Abstract: The paper represents a project of applied research, on how to teach more effectively the subject of technical drawing, using Student - centred education methods. The authors applied a new method of interaction with the students and teaching during a semester and the conclusions were drawn comparing the final results of the classes on which this project was applied with the ones where the classical method of teaching was applied.

Keywords: technical drawing, presentation, team work, public speaking.

1. INTRODUCTION

The European higher education system is focused on achieving a fundamental objective in creating a Europe of knowledge, creativity and innovation [1]. According to the Ministry of Education, the mission of higher education is to generate and transfer knowledge to society through initial and continuous training at the University, scientific research, development, innovation and technology transfer through individual and collective creation, as well as utilization and dissemination of the results [2]. The Bologna Process aims to create a compatibility between European higher education systems, increasing their transparency and mutual recognition [3].

Teaching in institutions of higher education involves in this case a curricular reform task requiring substantial development oriented to learning outcomes. The concept of education focused on student interests requires now new approaches to teaching and learning at all three cycles of study. Consequently, curricular reform promises to be an ongoing process leading to high quality and flexible learning pathways adapted to the needs of the public.

2. STUDENT - CENTRED EDUCATION

Student-centred education (SCE) is both a mind-set and a culture within an institution of higher education and is a comprehensive approach to learning related and supported by constructivist theories of learning. Student-centred education is characterized by innovative methods of teaching aiming at promoting learning through communication with teachers and other students involved in the learning process. These methods consider the students as active participants in their own learning, developing their transferable skills, such as problem solving, critical thinking and reflective thinking.

According to the Educational Policy Centre, the SCE concept is being discussed and applied in many projects, such as:

- Leuven Communiqué [4] states that "student-centred education involves focusing on the interests of learners, new approaches to teaching and learning, effective support and guidance structures".
- "Time for a new model in education: student-centred education (T4SCL)" project coordinated by the European Organization of Students (ESU) together with Education International (EI) [6].
- Quality Magazine in Higher Education Institutions is a scientific publication that focuses on strategies, policies, practices, methods and techniques assurance, implementation, incentives and continuous improvement of university education quality [7], [8].

SCE was assigned to Hayward since 1905 and then, to Dewey, in 1956. Carl Rogers was then associated with extending this approach to a theory of education in the 1980s and this approach to learning was also associated with Piaget's work (evolutionary learning) and that of Malcolm Knowles (learning directed to itself) [9].

The following ideas concerning SCE are based on the Toolkit for students, teachers and high education institutions, and are part of the project "Time for a new model in Education: Student-centred education", funded by the European Commission [6].

2.1 Principles underlying SCE

These principles give a clear approach on SCE and bring into debate the matter of the SCE subject.

- Principle I: SCE requires continuous reflection process. SCE philosophy is that teachers, students and institutions need to reflect constantly on systems of teaching, learning and infrastructure in a manner that would continuously improve the learning experience of students and to ensure obtaining the required learning outcomes of a particular course or program component in a manner that stimulates critical thinking of learners and develop their transferable skills.
- Principle II: SCE does not propose a solution of the type "One-Size-Fits-All". A key concept underlying the SCE is the realization that all higher education institutions are different, all teachers and students are different. Therefore, SCE requires an approach to learning that provides a support structure for each given context and appropriate teaching and learning styles for the participants.
2.2 Benefits of using SCE

If implemented correctly, SCE delivers benefits for all, including the institution, students and staff involved, unions of higher education staff, student organizations and society as a whole. Given this context of higher education across Europe, availability of higher education for the general population and the workload of teachers, there are many benefits that can be gained by implementing the SCE concept.

Below is a list of these benefits:

- **Determination of students to be a part of the academic community.** It is said that students are part of the academic community but in practice this can be difficult because of various rigid practices of teaching. By SCE students can become a part of the academic community, given that teachers act as an advocate rather than an instructor. By encouraging the students to think for themselves, they will get faster results on critical thinking and their analytical skills. In this context, research-based teaching is becoming more accessible. Teachers are able to talk on their research and listen to students opinions on them. Improving cooperation can further lead to increased interaction and student engagement. This can lead to increased participation in research and development, also contributing to the development of a given course, from the sense of belonging and ownership of the students. Finally, it could encourage more students to join as members of the academic community, because one must not forget that the students make the future teachers.

