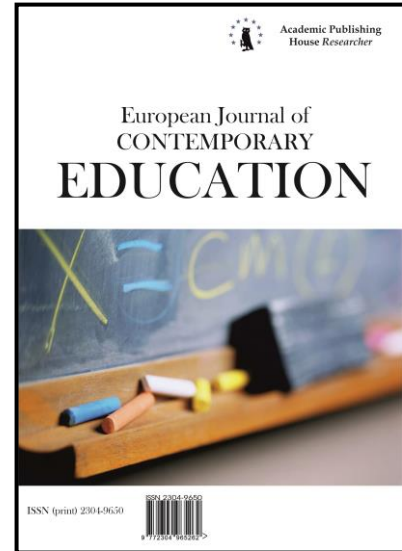




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Gender Differentiation in Perceiving and Evaluating the Interactive Methods of Education by the Engineering Students

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Abstract

The article gives an overview of the basic principles and approaches to the matter of cooperative learning based on the use of interactive forms and methods of education. It is argued that in the conditions of the changing labor market, there will be a demand for such skills, abilities and competencies that are most effectively formed and developed through interactive practices such as leadership, thinking skills, communication, decision making, project work, etc.

Interactive education methods are a synthesis of two components, pedagogical and technological. It is justified to combine these two components to achieve the best learning outcomes.

On the basis of the analysis of the data obtained as a result of the survey, as well as via its verification using the mathematical statistics methods, a hypothesis was proposed on the difference in the level of expectations, perception and evaluation of interactive forms and methods of education in gender-differentiated groups of engineering students. The results of data analysis showed a more skeptical attitude of the male student audience with regard to both the effectiveness and appropriateness of interactive methods of education. It was found that this part of respondents tends to be more instrumental and pragmatic in choosing the means and methods of learning.

Keywords: cooperative education, interactive forms and methods, cooperative pedagogy, gender differentiation, educational innovations, gaming methods, competences.

1. Introduction

Changes in the way of life, and sociality as such, transformation and challenges of the modern world require appropriate changes in the goals, means and methods of modern education, both primary and higher. In this regard, the so-called *conventional pedagogy* has definitely lost its

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functionality as a form of the teaching process organization that was characterized by a one-way transmission of *ready* knowledge from teacher to student, when the latter was not considered a full subject of the educational process, but only an object of mentoring, a passive consumer of information.

The circumstances are such that the modern education should rather focus not as much on academic subjects but on how students think and act, on critical thinking, solving complex problems, analyzing facts and verifying them, having leadership skills, communication skills, etc. In this regard, the issue of using effective methods and instruments in the educational process, the use of which would form and develop all these qualities, becomes relevant. It seems, the methodology of interactive forms of education, that is widely used in innovative pedagogy, cooperative pedagogy, could definitely be called such an instrument.

In this context, we have set a task to study the features of perception and evaluation of proactive and interactive forms of education by engineering students, taking into account their gender differences.

2. Materials and methods

The results of a survey of the Sumy State University engineering students, carried out using Google Forms of online surveys and polls, were used for preparation of the article. The study was based on the principle of gender differentiation and Pearson's χ^2 criterion as non-parametric methods of assessing the significance of differences between actually observed and expected results.

3. Discussion

Methods and ways of education play an essential role not only in the training of specialists-to-be, but also in the process of preparing the active, erudite, fully developed individuals, polymaths, as it is common to call such people nowadays, i.e. people who have versatile intellectual abilities, who are all-round scholars, whose interests and activities are not limited to a single field of knowledge and the only area of their application.

That is why the issues of education require special attention today, including the context of ever-growing workflow automation and the real competitive advantage of humans that can never be appropriated by a machine. We can confidently declare the end of *specialization era*, when being polymaths responds to the challenges of time and becomes a consequence of confrontation between androrithms and algorithms. We live in the era of digital technology, and our everyday life, as well as our education system, directly depend on the content and context of today's realities, which is reflected, in particular, in the approaches and methods of education.

