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The Features of the Organization and Perception of Teamwork by Students in Distance Learning

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The article explores the features of organizing teamwork among students in the context of distance learning. The research involves an analysis of the challenges faced by both students and teachers when working in teams. An ascertaining experiment is presented, during which the experimental group received detailed instructions on organizing teamwork, which led to improved learning outcomes compared to the control group. Additionally, a study was conducted to examine students' perception of teamwork in the "Digital Forest Pedagogy" distance learning course. A total of 56 second-year students from the Higher School of Technology and Energy of SPbSUITD participated in the survey. The analysis revealed that students perceive teamwork as more complex compared to working in pairs, their assessment is influenced by prior experience. Issues related to responsibility and self-discipline, coordination and collaboration, as well as communication and feedback, were identified as the most problematic aspects.

Keywords: university education; collaborative learning; organization of teamwork; distance learning; team interaction; online–communication.

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Особенности организации и восприятия студентами командной работы при дистанционном обучении

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Статья посвящена особенностям организации командной работы студентов при дистанционном обучении. Исследование включает анализ проблем, с которыми сталкиваются студенты и преподаватели при работе в командах. Представлен констатирующий эксперимент, в рамках которого экспериментальной группе были предоставлены детальные инструкции по организации командной работы, что привело к улучшению результатов обучения по сравнению с контрольной группой. Кроме того, проведено исследование, направленное на изучение восприятия студентами командной работы на дистанционном курсе «Цифровая лесная педагогика». В опросе приняли участие 56 студентов 2 курса Высшей школы технологии и энергетики СПбГУПТД. Анализ показал, что студенты оценивают командную работу как более сложную по сравнению с работой в парах, на их оценку оказывает влияние наличие предыдущего опыта. Наибольшие проблемы вызвали вопросы, связанные с ответственностью и самодисциплиной, координацией и взаимодействием, а также коммуникацией и обратной связью.

Ключевые слова: обучение в вузе; совместное обучение; организация командной работы; дистанционное обучение; командное взаимодействие; онлайн-коммуникация.

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Introduction

Teamwork training is an integral part of the modern educational process. The advantage of cooperative and collaborative learning is that students learn and share knowledge at the same time [5]. Consideration of the issue from different points of view and exchange of ideas contribute to better assimilation of material and give a powerful impetus to the development of each participant. Teamwork always requires cooperation and collaboration, as well as the ability to dialog and distribute tasks and responsibilities. According to Bates [4], collaborative learning is applicable both online and in the classroom. Numerous studies have focused on online collaborative learning and its various aspects [3; 15; 17; 22]: the role of the instructor [14], issues related to the formation of a learning community in online collaboration and its alternation with individual work [19], attributes of successful teams [6], tools for online learning [7; 10; 12; 16; 20; 21].

Organizing the work of teams in an online environment requires ensuring communication, work sharing, information sharing and control. For each area, different tools are used in the world educational practice, as shown in Table 1.

Table 1

The Main Tools Used to Organize the Work of Teams in the Online Environment by the Area of the Tasks Solved

Area and Tasks Solved	Tools	Examples

Communication: - Discussing and planning projects - Communicating in real time and creating different channels for different topics - Collecting opinions, evaluations and suggestions from team members	- video conferencing platforms - messaging systems - internal feedback	Zoom, Microsoft Teams, Google Meet, Slack, Telegram, WhatsApp, Discord Google Forms, Mentimetr Internal forum LMS
Collaboration: - Sharing and collaborating on documents - Task structuring, tracking and process control	- cloud storage - project management systems	Google Drive, Dropbox Trello, Asana
Information sharing: - Used to create a knowledge base where the team can easily find and share information - Allow to create diagrams, maps for better understanding of the project	Wiki platforms Electronic boards	Confluence, Google Jamboard, Miro, Mindmap, Mindmaster
Task organization: - Used to schedule deadlines and other events - Helps track the time spent on a task	Calendars, tools to track time	Google calendar, Microsoft Outlook, Toggl

The choice of specific tools depends on the needs of the team and the requirements of the project. Simply gathering a group of people who want to work is not enough to make teamwork effective. It is important that all team members work cohesively. In addition, the strength of the team depends on interpersonal relationships: the higher the degree of interaction, the better the result of the work. Therefore, the educator needs to evaluate the work of the whole team at the end of the lessons. However, cooperative learning is also characterized by the fact that, despite the fact that students learn and implement projects together, the teacher must evaluate the work of each participant individually. Accordingly, the task of organizing students' collaborative work is a complex process. A certain synergy must be achieved through intragroup interaction so that the effectiveness of collaborative work is higher than in the case of individual work.

