

A new teaching method of improving capacity of visualisation and understanding of future mechanical engineers

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Abstract. Being an aptitude, human intelligence needs to develop a lot of exercise and knowledge. The ability to understand, visualize and solve problems must be cultivated and rigorously guided. This paper presents a new integrated method of teaching the Technical Drawing and Infographics, with the purpose of training new students. The method is based on the observations of the teachers during the last years, their experience in education and the suggestions of the students. The results of applying this integrated method are quantifiable, leading to a better attendance at courses, towards 95%, at a much lower risk of school dropout and not least, creating bridges between abstract and reality.

Keywords. teaching methods, technical drawing, CAD, mechanical engineers.

1. Introduction

Analyzing the new generations of students from the last year I have come to the conclusion that they have a low interest related to the subjects that make up the basic school syllabus of a future engineer. This decline in student interest is based not only on the content of the program, which should be updated to the specific needs of our day, but also the teaching methods. The latter must evolve, keep pace with the modern age, be captivating and arouse the student's desire to know and understand more about the subject

2. Description of the method

Not infrequently I have heard from the students the question: "But what does this matter use for me?" My answer was always simple and objective, except that the students were not convinced and left some skeptics. Based on the observations of the teachers, their teaching experience and the students' suggestions, it makes this integrated method a starting point for future learning styles and methods. One of the main goals is to develop skills in 2D and 3D modelling, with pencil on paper, but also on the computer, to understand and design new models to be integrated into the ships of the future. The method is very simple and consists in correlating the laboratory hours from the Infographic and Technical Drawing, so that what is taught in the technical drawing laboratory will be applied and developed within the infographic laboratory. The method is designed in three steps so that in the end the student has an overview and traceability of his laboratory work.

Step 1: Considering that in a group there are between 20 and 25 students, groups of up to 4-5 students are created who each receive a drawing element in the technical drawing laboratory (usually explain how to approach the drawing of a flange or shaft). Each group

works separately. After they finish exchange between them so that within 3 hours of laboratory each student has drawn at least 4 types of flanges or shafts.

Step 2: In the infographic laboratory the same groups are maintained and the 2D and 3D modelling is carried out of all the drawings executed in pencil. It is important for students to collaborate with each other to debate the problems that have arisen, obviously under the careful supervision and guidance of the teacher.

Step 3: Model and print 3D drawings (flanges or shafts) using a 3D printer provided by the laboratory and discuss any drawing and design mistakes.

Following these three simple steps, the student goes through all the phases from theory to practice, obtaining a finished product, thus being able to visualize the whole process: sketching and design (technical drawing), computer design (Infographic) and effective realization through 3D printing.

Besides the purely didactic purpose, this combined method leads to the improvement of the practical skills, to the increase of the students' abilities to solve problems as well as to the development of the communication skills between them. This will stimulate the interest, enthusiasm and creativity of future marine engineers [1].

In order to be able to quantify the results of the study, the following elements were monitored and recorded: attendance at school, increased attention, school dropout, school situation but also the response given by the students involved in a test in which they tracked the attractiveness of the course and the ability to understand the new concepts [2].

3. Case study

Between 2018-2019, starting with the second semester, a case study was conducted on a group of 25 students from year 1 of the electromechanical faculty. They were trained, and they were told from the beginning that they are part of a pilot project in which it is desired to apply a new teaching method by monitoring some aspects related to their school situation. The three steps described in the previous chapter were completed and the results were astonishing for both teachers and students. In order to have a starting base, all students were asked to complete a questionnaire consisting of three simple and objective questions. The purpose is to bring to light the way students see the teaching material and to draw some conclusions that will be the basis for the future actions.

The questionnaire includes the following questions:

1. On a scale of 1 to 5, how attractive do you think the courses you have taken so far? (1 – low attractive, 5 very attractive)
2. What do you want to change to become more attractive? Give at least two suggestions
3. On a scale from 1 to 5 how difficult do you find it to understand and assimilate the new concepts learned? (1- not at all, 5- very difficult)

Below are the results from which the study started:

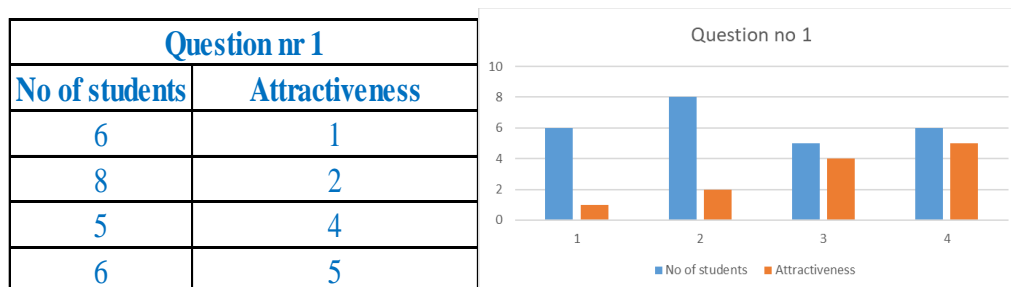


Fig1. Graphics of answers – question no 1

From the first data it can be seen that most of the students find the courses less visually appealing. This represents the first starting point in our analysis

The answers to the second question were different but most of them had a common point, namely the creation of more interactive courses with more examples from the practice. The last question was by far the most difficult. This aims to highlight their level of knowledge, given that the new concepts taught are derived from those learned in high school. Their answers lead us in a direction we already suspect; namely that students have gaps in the basics taught during high school years.

