

# Improving the engineering education system – a students' perception

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**Abstract.** Nowadays, we hear more and more complains about the quality of the Romanian educational system that decreased over the last decades. Therefore, one of the three pillars of the 2018-2030 strategy regarding the education system is "the adaptability of the educational system to external changes and trends of the future". As everybody may notice, trends change with every new generation. Those who are now students, the so-called members of the Z-generation are different from those before them. The authors consider that to identify the best teaching methods for increasing the efficiency of the educational process, it is necessary to address to the representatives of the Z generation. Starting from their expectations, a more efficient strategy can be developed. This will lead to an increase in the quality of the educational activities and a better integration of the graduates on the labor market. The authors chose two universities in Romania (University "Politehnica" of Bucharest and University of Petrosani) for the pilot sample and led several focus groups that aimed to identify students' dissatisfaction and expectations towards the educational process. After analyzing the results, there were identified several elements that can be implemented in the didactic process for improving it.

## 1. Introduction

Generation Z was born after 1995 and is part of the generation that does not conceive the world without internet. They are active, and Sparks & Honey [1] says that 60% of them want to change the world compared to "only" 39% of the Millennials. They hate hierarchies, and they feel able to take the boss's place anytime. Furthermore, they do not compromise on free time and personal life.

All these characteristics have produced a strong earthquake in the labor market. There are tens of thousands of available jobs, but not candidates. Studies show that one in four young people has no plans for the future and does not want to work. They do not want to work eight days a day in an office; they take a long time and work only if they have inspiration. To bring them to companies, there are employers who have decided to completely change the rules.

Given these, also the educational environment deals with a serious challenge in attracting these students into classrooms.

The anthropologist Vintilă Mihăilescu considers that "Digital natives are another type of human. When language becomes technically 90%, and social relationships include that much technology that can be called techno-relation, it already means that we deal with another type of human" [2].

Interactive teaching strategies promote active learning, involve sustained collaboration between students who, organized into micro-groups, work together to achieve pre-established goals. The teaching

environment places the emphasis, not on the role of speaker of informational messages but the roles of organizer, facilitator, and mediator of learning activities. The teaching approach is designed so that the center is the student, not the teacher. The role of the teacher remains a capital, but by renouncing the old rigid and uniform educational practices, he becomes the organizer of a learning environment tailored to the peculiarities and needs of the beneficiaries, facilitating the learning process and developing skills. The focus is on how assimilated information is processed, structured, interpreted, and used in various situations. Thus, students acquire solid skills, but also the confidence that they will prove operational and will serve them authentically in various life contexts.

The teacher influences the active and creative behavior of the student by asking for answers to a problem by organizing the information and training activities of the students by emphasizing the development of cognitive applicative processes,

The didactic strategy - in a postmodern vision - is thus the fruit of collaborative participation of the teacher with the pupils, completing their work plan with their interests, wishes for knowledge and intellectual activity. Thus, they can express their desire to learn through cooperation, teamwork, collectively or individually, they can opt for certain teaching materials to use, for specific methods, techniques, or working methods. Giving them the chance to make such choices, professor it contributes to increasing activism and developing the creativity of their pupils and teaching strategy, that comes from the harmonious combination of all stakeholders can successfully lead towards achieving desiderates primarily by providing learning.

## **2. Methods**

The main objective of the research was to identify the students' perception toward the state of art of engineering education system starting the conclusions of the Presidency's project "Educated Romania". The authors consider that to identify the best teaching methods for increasing the efficiency of the educational process; it is necessary to address to the representatives of the Z generation. Thus, starting from their expectations, a more efficient strategy can be developed. This will lead to an increase in the quality of the educational activities and a better integration of the graduates of higher education in the labor market.

The definition of the variables of the research had in view their conception to reflect the researched problem and to be in line with the trends in the field of the literature [3,4]. This research has operated with several categories of variables: basic variables, descriptive variables, situational variables, independent variables, and dependent variables. Qualitative research was designed to answer questions such as "Why?" and "How?" to discover, examine, and understand the root causes of the phenomenon.

To achieve the objective of this paper, qualitative primary research was used, based on a focus group which brought together 12 students from the final years. The topic of the focus group was "students expectations towards the didactic process", the students responding to several 10 open questions. In this context, specific interactions were developed, on the one hand, between moderator and participants (questions and answers) and, on the whole, between the participants (debates, questions, answers). The focus group was practically a group interview, with people representing a specific and homogeneous audience. The main disadvantages of the focus group are the existence of a very close relationship of dependence between the quality of the moderators and the quality of the obtained results, respectively the fact that there is the risk of reaching hasty generalizations when they are not followed by more complex investigations. That is why the focus group sessions were recorded to be analyzed in detail, and the moderator created a relaxed atmosphere in which the members of the group felt comfortable and were able to express themselves freely. Two focus group events were organized in each university center to see if the results of the separate event analyzes were similar.

The second step within the present demarche was to identify several strategies to improve the detected quality level of engineering education system. For that, several semi-structured interviews were conducted. Those interviews were held with the most talkative subjects for the focus groups.

### 3. Results

When assessing the focus groups' activity, there were several elements that came up frequently in terms of complaints towards the educational process or the educational infrastructure, as follows:

- The classes embed too much theory and too little practice
- There is unaddressed/unspecific information or too general thus the examples are not helpful enough
- During laboratories are used obsolete computer programs
- There is a lack of correlation between theory and labor market demands
- There are few practical applications
- Lack of internet in some rooms, video projectors, interactive whiteboards

It is interesting to mention that no matter the university nor whether there was the master of bachelor students, the main complaint emphasized was related to the fact that the teaching methods are conventional and they consider that their digital skills are not used.

