AAA METHOD APPLICATION IN EVALUATING TEACHING STRATEGIES FOR DEVELOPING CRITICAL AND CREATIVE THINKING

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Abstract: One of the most current issues in contemporary pedagogical theory and practice is suitable content definition in practical training of future teachers, along with the enhancement of their professional competencies in implementing teaching strategies for developing critical and creative thinking amongst children and pupils. Furthermore, the evaluation of these competencies is also at the centre of interest in didactics, pedagogy and educational psychology. The objective of this article is to point out a specific way to assess acquired professional competency level of pre-school and elementary pedagogy students, as well as lower secondary teachers of technical subjects in implementing teaching strategies for developing critical and creative thinking via AAA the method, the in-depth video footage analysis of a single or several educational situations.

Keywords: key competencies, AAA method, teaching strategies, technical subjects, critical and creative thinking.

1 Introduction

It is the aim of contemporary teaching strategies to put the pupil in an active position within the teaching process, which should have a predominantly active character with an emphasis on developing communication and self-reflective skills[1]. This is also the basis of several well-known teaching strategies which have been around for a long time, such as problem-solving teaching, project teaching, cooperative learning as well as some recently preferred methods: Interactive Lecture Demonstrations (ILD), Game Based Learning (GBL)[2,3]. Peer Instruction, P&E method or Inquiry-based Science Education (IBSE). When applying teaching strategies, it is necessary to base these on suitable teaching objectives and content, school conditions as well as the pupils´ age. Professional competencies of the teacher also play a vital role. Evaluation of these competencies, along with teachers' and pupils' results, has been the focus of educational politics of nearly every country. Class observation is one of the most popular methods of evaluating teaching competencies. Footage-based class observation, or a video-study[4] is a type of inspection based on in-depth footage analysis of the whole lesson or a part of it. This concept has arisen from the practical shift in socio-humanistic sciences defined by 2 theses:

1. Practice is the basis of theory;
2. Theory has to be practice oriented[5].

The principle of class observation consists of three methodological steps: annotation, analysis, alteration (AAA method or 3A method). Annotation is a brief description of the lessons or part of it, focused on the set objectives, topic, teacher and pupils´ activity content, continuity of the curriculum and applied teaching aids. The analysis researches the teaching strategies applied by the teacher in order to achieve the set teaching goals, with the emphasis on developing critical and creative thinking in pupils. Alteration is a hypothetical suggestion aimed to improve, modify or change the learning situation associated with discussion[6].

As previously mentioned, educational process observation is an integral part of the undergraduate training for future teachers, as well as practicing teachers. The AAA method represents an innovative approach to class observation in terms of requirements arising from the valid Slovak Republic legislation.

2 Teaching Strategies in Technical Education

Technical education represents the area of education at the end of which pupils have acquired technical literacy and work skills. The teachers and their individual competencies, which "show in a specific way of managing the lesson and organizing pupils' work, i.e. strategies that focus on content processing by the pupils[7] play a decisive role in this education,, as well as the development of critical and creative thinking[8,9].

From the results obtained in the research[10] carried out within the framework of the project APVV-15-0368 - Practical Training in the Centre of Field Didactics, the Field Didactics in the Centre of Practical Training, the objective of which was to map the strategy application for creative thinking in technical subjects, we specified the following strategies:

1. leading the students towards acquiring basic user skills in various fields of human activity,
2. using various teaching aids,
3. using various technical materials and equipment,
4. creating situations that induce the need for new designs, application of product creation processes in order to induce creativity,
5. inducing experimentation with ideas, materials, technology and equipment,
6. small group activity application,
7. developing the ability within pupils to take responsibility for individual or group project results,
8. informing pupils about current labour market requirements and recent technology development,
9. shaping the teaching content according to B. S. Bloom's taxonomy,
10. project teaching application,
11. problem solving application,
3. applying methods for developing creativity[11].

Our objective was to apply the AAA method in undergraduate training of pre-school and elementary pedagogy students, as well as technology students and provide them with this specific assessment of teachers' professional competencies in implementing appropriate teaching strategies with emphasis on developing critical and creative thinking in children and pupils. In the following lesson analysis, we focus on strategies applied within teaching technical subjects, namely experimenting with materials in pre-primary education and developing user skills when working in small groups in lower secondary education.

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2.1 Experimenting with Materials

ANNOTATION

The educational activity was carried out with students of the Constantine the Philosopher University in Nitra within the practical exercise Methodology of Work Education. The educational activity was represented by a simulation of a real methodological output for the area of Humans and the World of Work in pre-school conditions. The output was realized with pre-school and elementary pedagogy students. The teacher in the given output was also a student. The content of the educational activity was carried out with the emphasis on performance standards arising from the educational area Humans and the World of Work and the Sub-area Materials and Technology:

- name various natural materials,
- examine and research selected characteristics of the materials.