Interactive methods of education are not a tribute to fashion, but a challenge of time, characterizing various discourses of the educational system such as pedagogical (methods, techniques, instruments and methods of education) and technological (use of results of the latest research in science and technology for educational purposes). Conventional (classic) pedagogy has long become obsolete. Interactive, innovative cooperative pedagogy is the key to effective learning and teaching.

It is these and other aspects of interactive forms of education that researchers are drawing attention to, arguing for the need, feasibility and timeliness of "a new approach to teaching and learning that improves visual spatial skills, memory and multitasking skills." (Pradono et al., 2013).

The communication component of interactive education is no less important, at least as important as the minimum required set of skills, competencies and abilities of a modern university graduate. Interactivity in this context is understood as learning through communication, through the confrontation of ideas, opinions and arguments, through cooperation and mutual influence in the study and research groups. Interactive learning is a new way and style of life for both teachers and students. (Palaniyammal, Lakshmi Shanmugam, 2018).

Certain scientific works consider the interactive form of education in the context of skills and competence development in the system of dual, practice-oriented, project-based training using training models, simulators, cases, etc (Riemer, Schrader, 2020; Lebid, Shevchenko, 2020a; Lebid, Shevchenko, 2020b; Prosekov et al., 2020) and other.

Certain educational researchers have raised concerns that the involvement of stakeholders in the educational process is not fully used by the educational institutions, while such cooperation, on the contrary, improves university education. The authors identified five categories of interactive

practices that generally reflect the peculiarities of this approach to education: 1) interaction with peers for personal development; 2) exchange of innovative teaching methods; 3) cooperative learning; 4) creation of educational artifacts; and 5) systematic development of education. It is stated that there is a need to develop formal educational communities in order to promote more comprehensive cooperation and develop a sense of personal commitment and responsibility (Katajavuori et al., 2019).

Issues related to the study of individual and group interactive learning were discussed in the works of H. Li. As a result of cognitive diagnostic analysis, when most of the students were performing the tasks individually, and only a small part of them were doing it in groups using the methods of interactive learning, it was found that the students of the second group were more successful in the matter of passing the exam after the end of the course (Li et al., 2020).

The urgency of the interactive education issue in connection with the need to develop a special way of thinking based on the problem cognitive activities, learning in a personalized environment, the introduction of innovations and tasks of automation, globalization and competitiveness, was studied by E. Soboleva and N. Karavaev in their works (Soboleva, Karavaev, 2020). The authors conclude that there is a need for interdisciplinary constructive forms of interactive activity supported by appropriate learning instruments and methods.

A number of researchers have worked to develop the concept of collaborative learning as a joint non-hierarchical creative practice based on partnership and collaboration, student agency, joint creation of values (Kaminskienė et al., 2020).

Technological aspects of interactive learning are also of great interest to researchers. In particular, they studied the peculiarities of interaction in the student-student, student-teacher and student-content systems using Facebook, Twitter, WeChat (Quadir et al., 2019); the Quizlet educational platform (Valeeva et al., 2019); elements of online education and visual literacy in teaching and learning (Hayden, 2019), and there are other works focusing on modern technology and its ability to shape a personalized learning environment.

4. Deliverables

Today, the theory of education can distinguish three main models of education determined by the methodological principles and approaches used in the learning process. These are:

- passive model of education;
- pro-active model of education;
- interactive model of education (Table 1).

Table 1. Basic Learning Models (Methods) and Their Features

Learning methods	Main participant of educational process	Style of education	Position of students in the educational process	Form of interaction
passive	teacher	authoritative	passive participation	students are passive listeners
pro-active	teacher, student	democratic	pro-active participation	interaction of teacher with students
interactive	students	democratic	pro-active participation	interaction of teacher with students; interaction of students

As many years of personal experience in scientific and pedagogical work showed, it is the use of interactive teaching methods that increases the overall level of students' education, contributes to the development of necessary skills and abilities, including those related to the resolving of creative, non-standard problems, identification and analysis of complex research matters and others.