Given these, one can draw the following proposals of improvement:

- the use of tablets and smartboards during seminary activities at first and afterward maybe even during lectures
- participating in debates or free discussions rather than solving exercises
- using simulation software for a better understanding of in vivo technical systems for applying more the theory into practice
- solving case studies
- use of modern software programs that are specific to engineering and management environment
- involving students in designing the training activity
- creating blended courses
- using teaching strategies based on action, application, research, experimentation

Upgrading exposure can be done by prior notice the plan and objectives pursued, the use of the genetic process, explanation, anchoring in the reality of time, the use of the teacher's personal research, rhetorical questions, positioning, making opinion polls, formulating some value judgments illustrate by public education presentation computer, exposing the opponent, exposing debate etc.

### 4. Discussion

When using an interactive methodology, the roles of the teacher are diversified, enriched, so that he becomes an animator, counselor, moderator, participant with his students to solve problems, even a member of the working teams. It increases the degree of activism and the student's involvement in the activity, from the simple receiver to the active participant. Interactivity also implies a positive attitude towards human relationships, the importance of teamwork, and openness to co-operation, an attitude of supporting the ideas that emerged through collaboration with others. It specifies interactive teaching methods and multi-relationship between teacher and pupils, between student and colleagues, on the one hand, pupils and content on the other.

Exposure methods do not require exchanges between educational agents, being unidirectional, the message that they only tear from the teacher to the student. The interactive methodology aims at achieving cognitive goals (stimulating higher cognitive processes, developing the capacity to link knowledge to each other, and creating conceptual networks, developing multiple intelligences, etc.) and achieving socio-emotional goals. If the decision of the teacher aims at presenting the information in an actively problematic way, requiring the direct participation of the pupils in the rediscovery of knowledge, the methodology used also involves active and interactive methods (problem, discovery, collaboration, case study, mutual learning, etc.).

The academic environment is currently focusing on promoting techniques and methods that focus on active student participation; the direct interest of its development training, when distance-based methods conditioning, memory, and repetition.

There are several ways of activation of students, which educational practice and pedagogical research have validated [5, 6,7]:

- the use of a system of activation training and activation methods, such as heuristic approach, problematization, discovery, modeling, experiment, assisted training / self-training computer, case study, role play, learning using teaching simulators
- using methods to develop students' creativity;
- the integration into the training and self-training activities of the educational means and the valorization of their stimulating function by ensuring the interdependence with the other components of the didactic strategies [8].

Games have been created with the purpose of entertainment for a long time. They have always attracted people because they provide fun and excitement. For this reason, game developers have tried very hard to invent and introduce new ways of enjoyment.

Thankfulness to the rapid advancement and vast expansion in computer hardware and visualization technologies, every time, the graphical detail and definition of games have become more realistic and accurate to the player. With the ability to mimic or simulate reality, some game designers started to adopt a purpose of playfulness to develop another kind of games, a more serious one. Those applications can be used for research, education, and training as if they are seen as fit or compatible with the study and finding objectives. When discussing the use of games or concept of gaming in education, there are at least four categories of an existing idea emerging in the literature.

- **Serious Gaming:** The term represents the use of games for specific purposes or other benefits, such as learning, researching, and training, instead of entertainment value only. It may look just like playing digital games, but its objective is to achieve something extraordinary.
- **Simulations:** Simulation technologies are quite similar to severe games unless they can replicate and visualize the real-world objects or environment for real-life training.
- **Game-Based Learning:** The concept refers to the use of games in the traditional classroom to strengthen the course objectives and to enhance the learning and teaching experience. Game-Based Learning is considered a branch of serious gaming that designed to deal with designated learning outcomes.
- **Gamification:** Gamification adverts the use of game design elements in non-game contexts to motivate or influence desired behaviors. Those attributes include elements, such as leaderboards, badges, levels, trophies, or any other rewards. A concept is a considerably new to scholarly society but a substantially developed in the business world.

During the past 20 years, there are numerous research and studies on the effectiveness and productiveness of using serious games as a learning tool or gaming concept as a teaching technique. For example, [9] quotes that one investigation from a psychological association dating back in the early 1980s has logically revealed that playing digital games, both video-based or computer-based, develops the reduction in responsive times, improvement in hand-eye coordination, and encouragement in players' self-esteem and self-respect. Considering this found evidence, Prof. Griffiths also concludes that video games or computer games have great benefits and positive potentials not only for their entertainment value but also non-entertainment purposes, and a future success of this initiative can be achieved when appropriate games selection and playing requirements are designed to address a particular problem clearly or to teach a specific skill specifically [9]

Many research and experimentations also suggest that some critical or unique skills may be developed or strengthened by playing severe games [9-12]. For instance, the abilities of spatial planning and visualization, such as creative and critical thinking, data allocation and management, and three-dimensional objects rotation and manipulation gradually can be evolved along with gaming experiences [13]. Given that, serious games may seem to be more productive and advantageous for young people, like children and teenagers, who started with relatively beginner skills. As a result, researchers,

educators, and corporates are now using video games and computer games as an application or a tool for studying individuals, teaching students, and training personnel and staff.

The major objective of active and interactive pedagogy is to empower the student, to help them develop, shape their personality, and develop their self-confidence by resorting to pedagogical practices centered on an individual or collaborative learning.

## 5. Conclusions

Modernizing the means of learning and making them more efficient is an essential direction in pedagogical innovation. Information technologies are used for collecting, storing, organizing, processing, presenting, and communicating information. Modern technologies can also be used to teach disciplines to support and stimulate individual study. The diversity of teaching methods and tools used in student teaching and learning respond to a fundamental need for variation, differentiation, nuance and customization of educational activity, while at the same time broadening and accumulating considerable teaching experience and student learning experience, multiple action strategies appropriate to the many tasks and educational-educational.

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