- **Increased motivation to learn:** SCE encourages deeper learning, as shown in the Learning Pyramid below. Retention knowledge varies depending on how the material is taught, but all the active learning accumulation index is higher than that of the traditional forms of learning. Often the student is motivated to learn through SCE, because the set of tasks requires original thinking and an increased interest in the topic of study. As suggested in the Learning Pyramid (Fig. 1), students retain more of the information learned where that process involves learning and active participation [10].

![Fig. 1 Learning Pyramid](image-url)
• Independence and Responsibility in Learning: within SCE, students must engage in the course material, in control of their own learning. This helps the student become more independent and easier to adapt after leaving the higher education environment. This ability of the students to be independent enable them to learn more effectively and develop other skills such as teamwork, effective oral and written communication, division of tasks into priorities and critical analysis. In addition, students can develop transferable skills that would help them work more effectively in their future careers and life, in general.

• The consideration given to the student’s needs: SCE enables students to study in a flexible manner, by studying part-time, distance learning or in an e-learning system. SCE approach demonstrates that learning is not limited in time and space, the way it was with traditional education. Different learning needs of the students can be met and because they can address the learning materials in different ways. For example, some students work better with audio-visual materials, while others prefer to read. While the benefits of SCE seem obvious for the students, there may be concern if the same situation applied to the teachers, as well. Below are laid out some of the teachers benefits:
  • An interesting role for the Teacher: the teacher is there to only facilitate the learning and make it happen. This is a very good opportunity to challenge students academically to improve their learning.
  • Positive impact on working conditions: given that SCE provides the opportunity for learning to take place in different ways, teachers work may become more interesting and negative aspects of working conditions normally associated with teaching can be improved.
  • Continuing Personal development: SCE allows teachers to review and improve teaching methods and courses to optimize both course content and playback methods of teaching.
  • Increasing the involvement and motivation of the students: involvement and active participation of the students make the teaching profession more interesting.
  • Professional Development of Academic Community: SCE can provide a much higher level of professional development, skills and competencies relevant for both personal development and for career advancement.
  • The Mentor Statute: it takes into account innovation and enable teachers to conduct classes in the manner they want, while giving students the flexibility to develop in the way of their choosing.

2.3 SCE learning methods

What teachers need to consider when opting for a method type SCE learning over another is the public that they have to work with. Not all students are motivated to learn in the same way, therefore, in the classroom, the teacher can use one of these methods, or a combination of them:
• Buzz Groups (discussions in groups of two)
• Snowballing (turning buzz groups in groups)

• Cross-overs (mixing students in groups)
• Use meditation group type (tutorial)
• Round tables (one by one, each student speaks)
• Writing reflections on what they have learned (lasting 3-4 minutes)
• Presentations of the students
• Poster Presentations
• Role play
• Mind-maps diagrams, made by the students

Outside the class, the students could have the following tasks: independent projects, discussion groups, mentoring each other, teamwork, debates, field visits, internships, using learning logbooks, computer assisted learning, writing media articles and developing a portfolio.

3. CASE STUDY

3.1 Identifying the problem

In the presented case study, the first step was identifying the problems that the students are confronted with.

On the basis of deep psycho-sociological research, in the past 20 years, according to S. Chelcea [11], there are 15 important professional values. These are the following: altruism (A), aesthetic (E), intellectual stimulation (Si), professional success (R), independence (I), prestige (P), leadership (Co), physical ambiance (Am), relations with superiors (Rs), relationships with colleagues (Re), way of life (Mv), variety (V), creativity (C).

Taking into consideration the authors didactic experience, validated by the results given by “Chelcea Questionaire”, “The relationships between the colleagues” and “The intellectual stimulation” appear to be the last scored by the first year students from the present case study [12].