In a general sense, the main principle of the interactive model of education is the principle of direct communication, interaction and mutual influence of the educational process subjects, that is,

students, teachers, stakeholders and employers. It is the synergy of all of them that determines the essence of the interactive method of education, the ultimate goal of which is to train highly qualified specialists with a developed system of general competencies such as leadership, thinking skills, the ability to make decisions and other.

In this context, the thesis statement on the effective use of interactive teaching and learning methods for groups of students of different ages is confirmed. Its aim is to create a comfortable learning environment where everyone can unlock their potential of intellectual and emotional intelligence.

In this regard, it seems necessary to define the principles of interactive learning. We consider an activity to be such, understanding it as involvement of all students in joint work to achieve a common, team result. This principle directly defines the following, no less important part of interactive learning, that is, the principle of feedback that is demonstrated in pro-active forms of group work such as discussions, debates, brainstorming, etc.

The next principle is the experimentation of learning that implies a pro-active search for non-standard ideas and ways to solve problems and tasks. The case-study method and the project method are especially effective in this context.

The peculiarity of interactive forms of learning is that they are possible only in the context of cooperative education when there is a real opportunity for the student to act as a co-organizer, a co-participant of the educational process, expressing their vision and opinion on an equal basis with other participants of the educational process, to influence the decisions made. It takes place, in particular, at working out the curricula of educational and professional programs, shaping of the purposes and program training results when applicants for higher education (through bodies of student's self-government), stakeholders, degree-field graduates and teachers are involved in the process.

Unlike pro-active and passive models of education, where the teacher acts as a *source of knowledge*, an organizer, a supervisor, the interactive model teacher acts as a mentor, a facilitator. In this inherently democratic learning process, the student's role is most pro-active, combining different activities, making joint decisions, and sharing responsibility for them.

With this approach, the motivation system also changes. Its source is not as much a quantitative component (evaluation) as a qualitative one, expressed in the desire not only to obtain knowledge, but also to test it in practice in the real-life or simulated conditions. This is where such a factor as practice-oriented training is important, the training that takes into account trends and requirements of the labor market, and specific needs of stakeholders and employers.

The whole diversity of interactive learning methods can be classified in the following groups:

- group training methods (Joint Project, Information Search and Analysis, Gallery Walk, etc.);
- teamwork methods (Brainstorming, Situation Analysis, etc.);
- game methods (Public Hearings, Court Hearing and other role-playing games);
- training in discussion (debates, discussions).

Students discuss new material in the process of group training which allows them to comprehend and consolidate it in the memory more effectively. With this organization of work, students develop the skills of communication in groups, the ability to argue their opinion. They also develop skills of critical thinking, persuasion, and of defending their position. The skill of positive perception of criticism is equally important.

The teamwork method assumes simultaneous, joint, collective solution to the set task, excluding passive inactivity of some at the expense of the others' activity. Communicating in this mode, students do not only learn by contemplating the information, but they also teach others. The effectiveness of this method does not stop there, it is good in those situations when it is necessary to absorb quite a lot of information.

For this purpose, it is appropriate to use the game methods of learning through simulating the situations, which gives the opportunity to self-expression, develops the emotional intelligence of students.

Training in discussion shapes the skills of cooperation, respect for the opinion of others, the ability not only to talk, but also to listen. It also develops the quality of tolerance.

It is important to note that interactive learning complements a range of other teaching methods. It is one of the instruments to introduce innovation and diversity into the learning

process. Practice shows that such learning brings good results not only in terms of acquisition of knowledge, but also in their practical use.

In order to use interactive methods effectively, the work of both the teacher and students should be systematically planned, in particular:

- use the methods appropriate to the age of students and their experience with interactive methods;
- select the tasks for preliminary preparation and subsequent independent performance;
- prepare ad hoc tasks, specific interactive exercises on specific topics;
- analyze and self-reflect both the tasks and exercises per se, as well as the methods of their resolving, and the results obtained.

