Cooperative Methods and Development of Social Competence in Training of Technical Teachers

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Abstract—The demands of the labor market today emphasize the importance of emotional intelligence and social behavior. This fact determines the educational needs of prospective teachers. One of the most effective ways to do this is to use student-centered methods. However, the majority of teachers continue to work with a frontal presentation method that does not develop students 'social skills and does not contribute to preparation for real situations.

This study presents an ongoing program based on the application of collaborative methods and the development of participants 'social skills. The article identifies the main features of cooperative learning as a tool for developing the soft skills of future engineers and briefly summarizes the program. The results so far show that new methods can be easily promoted through well-organized planning and teaching processes, and students themselves recognize why the application of methods has a developmental effect.

Keywords—Social competence, cooperative methods, technical teacher training.

1 Introduction

Future work skills and education which supports its development, are the topic of many forums. In the list of Future Work Skills 2020, published by the World Economic Forum, among the top ten skills, mentions complex problem solving, creativity, cognitive flexibility, coordination with others, and emotional intelligence. [1].

"On average, by 2020, more than a third of the desired core skill sets of most occupations will be comprised of skills that are not yet considered crucial to the job today, according to our respondents. Overall, social skills—such as persuasion, emotional intelligence and teaching others—will be in higher demand across industries than narrow technical skills, such as programming or equipment operation and control. In essence, technical skills will need to be supplemented with strong social and collaboration skill." [1].

In the field of economics and technology, there is a discussion about new vision, new understanding and new thinking needed for change, as skills such as critical thinking, active listening or even collaboration. robots and computers cannot copy. [2].

In the field of engineering, these skills are highlighted as professional soft skills, emphasizing that they should become part of the training. "Process skills consist of communication proficiency, the ability to work in teams and groups, and ethics awareness proficiency." [3].

At the same time, it is a common problem that in technical education, in the field of engineering, too little attention is paid to supporting independent tasks, student presentations, the project, and the practice of cooperative learning. [4, 5].

2 Cooperative Learning and Social Competence

2.1 Group, individual and social skills development

An effective way to develop social skills and motives is to operate, use, follow, and acquire appropriate patterns of skills. The foundations of cooperative learning are provided by the findings of social psychology, which have shown that the strength of groups increases the effectiveness of the individual and the group at the same time, group members become more motivated, prefer to learn from each other and more effectively. [6, 7].

While the focus of frontal lesson management is on the educator himself, his knowledge, pedagogical tools and methodological knowledge provide the basic tone of learning, cooperatively organized lessons are based on the students' independent work and activity. However, the well-thought-out planning, organization and follow-up role of the teacher is essential for real cooperation. [6, 8].

If we interpret the concept of cooperative learning, it follows from its characteristics that it is one of the most appropriate tools for the development of social competence, which is realized during the mastering of learning contents.

2.2 Principles of cooperative learning

There are three defining American cooperative learning models. The basic idea came from Elliot Aronson, the creator of mosaic learning, Johnson and Johnson's Circles of Learning model, and Spencer Kagan's school, who further developed Aronson's idea. [9, 10, 11].

Their system and concept are similar, there is a difference in the structure and principles of Johnson and Kagan.

Here our basic approach is Kagan’s approach, as the author as the author knows this well and works with it, and the experimental program was built on this as well.

One fundamental misconception is that the cooperative learning system is referred to as one method, the “cooperative method,” and another is that group work and cooperative learning are the same. In fact, there are many methods involved, and teamwork is not automatically considered cooperative learning. [6].

Working in groups of 2-6 people can be true for any group work, but we can talk about real cooperative learning if four principles apply:

- Constructive interdependence: The success of the whole group depends on the success of each member, so the solution of each group member must be "flawless", perfect, answer a certain question, etc., while the negative interdependence prevalent in schools creates competition.
- Individual responsibility: Everyone is responsible for their own work and also for the performance of the group. The responsibility of each student contributes to the improvement of learning performance.
- Equal participation: It does not happen by itself; it can be achieved through regulation and division of labor. Everyone is responsible for a part of the task and plays a responsible role.
- Parallel interactions: Instead of the main role of the teacher, simultaneous pairwise, intergroup or intra-group interactions take place between students. [6, 11].