The COVID-19 pandemic forced the education system to adapt quickly to the new conditions. In this situation, issues related to the organization of collaborative work in distance learning have attracted our attention. This paper raises issues related to students' collaborative work. We aim to identify the direction of pedagogical work in translating collaborative learning into distance learning by analyzing an online course conducted within the DIGIFOR Digital Forest Pedagogy project. Three main research questions:

RQ1: How does the provision of guidelines and rules for team formation affect the process and outcomes of student teamwork in a distance learning course?

RQ2: How difficult is it for students to work in teams in distance learning compared to other modes (individual and pairs)?

RQ3: What problems have students encountered when studying distance course modules that require teamwork?

The material is presented in the following sequence: first we present the context - a real-life example from the DIGIFOR project, then a description of the research methods, the results of the questionnaire survey of students who studied the course, and a discussion of the problems of student teamwork in distance learning.

Online Teamwork: An Example from the DIGIFOR Project

A group of professors (from Finland and Russia) in the framework of the DIGIFOR project developed a course "Small Business in the Forestry Sector" consisting of 5 modules (2 c.c.) and including practical assignments that required both individual and teamwork.

In the presented study, the choice of Moodle educational platform and tools used in the course was limited by the conditions: free of charge, available in Russia and Finland, used in the participating universities earlier. The training modules and their sizes are presented in Table 2.

Table 2

Course Module Names, Sizes and Modes

Name of Training Module	Module Size, c.c.	Work Format
1. Forestry Sector in Russia and Finland	0,3	Individual
2. Small Business and Its Place in the Economy	0,5	Individual
3. Creation of a Small Business	0,5	Team
4. Business Model Canvas (BMC)	0,5	Team
5. Taxation and State Support of Small Businesses in Russia	0,2	Team

The course involves individual work on the first two modules and team work on the next three modules, i.e. each student works individually and then in a team during the course.

Initially the course was planned to be held in a mixed format. But because of COVID-19 and the transition to distance learning, the scenario had to be changed, and the course materials and organizational form of training had to be adapted to the new conditions. Already in the initial plan, the course included materials that were provided through the university's Moodle platform. This included voice-over PowerPoint presentations, as well as additional materials in the form of articles and YouTube videos. Collaborative tools such as Google Jamboard and Canvanizer were added when adapting the course for distance learning.

Research Methods

The empirical study of student teamwork in distance learning was conducted from November 2020 to April 2021 and included a formative experiment and a questionnaire survey.

Formative experiment. Two groups of students – the experimental (EG) and control (CG) - took the "Small Business in the Forestry Sector" course consecutively during the academic year. The students of both groups had already studied together for two years and were well acquainted with each other.

The control group of students was asked to independently team up and work on the course tasks, the algorithm of actions was not given in advance. The experimental group of students was instructed differently. They were offered the following sequence of actions to fulfill the tasks:

- form teams of 3-5 people at will (we placed a link in Moodle to a Google spreadsheet for signing up for teams, noting in its columns the numbers of teams where students had to sign up on their own. Students could choose with whom to work in a team, based on their own preferences and existing relationships in the group);

- choose a way of intrateam communication by creating a group chat in any messenger;

- agree on the role positions in the team and distribute the areas of responsibility. Students were asked to choose the following roles: manager (coordination of actions and distribution of tasks), analyst (collection and analysis of information), implementer (implementation of team ideas), designer (final design of the project).

The course instructors monitored: they followed the formation of teams, students' interaction, assignments and collected data on the results.

Survey. A survey was used to collect data on students' assessment of teamwork. The online questionnaire developed by the author was posted on the Moodle platform and was filled out by each student after taking the course. The questionnaire consisted of 11 questions and contained analysis and reflection of the course results as well as questions aimed at identifying areas of teamwork that needed improvement. In addition, all students were asked to compare the difficulty of completing tasks in team, paired and individual work, and to note the positive and negative aspects of teamwork (open-ended question).

Mathematical processing of data was carried out using MS Office Excel and IBM SPSS Statistics 23.0 programs.

Sample. The study involved 2nd year students of correspondence and evening forms of education of the HSTE SPbSUITD, studying under the bachelor's degree program of the training field 380302 “Management”.

The sample amounted to 56 people. The control group (N=28, men - 36% and women - 64%, age - 21-32 years, mean value - 26±2.8), experimental group (N=28, men - 46%, women - 54%, age - 21-34 years, mean value - 25.6±3.1).