3.2 The objective

During Technical Drawing classes, the authors want to prepare the students not only for obtaining the best results at this subject, but for a research carrier, as well. During these classes they will learn about rules of Technical Drawing, the way of reading and understanding plans and technical sketches, combined with team work and overcoming the fear of public speaking. The authors thought that allowing students to work in teams should increase the chance of improving the relationships between them. In the case of intellectual stimulation, the students were put in the situation of preparing the classes for themselves, preparing a presentation of the subject of the class and present it to their colleagues.

The subjects were chosen from the first year students from the Faculty of Civil Engineering and Building Services and the study was conducted during the second semester, for 13 weeks. The professors took time during the week to advise the students, for at least 2 hours during consultation time.
The title of the project was “Technical drawing for students, by students”.

The research skills that were aimed were the following:

- The ability to objectively analyse the results of others and their own, being able to grade the other class mates
- The ability to synthesize and to present the project status to the group
- Knowledge at the university standards
- The identification and accessing the appropriate bibliographical resources, recognizing the possibilities offered by these bibliographic resources
- The use of information technology databases and information management documents for the discussed subject
- Having the desire to learn and the necessary skills to identify new sources of information
- Being creative, innovative and original, developing the ability to find solutions to problems and to deliver new ideas
- Having the flexibility and openness to recognize the weaknesses of their research and to analyse objectively the results of others
- Being able to identify the need to improve, coming up with a plan for self-improvement
- The ability to self-discipline and work without supervision
- Being able to put together a well-structured and clearly written material
- The ability to communicate verbally using arguments and clear ideas,
- Producing a high quality presentation
- Being able to make a public presentation on research results, providing the lesson to the group
- The ability to teach, sharing information with others and being understood by others
- The understanding of the interactions between team members and efficiently working together in a team
- Developing an effective communication with other team members, listening and receiving feedback

3.3 The project development

For the first step, the teacher needed to provide the students a laboratory guide and a bibliographical list of books that can be purchased at the library faculty or given by the teacher.

The second step was dividing the class into groups of 3 to 4 students that will form the “teaching” teams. Each week, a team had to prepare and present the theory to the class, teaching the others a Technical Drawing subject. Two days before the class, the professor had to meet with the designated team for that week and check if they are prepared, giving them ideas and preparing them for the possible questions they might receive during their presentation. During the laboratory class, the chosen team presented the material (each team member had a part to teach), followed the work of their colleagues and answered their questions. They were teachers at that time and had all the duties of a teacher. As an example, the development of a lesson taught by students and the same lesson, taught by a professor to a class not participating at this project is presented hereinafter.

The subject of the lesson is: “Threads and threaded joints”.

In the class not participating at the experiment, the teacher started the lesson by calling the attendance list, making order in the room, and presenting the lesson to the students. Then the professor talked about threads, thread types, thread dimensioning, and drawing rules for threaded joints, with students writing notes on the notebooks and looking at the theoretical notions from the course book. At the end of the presentation, the students received a home assignment, according to the topics of the practical works and they started working in class. While they worked, the teacher corrected and graded the home assignments from the previous class. Students asked questions and discussed about the subject taught during the course. Finally, during the individual work, the teacher responded to students need to be helped with the new assignment topic.

In the case of the lesson taught by students (the team is presented in Fig.2, teaching the same lesson about “Threads and threaded joints”), they presented the lesson following the Lesson Timetable previously prepared by the teacher (Fig. 3). They had to check the attendance sheet, kept the peace and quiet in the classroom, checked student assessments and graded their classmates, as shown in the Lesson Timetable.
Discussions between students and student-teachers were left for after the lesson topic was presented, with students carefully writing down the questions they wanted to ask. This made students more alert and mobilized them to pay attention to the presentation that was taking place. At the end of the presentation, two of the student-teachers graded their colleagues’ home works, and the other student-teacher and the professor assisted those who worked on the given home assignment in the classroom. This way, work became more efficient, instead of just one person grading and helping, there were four people who had the ability to note and help those who needed it. The fact that student-teachers helped their colleagues opened a better communication between each other. Students who graded the previous home works had the opportunity to understand the way the grading system is done, helping them to be more invested in their own home works.