The realization of cooperation and division of labor is provided by the responsible roles, in addition to the well-thought-out organization of the division of tasks. Care must be taken to ensure that the roles are not fixed, but that everyone has the opportunity to try out the leader, the person in charge, the spokesperson, etc. role that projects real-life situations in life and work. We support the specification and observance of roles and tasks with role cards.

During planning period, it is important to prepare and arrange the equipment and the room. The disintegration of the usual classroom order must be taken into account and accustomed to a basic noise, which is the so-called Can be coordinated with a silent signal. [6, 11].

2.3 Cooperative methods used in the experiment

Out of the multitude of cooperative methods, the author mainly incorporated the more well-known methods into the processing of the thematic units, but also used a few lesser-known methods. The aim is to give planning and organizational samples, to present concrete methods.

Methods of group formation:

- Montage: We cut a picture into 4-6 parts and the students find the related parts. They form a group.
- Colored discs: Discs of different colors are distributed, students with the same color will be formed a group.
- Worksheet: Worksheets are distributed and those who receive the same will work in a group.
- Age-line: Students form a group according to their month and/or day of birth (close or distant).

Methods of processing/learning:

- Mosaic: A topic is divided into four or six parts; group members are given one for individual processing. Everyone prepares from the part assigned to them and teaches their own sub-topic with the other group members. Version: each group gets a share.

- Mind map, word network: Depicting information, concepts and relationships between a topic, individually, in pairs or in a group. A central concept, a keyword, is placed on the board or paper, for this the students collect the related concepts, connect the connections.
- Poster: In a given topic, the group members / groups work in different colors on a wrapping paper.
- Window: A sheet divided into 2 + 1 or 4 + 1 parts, one middle part is empty, the others are marked with letters or numbers. The group members write about the topic in the extreme parts, and the common position of the group is written in the middle part.

Methods of knowledge control:

- Anagram: Meaningful expressions should be unpacked and defined starting from mixed letters.
- Student Quartet: Groups from 1 to 4 are given a number or A, B, C, D. In the same way, members of each group receive a signal. The teacher asks a question. The team members discuss the answer, checking with each other to make sure everyone really knows. The teacher designates or someone draws on a card which student answers at which table. The answer is evaluated and supplemented by other or selected groups. Then comes the next question and so on.
- Quiz: Groups from 1 to 4 are given a number or A, B, C, D. They are also members of each group. The teacher projects quiz questions and selects which group will give the answer.
- Task card: Each group records the essence of a question, topic or rule on a card. The cards are circled and repeated and practiced by asking each other. [6].

3 Experiment Program and Methods

3.1 Participants

The program took place with 4 students in 4 correspondence groups and 74 students in 4 full-time groups, so a total of 154 students participated in the classes during the 2015/16, 2016/17, 2017/18 and 2018/19 academic years in both semesters. Cooperative methods were applied for 4 consecutive teaching hours in the subject of Education and Didactics.

The age of full-time students is between 20 and 23 years. Correspondence students are more segmented in terms of age, with 25-30 years old in the minority in 12, 30-40 years old with 31 and 40-55 years old with a similar proportion of 33, and 55-65 years old in 4.

3.2 Process and methods

According to the author, it is not expedient to use a form of work or method, so she combined frontal presentation with individual, pair and small group methods. [12].

The data collection was based on a holistic approach, and the collection of student opinions took place in a dialogical framework. Accepting the effectiveness of qualitative data collection, the program integrates quantitative and qualitative methods with a multilateral approach. This is justified by the fact that the implementation of the experiment and the research of the topic took place in parallel and in a social environment, and the qualitative research is more suitable for perceiving and interpreting human behavior and social interactions, opinions and attitudes. [13, 14].

