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Current perspectives on innovative methods used in teaching technical drawing

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Abstract. This article emphasizes some innovative methods that can be used to improve the teaching of the basic concepts of technical drawing, for students of technical faculties. These methods stimulate both the learning process and personal development, ensuring the improvement and optimization of the educational process through the exchange of ideas and experiences. The innovative methods included in the case studies presented in this paper were applied in the teaching activities, at the subject technical drawing, and demonstrated both the motivation and implication of students, as well as the fact that effective results were gained by using these methods. The results of these case studies were reflected in the improved performance of students and can also be used to improve the quality of teaching and learning technical drawing.

1. Introduction

In order to increase the quality of the instructive educational process in the technical university education, an important aspect is to improve the traditional methods, but also to introduce new, innovative methods.

Innovative learning methods are modern ways of stimulating learning and personal development, they are teaching tools that promote the exchange of ideas, experiences, knowledge, ensuring the improvement and optimization of the educational process. Students are not just receivers of information, they actively participate in education in the educational process, developing the ability to express opinions and assessments on the issues studied.

In university education, both classical and modern methods are used, the ability and experience of the teacher being able to make any method used to arouse the students' interest and determine them to learn.

Innovative methods involve learning through communication and collaboration, which leads to a confrontation of ideas, opinions and arguments, creates learning situations focused on the availability and willingness of students to cooperate, on their direct and active involvement, and creates social interaction of group members [1].

For creating the optimal learning environment, teacher needs to take into account certain criteria in applying modern learning methods, such as: skills to be developed by the students, their intellectual level and abilities, accessible material resources and complexity of content [2].



2. Innovative methods used in teaching Technical Drawing

The integration of innovative methods in the educational process of technical university education depends on a multitude of elements such as: the type of lesson (presentation of new knowledge, systematization, resuming), group level, students' willingness to work individually or in groups.

Regarding the teaching of the technical drawing subject, teacher must help the students to understand the technical concepts and to reach the highest possible level of knowledge and thinking, using analysis, synthesis, application of new knowledge or problem solving [3].

Teacher must use the knowledge and experience gained to put students in learning situations that will ensure the training and development of skills required on the labour market, but also to acquire the ability to learn throughout life.

In the case of the technical drawing subject, a multitude of modern methods can be used, accompanied by specific techniques and material resources, some of them being presented below.

2.1. Teaching using the "Practical examples" technique - the connection between theory and practice

Students are interested in practical examples from the industry because it helps them understand better the theoretical notions taught in class. The use of practical examples helps to ensure the connection between technical concepts and practical applications, thus strengthening effective teaching and learning. The introduction of practical examples does not exclude theory but only helps to understand and learn theory in the classroom. It is very important to develop both the theoretical and the practical basis simultaneously [4].

The examples we are going to use in teaching must be as clear and appropriate as possible. For the effective implementation of practical examples the teacher must understand very well the given example and be able to explain it, otherwise it will cause confusion instead of helping students to understand.

Practical examples can be based on analogy, observation, demonstration and can be gathered into two classes:

- Examples which enable the explanation of the theory and of the new notions;
- Examples which present applications of the elementary principles.

2.2. Teaching using the "Flipping Classroom" method

The overturned class has become a very effective teaching method, whose popularity has grown more and more. With the help of this technique, students become active participants in the learning process, learning becoming centered on them, and teachers having the role of providing the necessary learning resources. Students have the obligation to gather all the information necessary for learning. Using various technological tools, they are encouraged to "build their knowledge", to fill in the gaps and to ask for clarifications when necessary [1, 2].

This method of learning is one of the best ways to train independent learning. To "overthrow" a class means to change the "order" in which knowledge and skills are formed. Students, instead of learning exclusively in class, learn at home by watching videos made by teachers. Discussions, practical activities and projects take place in the classroom. Students analyse and apply their knowledge by interacting with other students, but also with the teacher.

2.3. Collaborative learning method

This innovative teaching method involves encouraging students to participate in various projects. Today, collaborations are a very important life skill for one's future career. Teachers can help students to develop their collaborative skills in the classroom, allowing them to study and work in groups, to achieve the various topics and objectives proposed [1, 2, 7].

Today, collaboration as a form of teaching has become a very accepted teaching tool, where each student has the responsibility of the group of students, through the role he holds in that group. Some collect information, others write it, others look for images, a leader divides the tasks and presents the whole project at the end.