The educational activity began with motivational narration, which smoothly became a conversation between the teacher (student in the role of teacher) and children (students in the role of children). The teacher told the children a story about the problem that happened on his way to school. On the way he used a shortcut, which led through different types of terrain (gravel, sand, clay). He finished the story by asking a question: "What do you think, pupils, which part of the road was the muddiest? Which part of the road made my shoes the dirtiest?" The story resulted in a brief discussion through which the teacher examined the children's answers. The teacher also asked: "which of these materials (sand, clay, gravel) transmits water the most? Each child was able to express their assumption. The main part consisted of a simple experiment. The teacher announced they were going to play researchers and asked the pupils to note down their assumptions into their worksheets (Figure 1) which they then verified by experiment.

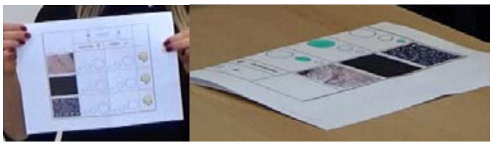

Figure 1. Work sheet

The teacher planned to carry out the experiment in groups, however, given the small number of children (5) in class, he suggested they do the experiment together. The children´s task was to distribute 3 different natural materials mentioned in the story - gravel, sand, clay - into the 3 glass containers, based on the verbal instructions from the teacher. Afterwards, they poured the same quantity of water into each container using a measuring cup and observed which material transmits water the most.

In the next section, the task was to drain the water from each container, using a sieve, and observe what changes had happened to it ("Did the water change its colour? Has its quantity changed?" etc.). Once again, the teacher directed the pupils´ attention to the experiment by asking suitable questions and emphasizing what they should be concentrating on in order to be able to formulate results.

Figure 2. Experiment results

From observation, the pupils figured out that the materials which left the water dirtiest were sand and clay as they dispersed in water. Furthermore, the least permeable materials of these were clay and gravel (Figure 2). Afterwards, the pupils concluded that the assumptions they noted down into their worksheets were consistent with experiment results. Finally, by means of additional questions, the teacher led the pupils to summarize their findings. He evaluated the activity and praised the children, and their work.

ANALYSIS

The educational activity was carried out in the spirit of strategical experimentation, with emphasis on the goals that the teacher tried to achieve throughout the whole course of the educational component. The set goals were aimed at comprehensive development of the pupils´ personality. Cognitive development was stimulated by working with worksheets, asking and answering questions, discussion and object manipulation. In addition, during the experiment children learnt about selected properties of natural materials and developed their skills. In order to achieve the development in the socio-affective area, the teacher provided everyone with the opportunity to express their attitudes, feelings and experience. The fulfilment of the objectives was particularly visible in the main part of the educational component. The educational activity consisted of a motivational, exposure, fixation and diagnostic part logically connected to one another.

In the introduction of the motivation part, the teacher induced the attention and activity in children with a motivational story about his way to school and a problematic task focusing on the permeability of materials. This introduced them to the issues and content of the educational activity. In a logical sequence, he proceeded to the main part, at the beginning of which he motivated the pupils again through the game of researchers. By a purposeful discussion, the teacher returned to the original issue of his way to school and dirty shoes and the children´s task was to note down their assumptions into the worksheets. In this section, the teacher did not address the images in the worksheets, which could have ultimately led to misunderstanding.

Subsequently, the pupils had the opportunity to verify the correctness of their assumptions using a simple experiment with natural materials. This method led them to be able to draw conclusions and acquire new knowledge from the issue of permeability of selected materials based on their own experience and observation. The teacher encouraged the pupils (through questions and practical work) to actively participate in the learning process instead of being a passive observer and led them to conclude their own findings based on practical activities. Implementation of the experiment was accompanied by continuous instruction and guidance from the teacher. Pupil´s task was to individually approach the table and distribute the same amount of natural material (gravel, sand, clay) into the 3 containers prepared. After that, they poured water into the containers using a measuring cup. By appropriately selected questions, the teacher constantly drew attention to the essentials of the materials and water. In the second part of the experiment, children were asked to pour the water out of the containers using a sieve and observe the material. At the end of the experiment, the teacher led the children to synthesis, i.e. to summarize the knowledge they had acquired throughout the experiment. Together they concluded that the most permeable material is gravel, at least permeable are sand and clay. The most soluble material is clay and the least soluble is gravel. Teacher repeated the question: "Which way should I have used in order to keep my shoes clean?" Significant part of experiments such as this is the confrontation of results and transfer of acquired knowledge into new situations and their use in everyday life. However, in this case, the teacher did not pay enough attention to this.

Worksheet evaluation was also omitted. The teacher only asked these (incorrect) questions: "Did you all have the right assumptions? Or "did anyone make a wrong guess?"