Based on the structure of participatory action research in cultural anthropology, the author followed the cycles of activity and activities during action, and then defined and planned or redesigned further activities based on them. [14, 15, 16].

The framework is provided by a qualitative perspective: the collection of participants' perceptions by the instructor in the so-called a fieldwork diary, which is a specific data collection tool for cultural anthropology. [13, 17] The quantitative side is given by the recordings of the feedback cards given at the end, as well as the other element of the framework, the questionnaire. Observations and field notes recorded non-written and non-verbal communication too, and reactions between students in the whole group and small groups. Photos were also taken, and the students contributed to their use.

Steps, stages and methods of the process:

1. Preparatory phase: preliminary detailed planning every semester, pre-interview, students' pedagogical, methodological, and attitude background. Method: questionnaire, reflective information, additional discussion.
2. The experiment phase: applying teamwork to the lessons and gathering assessments. Methods: observation, spontaneous unstructured interviews, opinion cards (evaluation scale 1-5, and free text evaluation). Questionnaire: general experiences of the semester, usefulness of the subject and topics, teacher suitability, popularity of teaching methods.
3. Organizing and evaluating feedback. Method: sorting the related conversations one after the other, counting the frequency of positive and negative feedback. Questionnaire on the forms of work used. [13, 17].

4 Results

4.1 Preparation period

The results of the preliminary mixed questionnaire are summarized in Figure 1, which maps preliminary methodological knowledge and attitudes. Based on the responses, teacher candidates prefer frontal forms of work and prefer to use the methods included here.

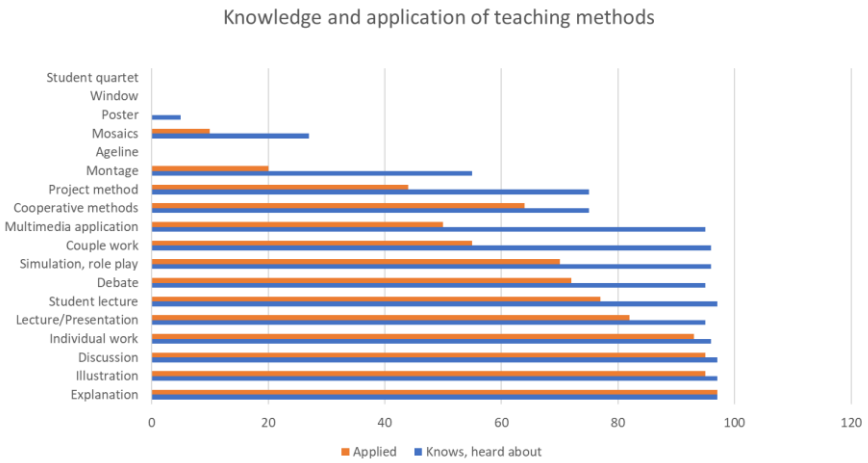

Fig. 1. Knowledge and application of teaching methods

The most popular, most commonly used method of explanation is nearly 100% known and applied. Popular methods include illustration, discussion and individual assignment. However, with the information provided by the qualitative methods, the information on the individual task reveals that the respondents think primarily about homework and less exploratory, research-type independent work, even less about individual task processing within groups.

The presentation is similarly among the well-known methods (95%), but its application shows 82% compared to the first three. Student presentations and discussions are also unknown, followed by the use of multimedia, as in several previous major researches. [18, 19] However, their use is much smaller, as is pair work, too.

Many responded to the fact that they are familiar with cooperative methods, with 64% of respondents saying they also use them, while only 44% say they use the project.

Specific cooperative methods, on the other hand, are marked as unknown methods (line, window, student quartet). The preliminary and supplementary discussion and observation during lessons also made it clear that many thought they were working in cooperative groups, but there was actually no conscious organization behind it.