Knowing each other, students know best how to share their roles in the group, for example the most casual speaks in public-in front of the class, the one who has better IT skills searches for information on the internet or writes the project, etc. This form of teaching teaches students what empathy, negotiation skills, teamwork and problem solving means.

2.4. The method of learning with the help of virtual reality

A virtual learning environment is a computer-simulated space where students and teachers can "meet" and interact to work together. This type of system is based on a virtual environment (virtual classroom) that provides users (students and teachers) with a series of tools that serve the teaching-learning acts; moreover, through the use of computers and the internet, these tools have the role of adding value to the learning process [5].

The tools of a virtual learning environment allow teachers to create online tests, questionnaires, but also other educational content such as presentations, lesson plans and topics, allowing curriculum creation, tracking student progress, online communication (e-mail or chat).

Students can access a variety of materials (course information, additional links, PowerPoint presentations, tests, etc.), download, open files, and solve work tasks digitally.

For example, teachers who teach technical drawing can use 3D technology to visualize bodies, parts in space, for axonometric representations.

It is possible for students to work with objects in a virtual environment, such as to obtain a better understanding. This concept is valid for cases in which students need to understand data sets, difficult formulas and abstract ideas that may be otherwise unapproachable. For some students, learning by doing seems to be less complicated than learning through listening.

Virtual reality technology offers students a valuable opportunity to learn in a certain innovative way that creates a lasting and impactful memory in their minds.

2.5. Learning with CLOUD storage systems

Cloud storage systems are a set of technologies and service models, based on the internet, they imply the use and transfer of computer applications, resources with storage space, information processing and loading capabilities [6].

The cloud is a recent notion in the field of computers and informatics, creating the conditions to distribute computing services, access applications and information, to store data, it is a solution for using external IT resources, according to needs

Learning with CLOUD storage systems is a method by which teachers can store vital teaching resources, such as teaching projects, notes, audio readings, videos, etc.

They can be accessed by students from the comfort of their home, whenever they need, being just a click away from accessing the necessary information. It is also useful for students who for various reasons did not attend classes, so they can recover lost classes in a timely manner.

2.6. Stellar explosion method

It is also known as the starbursting method ("star" = star, and "burst" = to explode) and designates a method similar to brainstorming, which is not to be confused, although it involves organizing a group of students into a group and stimulates the creation of question to question, as brainstorming develops the construction of ideas on ideas [1, 2, 7].

Starbursting is one of the most relaxing and enjoyable teaching methods; stimulates individual as well as group creativity; creates the conditions for teamwork and competition; creates the opportunity of exchange ideas; develops group spontaneity and creativity, but also teamwork skills; emphasizes the stimulation of each participant in the discussion; it does not require too much time for prior descriptions, being very accessible to all students.

Basically, write an idea or problem to be debated on a piece of paper, then line up next to the concept, as many questions related to it.

The method contains the following steps:

- Propose the issue;
- Organize students into several groups, each of which writing down the issue;
- Elaborate in every group a list with different questions on the issue;
- Communication of the results of the group activity;
- Emphasizing the most interesting questions and the teamwork.

3. Case studies

3.1 Graphic organizer method - Spider diagram applied for the chapter "General rules of technical drawing".

The graphic organizer, as an active learning method, facilitates the essentialisation of an informative material to be expressed or written, outlining the idea / ideas.

The basic premise of the spider diagram is to familiarize students with an issue at a basic level, in the case of the technical drawing, applied for the chapter "General rules for technical drawings".

Students, at first, still have a low level of knowledge in terms of technical drawing. Using the spider diagram in the first chapter of the subject, a deeper exploration is encouraged, this method allowing a multidisciplinary approach.

The spider diagram gives students a way to record and organize their ideas, by completing custom worksheets. In a spider diagram, a main concept is presented on a page and lines are used to connect the ideas, thus obtaining as many details as possible about the topic approached.

Following the application of this method, one has found that the students realized that they knew more or less than they initially thought. Also, students increased their self-confidence by synthesizing individually issued ideas. As more ideas emerged, students achieved a graphic representation of an issue that otherwise might have been difficult to understand, because, for most of them, visualization is the best way to fully understand something.

The requirement of the graphic organizer method is to organize the learned information about the technical drawing, filling in each box (figure 1 and figure 2).