The final evaluation was performed by team “teacher” and the professor, taking into consideration the team teacher notes and observations on the class.

Students’ evaluation had certain guidelines, such as:
- The ability of students to work in teams
- Their ability to select, synthesize and present the subject, according to imposed standards
- The seriousness they have showed in taking over the role of the teacher

The group of students participating in the experiment was made up 32 students, all men. The group of students from classical teaching was made up 30 students, from the same year of study, also all men.

After a semester of study, certain differences between the students’ results were observed:
- In the group of students participating in the project, 32 persons, 15.63 % recorded grades of 8 (5 out of 32 students), 34.38 % of 9 (11 of 32) and 50 % had grades of 10 (16 of 32) (in Fig. 3, the group represented with X, the group of 32 students). The attendance at the laboratory hours was on average 99%.
- In the case of the students taught by the classical method, the final grades varied between 7 and 10 in the following way: 16.67 % graded 7 (5 of 30), 20 % graded with 8 (6 of 30), 30 % with 9 (9 of 30) and 33.33 % graded with 10 (10 of 30) (in Fig. 3, the group represented with black, the group of 30 students). The attendance in the laboratory classes was on average of 90%.

At the end of the semester, after getting their final grades, the students in the project participated in a poll. The applied questionnaire consisted in questions on how the interpersonal relationships had improved and whether they felt intellectually stimulated during the experiment. These two aspects were the issues that were wanted to be improved by this SCL method at the beginning of the semester.

Students responded by an overwhelming majority of 96.88% that this method has considerably improved their relationships with their colleagues and 93.75% felt intellectually stimulated and overcame their limits of shyness and public speaking phobia.

Students told about certain challenges they have encountered in preparing the lessons and how they helped each other to make a better presentation, as a team. Some admitted that the most difficult part was to explain the topic to others, especially the questions and answers part. They admitted how sometimes they had to become inventive to make themselves understood and useful, bringing different objects with them, in order to better explain the subject they’d prepared.

It was also difficult for them to grade their colleagues on their home assignments, as they realized how difficult it was to maintain their objectivity.

All students participating in the project appreciated this way of interaction, some even embracing the idea of following an academic career in the future.

4. CONCLUSIONS

Comparing the two groups of students, one of which was part of the project and one used the classic teaching methods, the following conclusions were drawn:
- The students participating in the project became closer to each other, by working in teams and preparing the presentations together
- They developed the ability to understand the grading process and not overestimate their own work
- The understanding of the Technical Drawing subject was improved by using this teaching method, by preparing the lessons by themselves
- They felt intellectually stimulated in order to find methods to make the others better understand the lesson
- Their self-esteem improved by giving them the ability to grade the other colleagues and taking into account their observations for the final grade
- The classes were more dynamic and fun
- They have noticed an improvement in their public speaking techniques
- The relationship between professor and students improved by assigning the job of teaching to the students. They have understood that teaching is not an easy task and respected the professor job more
- The attendance at the classes where the experiment was performed was higher than in the other group
- The students were pleased with themselves and their achievements, having the feeling that they have really
gained new skills and another level of interaction with their colleagues

- Some of the students opened themselves to the idea of becoming teachers in the future

In conclusion, using this SCE method of teaching proved to be more useful and appreciated for both students and teachers, proving that SCE methods are, indeed, the future in higher education.

This experiment was important for the authors because it showed them that in higher education these non-conventional methods can produce wonderful results. Although this method has been successful for the Technical Drawing subject, it can certainly be applied to other study topics, as well.

For future reference, the authors want to further apply this method, because the results can be more relevant after several generations of students will participate in this project.

However, the initial aims, to improve student relationships and intellectual stimulation have been successfully met. With each generation, depending on the professional values needed to be improved, the authors aim to develop this project in other creative ways to help students achieve their goals and make the best of their innate qualities.

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