The open-ended questions of the questionnaire asked about the social skills and personal qualities that were considered important and what were the areas that were considered important to develop in the learning process. The students collected their own characteristics that help their teaching success in a SWOT table.

The most frequently mentioned properties were ranked in order of importance on a five-point scale (Likert scale), which are shown in Figure 2 ranked.

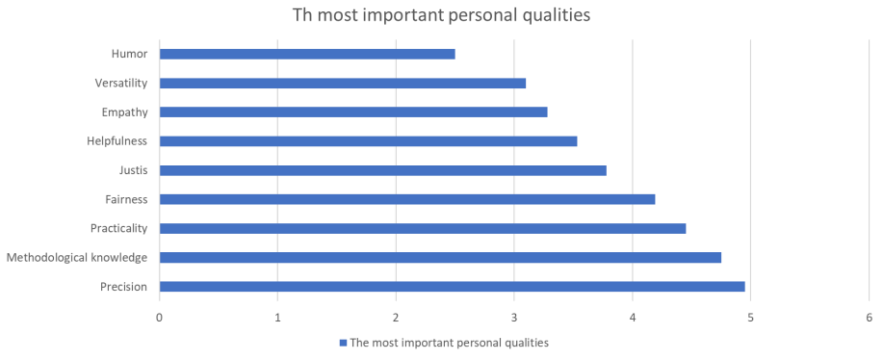

Fig. 2. The most important personal qualities according the teacher candidates

In the ranking, precision is the first (4.95) and is quite close to it the methodological knowledge and practicality. These are mainly emphasized the professional and practical side, while the other half of the qualities are already social skills.

From the next characteristic, the skills belonging to social competence are already mentioned, but in the ranking, they follow only the former skills. Helpfulness and empathy at the end in 3.53 and 3.28, respectively. It is an interesting experience, however, that these were also discussed in the follow-up conversation as indispensable tools for the role of teacher.

New items have placed in the established order of the student qualities to be developed: collaboration, conflict resolution and creativity are the first, but tolerance, empathy and problem solving are closely followed. Cognitive abilities have moved into the middle field, with even lower management of correlations, and a declining line of autonomy, self-esteem, and, ultimately, communication.

Another question was what the participants thought about alternative, student-centered methods. The vast majority of responses to the methods acknowledged that they were necessary, but listed almost uniformly the known reasons that prevent them from being put into practice: they take too much time out of their learning time, they can't meet the requirements, they can't be quantified, some students don't work properly, the teachers can't keep control in their hands and track progress, it puts too much extra work on the teacher.

Full-time students see this differently, they mentioned fewer barriers and more personal barriers, such as lack of approach and methodological knowledge, laziness, adherence to the usual path, inflexibility.

4.2 The experimental period

Table 1. summarizes the key dimensions and indicators in line with objectives and expectations. These are on-the-job observation and items sought in question rows and rankings. In the present case, according to social science research, the indicators here are, on the one hand, typically attributes, the related groups and elements of which have been combined in my evaluation. Behavioral dependent variables are one of the key

elements of this, but a reasonable, cognitive side also appears, as it involves methods, teaching design, and new knowledge. In summary, they are intended to show an attitude of working together and collaborating.

Table 1. Dimensions and indicators

Dimensions	Indicators, elements
Willingness to work together (To be happy to participate in common tasks)	Openness (Volunteering), Desire to work, Creativity
Accepting others as a group partner, as a workmate at the beginning of the process	Immediacy, Sorting, Spacing
Promoting the best group results	Responsibility, Accuracy, Awareness Participation in planning
Attitude towards peers in the process phasis	Communication Tone, Trust, Openness
Sending Messages (Emotional Messages)	Interpretation of the situation, Intent to help others, Signs to others, Expression of emotions, thoughts
Receiving Messages (Emotional Messages)	Interpretation of the situation, Receiving signs, feedback, Expression of emotions, thoughts
Linking to one's own, independent activity	Self-sufficiency, Ideas Thinking about and rethinking learning and teaching, Planning
Noise level perception and management	Indifference, Persistent tension, Transient tension
Evaluation of one's role and peers	Satisfaction – dissatisfaction, Recognition of others, Self-esteem, Liking popularity

In terms of trial practice, full-time students between the ages of 20 and 23 welcomed the new learning approach with greater interest and openness, which was often expressed and worked more enthusiastically from the beginning. They focused on the benefits rather than the difficulties. cooperative forms of work were uniformly well received.