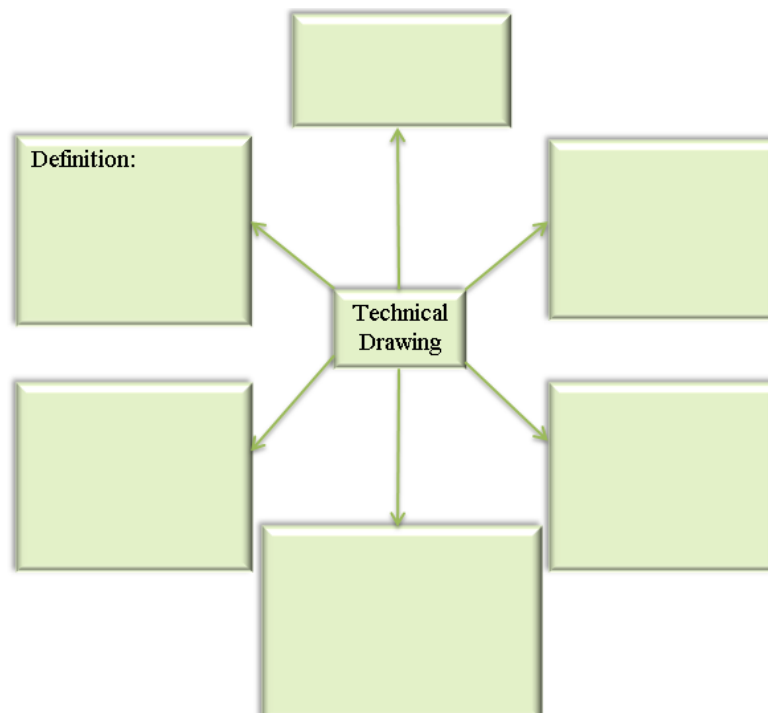


Figure 1. Spider Map diagram scheme

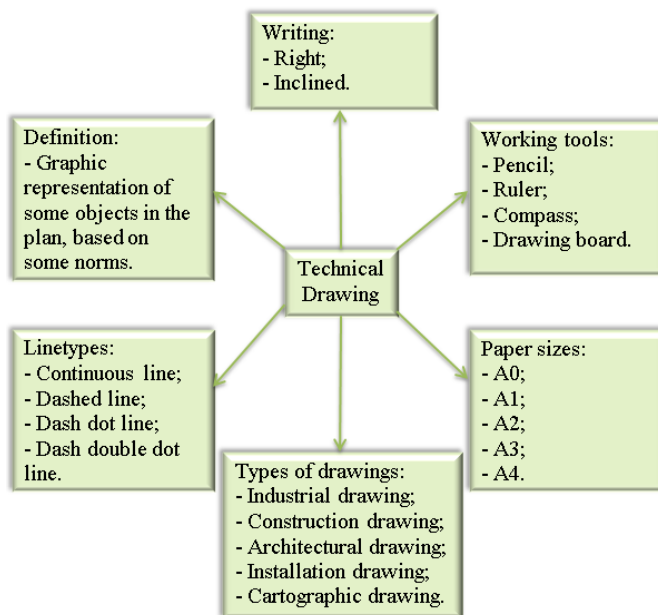


Figure 2. Spider Map diagram applied for the chapter General rules of technical drawing

3.2 Graphic Pyramid method. Theme: Dimensioning in industrial drawing

It is a combination between individual activity and group activity. It has the role of incorporating the activity of each student in an ample approach meant to solve a complex problem. This method involves organizing a structured activity in the following stages (figure 3):

- Descriptive - the teacher presents the data of the problem in question. The teacher writes on the board "Symbols used for dimensioning".
- Individual - students receive a worksheet with symbols that they solve individually in a short period of time (usually 5 minutes). Students must correlate between the symbols used in the dimension and the corresponding geometric elements.
- Pairs - groups of two students are formed, who check each other's results and try to answer the questions that were asked within the group.
- Groups of four students - formed by joining pairs two by two. They confront their results, conceive a new answer, in a formulation to which they all contribute, identifying the general conclusions in the areas of controversy resulting from each one's questions.
- The whole group - a representative of each group presents his conclusions. These can be noted on the board so that the answers between the groups can be compared.
- Decisional - the final solution is chosen and the conclusions are established on the steps taken and on the students' participation in the activity.

