesson***

In the opening part of the lesson, the teacher could also use the activation elements to increase motivation. In the meaning of the above mentioned (see the previous point), these could be e.g. brief demonstrations of new work skills (related to the practical activities of everyday life) subsequently described in detail in the interpretation and explanation.

- ***Incorporation of correct technological practical operations***

During the interpretation and explanation, the teacher could continually encourage pupils to try to fulfil the activities

explained and demonstrated by him, either in their own places (all pupils) or in the teacher's place (called pupils). In this way, he would also receive feedback as to whether the pupils correctly understood his interpretation. In addition, he would turn pupils - passive listeners into the involved participants of the course of the workroom events already during the explanation phase of the lesson.

In the case that training is not included during the explanation phase of the lesson (e.g. due to time constraints), pupils should definitely have an opportunity to try new work operation activities before applying them in the given assignment (ship model construction). Certainly it was necessary to devote a separate extra time space to at least practice the correct technological practical operations of hand sawing and not to leave this training only at the level of a part of the work on the given assignment. Since pupils did not try the new practical operations, there was a “mass failure”, especially when working with the saw. The teacher - a teacher trainee with no previous experience - wrongly assumed that the given interpretation and explanation of the correctness of the applied technological practical operations would be sufficient for the pupils and consequently they would be “automatically” able to apply them practically. An adequate solution at the time of this problem appearance could be interruption of pupils' work on the assignment and repetition of the basic instruction and demonstration of sawing.

- ***Use of cross-curricular relations with mathematics***

With regard to the problems that pupils had with converting the dimensions of the ship's model from millimetres to centimetres, the teacher was to create a space for repetition and fixation of the mathematics subject matter (length unit conversions), although he did not anticipate this problem and therefore he did not plan such part of the lesson.

- ***Involvement of pupils in the assessment of the work on the given topic at the end of the lesson***

At the end of the lesson, the teacher was to activate the pupils by involving them in the assessment of the work on the given topic during the lesson. The pupils could express their comments, opinions and approaches related to their own work as well as to the results of the work of the others. This would result in a higher perception of the given facts by pupils and, moreover, the pupils would be encouraged to think critically, to analyse critically, to evaluate the results of the work of the others, as well as to self-evaluate their own work results and to self-reflect on their own activities.

4 Conclusion

As described in the description of the conceptual analysis of the lesson, through its application it is possible to develop professional competencies and pedagogical mastery of teachers of any subject. Applying different alterations contributes to the elimination of didactic formalism in the pedagogical practice of teachers, manifested by application of “routine" procedures in their work, and at the same time it forces teachers to think X continually about introducing various innovations into their teaching to achieve the best results of their teaching practice. It is precisely this fact the answer to a very specific question set in the title of this paper raises from and a solution of which some readers may "miss" in this paper. So what is our answer to the question of *how to train teachers to support pupils' orientation for technical study programs*? The answer is obvious. A very suitable way is to train teachers of technology to apply AAA methodology in their self-reflection with an emphasis on possible alternations of particular parts of the lessons taught, mainly particular activities of pupils and to pupils assigned tasks, with regard to the contribution of these alterations to the increase of the pupils' interest in technology and technically oriented study programs.

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