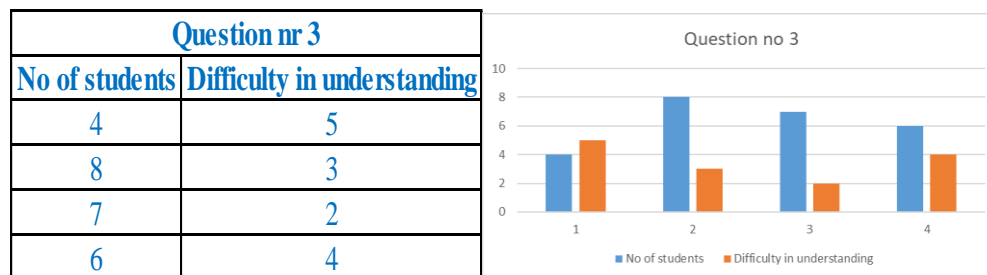


Fig 2. Graphics of answers – question no 3

Analyzing these results carefully we drew the following conclusions:

- due to the lack of attractiveness of the courses the attention and interest of the students decreases,
- the absenteeism increases,
- the level of knowledge drops dramatically and from this point the school dropout is very close.

In this study, the most difficult moment was the formation of groups due to the different personalities of the students. We tried to form homogeneous groups, within each one being a female person.

The teachers involved in this project were asked to change the format of the courses and to adapt them so that everything was as visually and captivating. The results began to be seen after the first two weeks of courses. As the seminars are very interactive and at the same time the students have a high degree of freedom in presenting their opinions and choosing the way to solve problems, they have begun to participate in the largest number to seminars.

The fact that what they were drawing at the time of technical drawing they projected on the computer over a few days in the infographic laboratory led to the creation of constructive discussions between them, the role of the teacher being only guiding and observing. And the most spectacular element and the one that really made them more aware of the need to understand and deepen the basic engineering materials, was the 3D printing of the elements first drawn by them on paper and then projected onto the computer.

4. Conclusions

The conclusions of this teaching method, and of our study, are as relevant as possible and lead us to the fact that if we want to have future students and future good engineers to rely on,

we must provide availability, flexibility, adaptability to their needs and also try to visually improve the subjects taught.

The monitored elements showed a positive growth:

- there has been an increase in the students' attention due to the changes made to the courses taught,
- interest in these matters has increased,
- the school situation has improved in some cases

The most encouraging result was that students began to demand that other teachers adopt such methods.

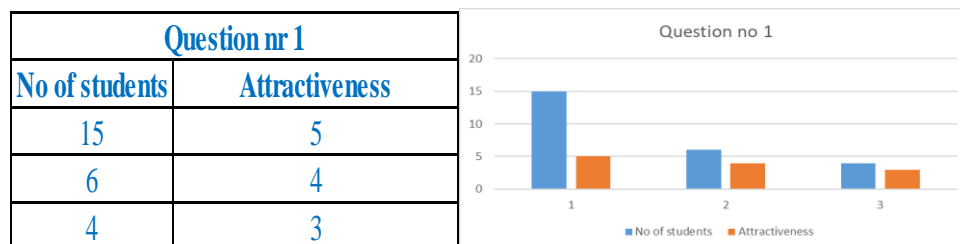


Fig. 3 Graphics of answers – question no 1

The graph presented above shows that the students became more interested in the respective disciplines. And the basic element that is not seen but it appears from the analysis is that no student has ever thought about giving up classes (leaving school).

References

- [1] Raicu Alexandra, Emil Oanta - Modern Education Facilities for CAD/CAM/CAE Training of the Future Maritime Engineers, *Advanced Materials Research*, vol. 837, Trans Tech Publications, Ltd., Nov. 2013, pp. 769–774. Crossref, doi:10.4028/www.scientific.net/amr.837.769;
- [2] Nita Alexandra, Raicu Gabriel Improve Maritime Education Training Through Online Teaching, *Journal of Marine Technology and Environment*, volume 2, Constanta Maritime University
- [3] Silberman Mel - Active Learning: 101 Strategies To Teach Any Subject, 1996, ISBN-0-205-17866-9
- [4] R. I. Issa and A. J. Saleh, The Difficult Application of Modern Education Technology from the Point View of the Members of a Teaching Staff , *JUBPAS*, vol. 27, no. 1, pp. 206-227, Apr. 2019.
- [5] Vladimir A. Tsvyk, Irina V. Tsvyk, Digital Technologies in Modern Education: Ethical Aspect, 5th International Conference on Arts, Design and Contemporary Education (ICADCE 2019), August 2019, ISBN 978-94-6252-777-5.
- [6] Hyungshim J, Eun K, Jhonmarshall R, Why students become more engaged or more disengaged during the semester: A self-determination theory dual-process model, *Learning and Instruction*, Volume 43, June 2016, Pages 27-38.
- [7] Anuradha, M. K. Ariyartne; Faiz, M. M. T. Marikar, Innovative teaching technique: the 3T pedagogical model for computer science degree programme, *South Eastern University International Arts Research Symposium -2019*.
- [8] Wang V., Torrisi- Steele G. ,Handbook of Research on Challenges and Opportunities in

Launching a Technology-Driven International University, 2019.

[9] Beard, Ruth M.; Bligh, Donald A.; Harding, Alan, Research into teaching methods in higher education: mainly in British universities, Guildford, England: *Society for Research into Higher Education*, 1978.

[10] Baeten M., Struyven K., Student-centred teaching methods: Can they optimise students' approaches to learning in professional higher education?, *Studies in Educational Evaluation*, Volume 39, Issue 1, March 2013, Pages 14-22.