It should be noted that the use of interactive learning methods can in no way be a goal in itself. It is only a means of building an atmosphere of cooperation, understanding and trust among the participants of the learning process. It is not worth looking for universal methods that are effective for all types of work, because no method is universal, its effectiveness determines its relevance, appropriateness of use, as well as functionality.

Based on that, we can build the PIES Matrix of Interaction for the cooperative learning (Figure 1).

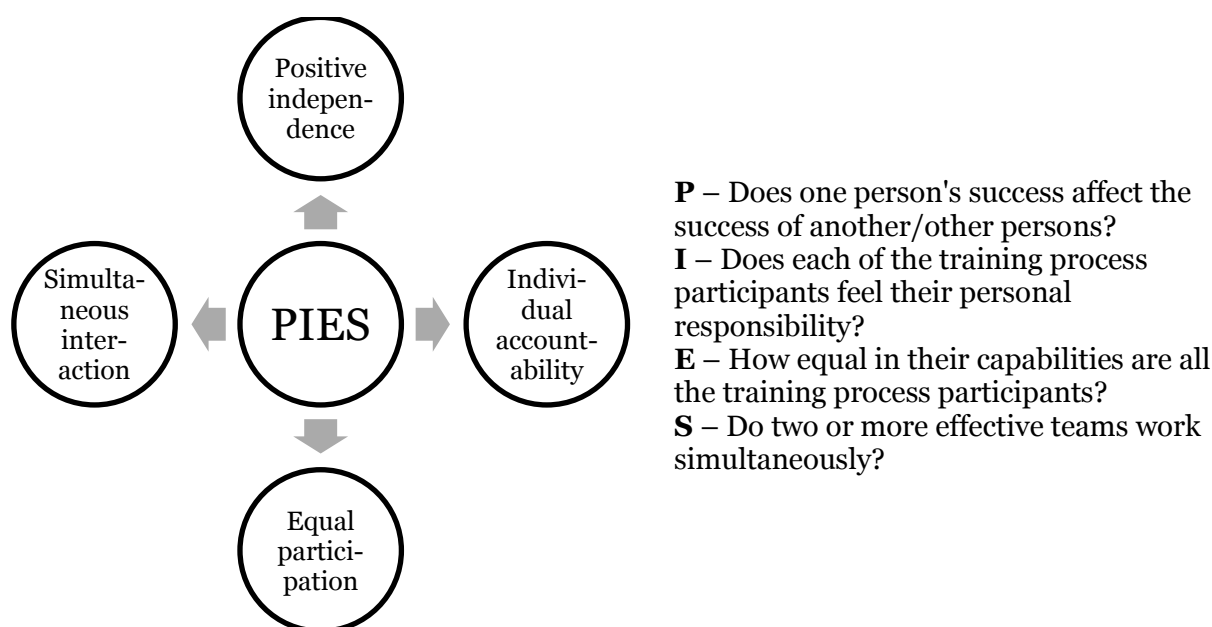


Fig. 1. Matrix of Interaction

In the context of the above, we have performed a study devoted to the problem of perception and assessment of corporate education and its interactive forms among the Sumy State University engineering students. Our task was to establish these differences, based on gender differentiation of students.

We used the results of an online survey carried out with the participation of the Sumy State University students in the Google Forms platform. The total of 85 students took part in the survey, 48 males (56.5 %) and 37 females (43.5 %). The questionnaire contained questions concerning the students' general knowledge of the interactive forms of education, as well as specialized questions on specific methods.

In particular, 83.8 % of females and 70.8 % of males answered positively to the question whether students know the differences between pro-active and interactive learning. At the same time, 22.9 % of males and 35.1 % of females spoke about the high effectiveness of interactive methods in the learning process; 62.5 % and 59.5 % respectively mentioned their relative effectiveness. The number of negative evaluations for these groups was equal in quantitative terms,

within 2% of the total number of respondents, while 12.5% of respondents also found it difficult to answer this question, males exclusively.

Answers to the question on the benefits of using interactive learning methods look interesting (Table 2).