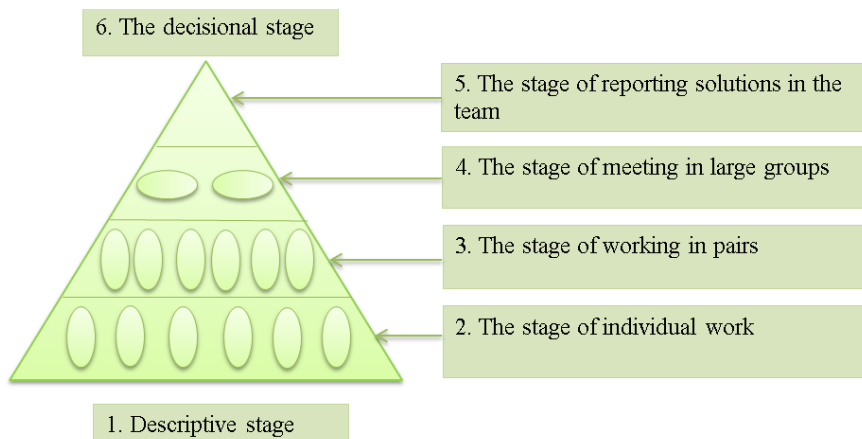


Figure 3. The stages of the pyramid method.

Figure 4 presents an example of using the pyramid method on the theme: Dimensioning in industrial drawing.

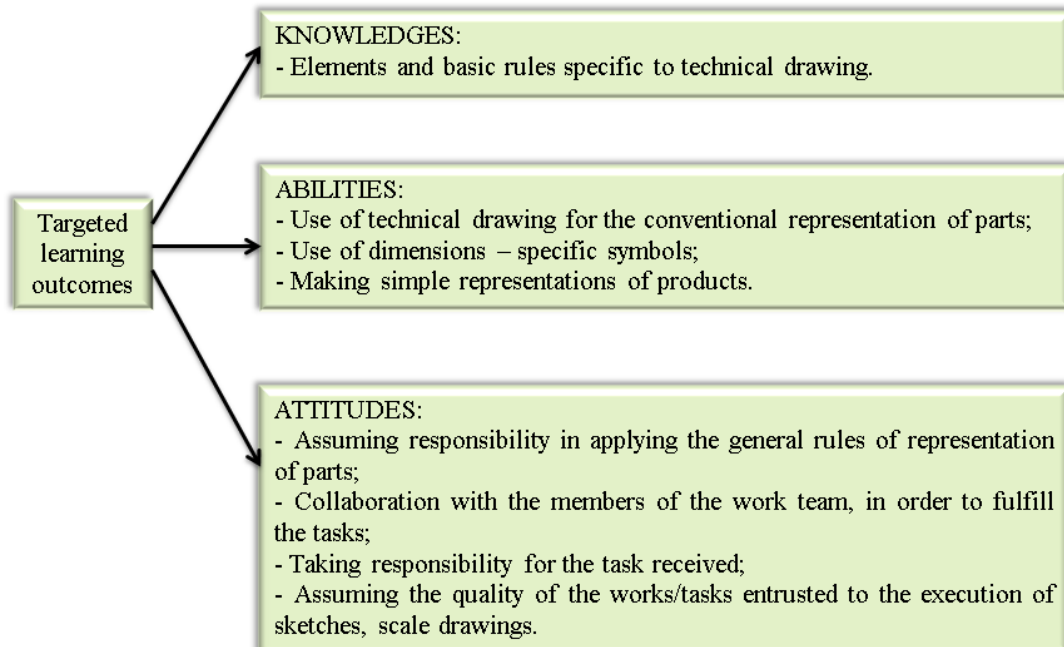


Figure 4. Example of using the pyramid method in dimensioning in industrial drawing.

4. Conclusions

This study aims to improve and diversify the teaching-learning process of technical drawing in university education, using innovative methods.

The objective of this study was to involve and motivate students to develop a greater interest in learning technical drawing, using innovative teaching methods. The methods presented in the two case studies were particularly interesting for both the teacher and the students who participated. The efficiency of using these methods is appreciated by students as having a high degree, due to the level of involvement, understanding and assimilation on the issues studied.

The results of these case studies were reflected in the improved performance of students at the final exam and can also be used to improve the quality of teaching and learning technical drawing.

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