Initially, correspondent engineering teacher students expressed more resentment about group work, and it was shown that only a few actually tried it.

In the final set of questions, ten statements examined students 'attitudes towards familiar methods, learning organization, and the cooperative learning atmosphere, and how they saw their role, their own and their peers' place, and their role in small group cooperative work.

The series of questions asks about the popularity of the group, work and peers, the unusual noise level, the way attention works.

The questionnaire also includes a question about how well you have learned what you have learned, what you think about your own results, what you would change, what else you suggest. Table 2 summarizes the proportions of responses received; attitudes related to cooperative work. The statements reflect the system of goal-requirements, and also integrate the dimensions and their elements.

Table 2. Students' attitudes towards cooperative teamwork and elements of social competence

	Teamwork attitude	**Full-time students**		**Correspondent students**	
		74 people	%	80 people	%
1.	I liked the fact that we worked together and loved the teamwork	74	100	77	96
2.	I am satisfied with my groupmates	70	95	63	79
3.	I contributed greatly to the results of the group	74	100	68	85
4.	My relationship with my peers has improved through small group work	74	100	77	96
5.	It was difficult to get used to working in small groups	0	0	38	48
6.	Disturbed by bustle and noise	2	3	65	81
7.	I paid more attention than usual	74	100	75	94
8.	I could also explain to others what we had learned	74	100	68	85
9.	I think I'll use the methods in my lessons	72	97	63	79
10.	I need to work less on the curriculum at home	74	100	63	79

None of the full-time students indicated that she had difficulty working in small groups and everyone felt she had contributed to the success herself. This may be due to what was revealed in the oral interview: young students believe that participation in itself, intention, already brings about success. They don't think their group would have had similar success if they weren't good enough at completing the task.

It can also be seen from Table 2 that from the 80 main correspondence students, three students were less fond of group work, they consistently indicated this trend in almost all questions. The other 77, on the other hand, indicated the opposite with minor differences, of which 75 were explicitly positive and want to use the methods, and some have already started in the meantime.

It was difficult for many people to work in small groups at first, as indicated by 38, but many more were satisfied with their groupmates. 68 people felt that they contributed greatly to the success of the group, but the author here saw that more, all students did contribute after the initial looser, more humorous start. This also confirms the importance of talking about the evaluation and ways of teamwork.

4.3 Organizing and evaluating the feedback

Feedback, diary notes, cards, and question sets have been evaluated in part, and are still ongoing as the program continues with newer groups. The results of the obtained information and data so far have been summarized above.

In addition, the year-end questionnaire, which examines attitudes towards small-group forms of work and opinions on specific methods, asks participants for their views on curiosity, novelty, and developmental impact on teacher and social competence.

The responses show that the majority of participants generally found the program interesting, novel and agreed with the skills development effects. Group-formation methods were rated the least useful and not very effective in terms of teacher competencies.

The methods that helped to process the new learning were rated the highest, and the methods of repetition and control were similarly or slightly behind it. Figure 3 summarizes the opinions given on cooperative methods.