Table 2. Benefits of Interactive Forms and Methods of Learning

	Promotes learning pro-activeness, %	Promotes communication, discussions and the use of practical skills, %	Improves working climate, %	Acquisition of skills related to identifying a problem and finding a solution strategy, %	Control of educational process, identification of the strategic resources in learning, %
Females	16.2	70.3	2.7	8.1	2.7
Males	18.8	39.6	14.6	14.6	12.5

As we can see, the largest number of answers in both groups went to the first two positions that are most of all related to the communication component. Especially among females, for whom the interactive form of learning is directly related to the possibility of discussing problematic issues, and discussions. These results are also confirmed by the answers to another question on the questionnaire, which implied a choice from the list of methods that, in the opinion of respondents, could be classified as interactive. In their response to this question, 81.1 % of females considered group discussions to be such, while the majority of males (72.9 %) considered game-based learning methods to be such.

In some ways, this difference in attitude has also determined a more skeptical opinion among male respondents toward the methods of teaching in their groups. 70.8 % of respondents believe that interactive teaching methods account for only 1/3 of all courses read, while just over a half of the female audience has a similar view, and this was while all respondents were in the same department and class where the same teachers were teaching the same subjects.

In particular, among the reasons that, to a certain extent, prevent the introduction of interactive forms in the educational process, males named two main reasons among the other: mutual unpreparedness of students and teachers to the use of interactive technology of teaching, as well as the impact of the pandemic and the online teaching mode.

At the same time, answering the same question, the majority of females also pointed to the peculiarities of conducting classes under quarantine restrictions, but as opposed to males, to a greater extent, the ineffectiveness of interactive teaching methods was associated not with the personality of the teacher as such, but directly with the students themselves, their motivation, expectations, view of life, individual characteristics.

In this regard, we have set a goal to prove, using methods of mathematical statistics, that gender differences do not affect the level of perception and evaluation of the interactive education forms. In this context, we defined the observed and expected results of the students' sociological survey (Table 3, Table 4).

Table 3. Observed Results

	Females		Males	
	number of people	%	number of people	%
They know the core of the interactive learning	31	83,8	34	70,8
They consider it effective to use the interactive methods in education	35	94,6	41	85,4

Table 4. Expected Results

	Females		Males	
	observed results, number of people	expected results, number of people	observed results, number of people	expected results, number of people
They know the core of the interactive learning	31	30	34	34
They consider it effective to use the interactive methods in education	35	35	41	40

Based on the observed and expected results identified by us, an H_0 null hypothesis was formulated where gender differences do not affect the overall level of perception and evaluation of interactive forms of learning.

Using the formula to calculate χ^2 ,

$$\chi_n^2 = \sum_{i=1}^n \frac{(O_i - E_i)^2}{E_i}$$

we obtained the following results: the χ^2 criterion value is 0.033; p-value=0.8558. The significance level of $p > 0.05$, and therefore, we can confirm the formulated null hypothesis where there is no dependence between belonging to a particular gender group and the attitude to interactive forms of learning, which is confirmed by our survey that showed a fairly high level of their support and confidence in their effectiveness in both groups (94.6% of females and 85.4% of males).

5. Conclusion

In general, noting the independence of gender differentiation and the overall level of perception and evaluation of interactive forms of learning, we can still state the fact of certain minor differences. Thus, for example, if we take those who do not distinguish between pro-active and interactive forms of learning, this indicator among females is twice lower than among males.

The male audience appeared to be more differentiated with respect to the effectiveness assessment of interactive forms of learning, where opinions were more or less evenly distributed across all the proposed response options, while the female audience in its absolute majority (70.3%) understands interactivity as formation and development of practical communication skills.

It is also important to note that the male part of respondents was more skeptical about the factors affecting the effectiveness of interactive forms of learning. They included both objective (conditions of learning, the teacher’s personality, the availability of technical means, etc.) and subjective factors such as unwillingness to participate in the interactive activities, lack of motivation, passivity and other. While the female audience is more inclined to subjectify these factors, only occasionally naming the ineffectiveness of interactive forms of learning among other objective reasons.

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