ALTERATION

The success of the experiment, and therefore, the quality of the gained knowledge, depends, among other things, on a purposeful and systematic approach (1. correct formulation, issue identification, 2. hypothesis formation, 3. finding a suitable form of experiment, 4. realization of experiment, 5. comparison of results and hypotheses, 6. generalization of the results, formulation of conclusions).

Our recommendation is to put emphasis on correct terminology, not to include suggestive questions, but rather questions that support the ability to observe and classify. It is essential to apply correct, professional terminology, as it is gradually becoming a part of the children's vocabulary. Pupils at this age mimic not only the activities, opinions, but also the words, concepts and expressions of the teacher. With the correct terminology, pupils create the right ideas.

Furthermore, we recommend including activities for familiarising with different materials. Experiments in technical education are of great importance, given that pupils acquire new knowledge through their own activities and experience. According to Trna[12] (2005), experiments have a motivational effect, increase the transparency of the researched phenomenon, develop the ability to solve problems in pupils, and require simple technical equipment used in everyday life. The teacher can include activities for learning and observing materials e.g. using motivational discussion and questions such as: “What is the material? Where can we find it? What would happen if we did not have such materials? Could we replace it with other material? What is its use?” In order to activate higher thought processes, it is advisable for the teacher to create situations in which the pupils themselves can design their own process of verifying selected material properties. It would certainly be appropriate for pupils to have more materials in order to observe the properties, as well as more time to get as much new and interesting information about them as possible. It is also important that the teacher provides constant guidance and help. Failure to do so may lead to misunderstanding of the task or activity and thus failure to achieve the goal. For a better and more effective knowledge acquiring, we recommend paying more attention to the transfer of already acquired knowledge into everyday life examples. The teacher also omitted worksheet evaluation.

2.2 User Skill Development through Small Group Activities

ANNOTATION

The lesson was realized with 6th grade pupils of elementary school (age 11). The teaching strategies applied by the teacher were in accordance with the performance standards of ISCED 2, the sub-area Electricity, Electrical Circuits, from the educational area Humans and the World of Work for the 6th grade of elementary schools. The main objective of the lesson was for pupils to design a solar powered vehicle model according to the instructions (Figure 3).

Figure 3. Solar powered vehicle model

The teacher chose the following lesson structure in order to meet the educational objectives: motivational part, exposure part and diagnostic part. The fixation part was omitted for the exposure part. The teacher has planned and implemented the situations so that pupils had enough time for realisation as well as validation of the model's functionality, which is an important prerequisite for the strategy of developing user skills.

The teacher intrigued the pupils and created a pleasant mood right at the beginning of the lesson. After the motivational demonstration of an all-constructed model and its functionality, the pupils expressed great excitement and interest in the task. Even more so, once the teacher informed them that at the end of the lesson, they will hold a solar powered vehicle model race in the school playground.

In the exposition part of the lesson, the teacher asked one of the pupils to distribute the kits amongst the class. Before the construction activity began, the teacher had established the rules and principles of safe work:

- extra attention was needed so that the pupils do not lose any of the kit parts, as they were very small, as opposed to the construction kits they normally work with,
- the kits included only Chinese instructions; however, this was not an issue since pupils were instructed to work according to the instruction images,
- the teacher also pointed out certain difficulties that the pupils may come across, as well as the way they should be addressed.

Pupils worked on model construction in pairs and according to the instructions (Figure 4).

Figure 4. Vehicle model construction

The teacher remained in the role of an advisor, intervening only in case pupils could not cope with something. Pupils worked independently without any major issues. At the end of the lesson, pupils verified the functionality of the constructed models as previously promised by the teacher – by taking them to the school playground and organising a solar powered vehicle model race. The activity was considered instructive and interesting by the teacher, as well as pupils.

ANALYSIS

The objective of the lesson was for the pupils to design a vehicle model according to instructions. The stated goal was cross-sectional, aimed at application of knowledge in the field of Electricity and Electric Circuits in the context of household work and home maintenance.

Based on performance standards from this area, pupils should be able to:

- assemble the model according to the instructions,
- carry out the model construction,
- verify model functionality, propose own functionality examination.

To implement these performance standards, teachers can apply building kit activities, as well as various design and handling activities in order to develop pupil´s user skills.