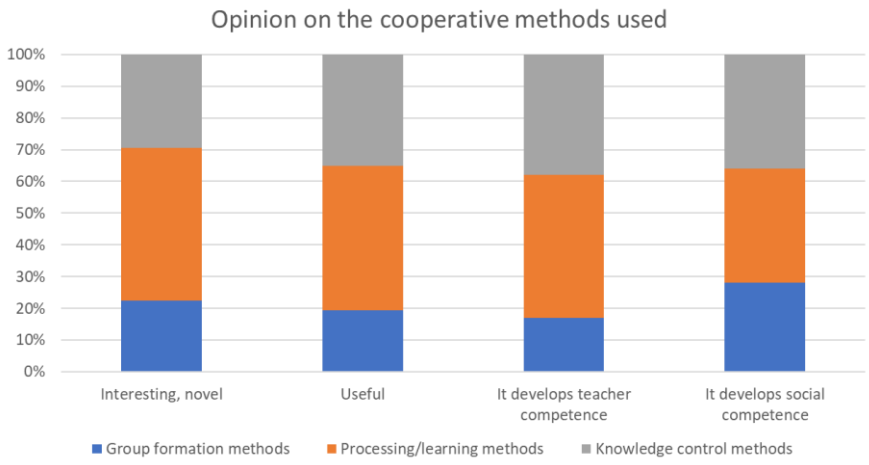

Fig. 3. Opinions on the cooperative methods used in the program

Interpreting the feedback cards and comparing them with the other results, the majority of teacher candidates, like practicing teachers, do not dare to entrust the responsibility to the student. Although the methods that help to process new knowledge have received the best evaluation, there are still comments that this can be done at most rarely because it is at the expense of learning.

In a negligible proportion, there is also a comment that calls small group work a game that the teacher rewards students with.

Thus, engineering teacher candidates do not think that the school does not meet the need to develop social skills, or even the needs of individual, age-appropriate students. This is a small contradiction to the results of the questionnaire, but the qualitative approach helps to align these hidden layers alongside the numerical results. [20, 21]

5 Summary, Future Plans

The study reviewed some of the peculiarities of cooperative teaching methods, the awareness of these and other methods among students in engineering teacher training, and their attitudes after an experimental trial period. The obtained data revealed that the majority of engineering teacher students are primarily familiar with and preferring frontal forms of teaching-learning and that the other side of skill development, soft skills, does not appear in addition to vocational education.

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The obtained data revealed that the majority of engineering teacher students are primarily familiar with and preferring frontal forms of work and that the other side of skills development, soft skills, does not appear in addition to vocational education.

This is in line with previous research. One such well-known interview research is that teachers are basically happy to work with traditional teaching methods that are less suitable for differentiation and collaboration. [22, 23] Although they teach with a variety of teaching methods, 80% of them use more than eight methods, according to research, but next-generation methods (cooperative, project, etc.) account for less than 50%. [22, 23].

On the other hand, it is a positive result that the majority of the participating engineering teacher students do not reject the application of innovative methods, in fact, they approach and connect them from a practical point of view with their own teaching competence. It can also be read that they recognize and value the development of social skills, including their own, for which the use of cooperative methods is considered a viable path.

This indicates that diverse, multi-method education also has a place and timeliness in university education. This confirms the continuation of the soft skills development process at our center, which is a new task for the training of engineers and engineering teachers. The less "used" methods need to be applied as often as possible in order to have their own personal experience from their practical, usable side.

However, the question arises as to why they did not like to develop social skills and combine learning more often. The answer to this is given by the lack of knowledge, the tightening of the curriculum framework and the interpretation of the teacher role, based on what is discussed here.

There may also be backgrounds that engineers and engineering teachers are accustomed to frontal methods as learners, and they follow this pattern as teachers as well. Trying the novelty does not automatically bring about change, abandoning the old "proven" approach. It is a multi-layered problem-area, it means an additional research task.

Further plans for the future include follow-up, how learners will be integrated into post-graduate schoolwork.

Gathering experiences and good practices would also be important, for which a questionnaire survey is currently underway.

Creating an online professional group and knowledge base to share experiences and ideas and publishing them would certainly make a practical methodological material available to many.

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