The lesson was practical and experiential. The teacher applied narration in the motivational part, i.e. they verbally described the pupils' goal of assembling the solar powered vehicle. In order to enhance the pupils' interest in the activity, the teacher demonstrated the target model which the pupils were supposed to work towards. Although the topic of solar panels is included

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in Technology curriculum for higher grades, the teacher briefly and adequately explained to the pupils the principle of solar powered wheel movement, which is that if the solar panel is exposed to direct sunlight, the wheels start to spin on the solar vehicle model. The fact that pupils immediately began making suggestions and examining the model functionality under sunlight exposure proves that this activity was suitably interesting for them. There was laughter and good mood in the classroom. The teacher instructed one of the pupils to distribute the aids amongst all the classmates. Teacher also chose work in pairs which was a prerequisite for developing cooperation, mutual communication and tolerance. Prior to the activity itself, the teacher informed pupils about possible pitfalls in the construction, the knowledge of which facilitated their activity. The teacher also provided the pupils with information about some parts of the kit. Not too much direction was provided on the instruction manual, since the teacher assumed the illustrations were clear enough for pupils to be able to carry out the construction according to them.

The pupils worked in pairs, whilst the teacher approached them individually and constantly supervised, advised and directed the activity. At the same time, teacher constantly allowed pupils to verify the correctness of their design, by comparing it to the model vehicle used in the motivational part of the lesson.

At the end of the activity, the pupils verified the functionality of the constructed models by placing them in a direct sunlight by the window as shown by the teacher in the motivational part. At this point, the teacher used the space for development of technical thinking and ascertained the pupils´ knowledge level of the unit Construction Basics. He formulated the questions in such a way that the pupils were able to come to the explanation.

Lastly, the models, as promised, were verified outside in the school playground, where a solar car race was held (Figure 5).

Figure 5. Functionality verification of constructed models

ALTERATION

The development of cognitive and psychomotor area of pupils´ personality represents the basis of the Technology subject. However, currently there has been an issue with a bad state of many classrooms and workrooms as well as lack of materials for practical activities. Teachers must get very creative and resourceful in seeking suitable alternatives to activities for achieving the educational objectives and personal development of pupils despite unfavourable material or spatial conditions. Therefore, we consider the inclusion of activity focused on the construction of a solar powered vehicle model as a suitable alternative for developing pupils' assembling skills. The vehicle model brought joy, experience and above all a desire to work into the classroom. Not only boys, but also girls were interested in this activity. The activity was aimed at enabling pupils to:

- cooperate in model construction,
- build the model according to the instructions/manual,
- critically analyse the illustration content in the manual,
- carry out the actual construction,
- verify model functionality, apply personal functionality examination.

Based on the teaching strategies implemented by the teacher, it can be concluded that these objectives have been fully met. Pupils worked with the kit according to the instructions and at after completing the assembly of the vehicle they had the opportunity to verify its functionality not only in the classroom, but also unconventionally on the school playground. The activity was therefore appropriately aimed to develop user (manual, assembly) skills.

However, in terms of complex personality development, the inclusion of practical activities should by no means eliminate the inclusion of methods for cognitive development. Therefore, it is recommended to create room for discussion on the topic or provide information that is closely related to it during practical activities, if the activity allows it. In this case, the teacher could have used the motivational method of updating the content of the curriculum in order to bring the content closer to the pupils with real life examples. Thus, through discussion, the teacher would have been able to include information previously acquired by the pupils to the curriculum at least marginally. (e.g. where they have seen solar panels, what they thought their purpose was, why they were called solar, etc.).

In relation to this issue, the teacher could have established a discussion on related professions and inform pupils about changes and development within technology as well as current labour market requirements. Our recommendation would be to discuss the professions that are related to the topic of solar panels or professions that require construction activities such as those that they had just performed with the vehicle model. Discussion could also focus on identifying pupils' opinions and relationships with professions and activities in relation to their personality traits.

The prerequisite for the best learning outcomes is activity evaluation, which is also the basis for further development of pupils, as well as teachers. Since evaluation was not carried out in this lesson, we recommend including at least a short discussion or open question method and point the pupils´ answers towards self-evaluation.

3 Conclusion

The content of technical subjects is an integral part of the educational process as it complements general education with an important component necessary for one to find success on the labour market. Through practice-oriented work, pupils are supposed to distinguish and use technical materials, as well as the tools necessary for processing these materials. In addition, pupils are expected to apply planning, organizing, work evaluation, and work in a safe manner. The teacher plays an essential role in this process. Their task is to create situations and apply teaching strategies with enough technical materials and their practical application. Through these materials, pupils are supposed to develop their skills in various areas of human activity by observing, exploring, experimenting, and problem solving at an appropriate level. The education content is primarily aimed at developing practical skills, however, specific cognitive technical skills, such as technical, critical and creative thinking are also coming to the forefront.

In relation to the presented outcomes of the above mentioned project, our future goals will include the creation of tools for evaluation of future teachers´ professional psycho-didactic abilities, particularly creation of tools for evaluating the outputs of practical training of teachers within various fields and their expert assessment by practice teachers or regional education representatives. In the final stage of this project we anticipate popularization of complex outcomes by making such methodological materials available throughout the academic community within the upcoming Centre of Practical Training.

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