EG and CG students were divided into 8 teams when studying the course modules that required teamwork.

Four instructors (2W and 2M) aged 35-60 years worked on the course. All instructors had more than 10 years of experience, including online experience of more than 1 year.

Results

A comparison of the overall course results in the two groups shows that the percentage of both teams and individual students who completed the course was higher in the experimental group who received instruction in team building and role negotiation. The percentages are shown in Figure 1 and Table 3.

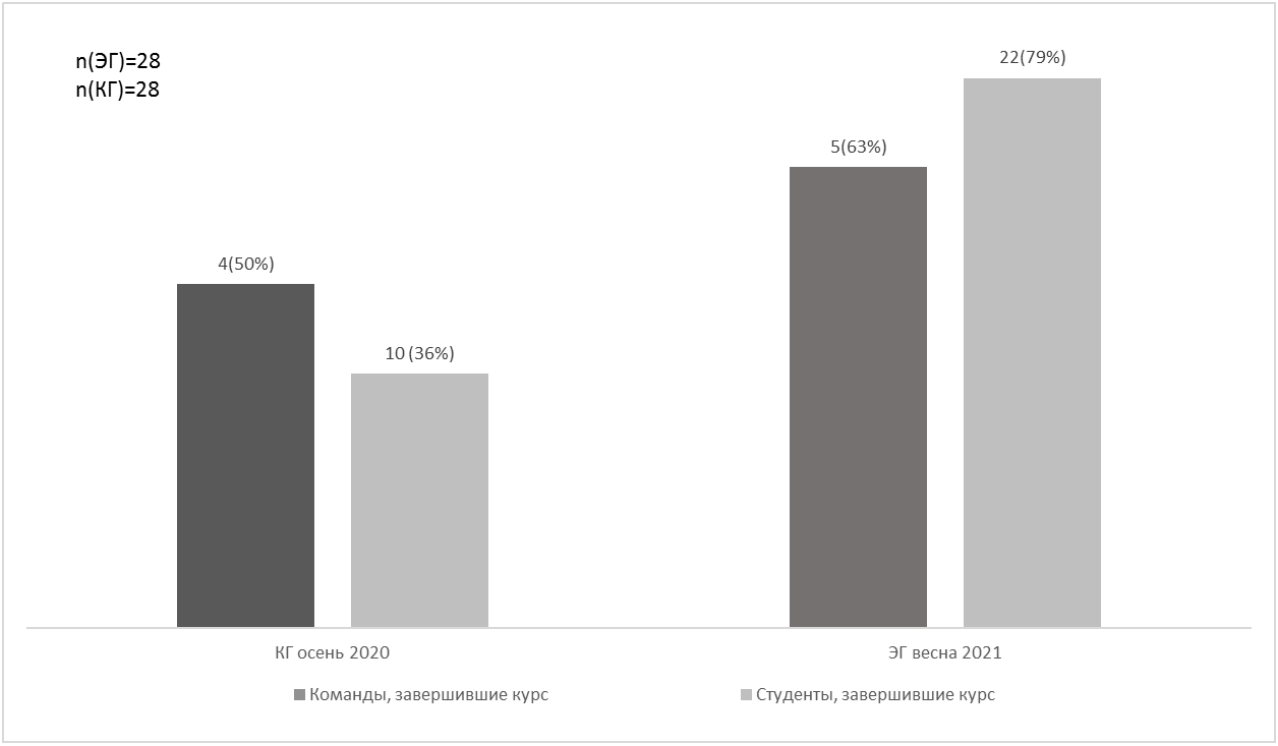

Figure 1. Comparison of completion rates in two groups taking the "Small Business in the Forestry Sector" course

Figure 1 shows the comparison of course completion rates in the control and experimental groups. In the CG, 4 teams (50%) and 10 (36%) participants completed the course, while in the EG, 5 (63%) teams and 22 (79%) individuals completed the course, respectively, as shown in Table 3.

Table 3

Students' Performance Results in Experimental and Control Groups

Factor Attribute	**Resultant Attribute**		**Total**
	Completed the course, people.	Did not complete the course, people.	
EG	22 (79%)	6 (21%)	28
CG	10 (36%)	18 (64%)	28
Total	32	24	56

The number of degrees of freedom is 1. The value of Chi-square criterion is 10.5. The critical value at p=0.01 is 6.635. The relationship between the factor and the resultant attribute is statistically significant.

Students from the experimental group were significantly more likely to complete the course and with a higher grade for the final presentation as shown in Figure 2.

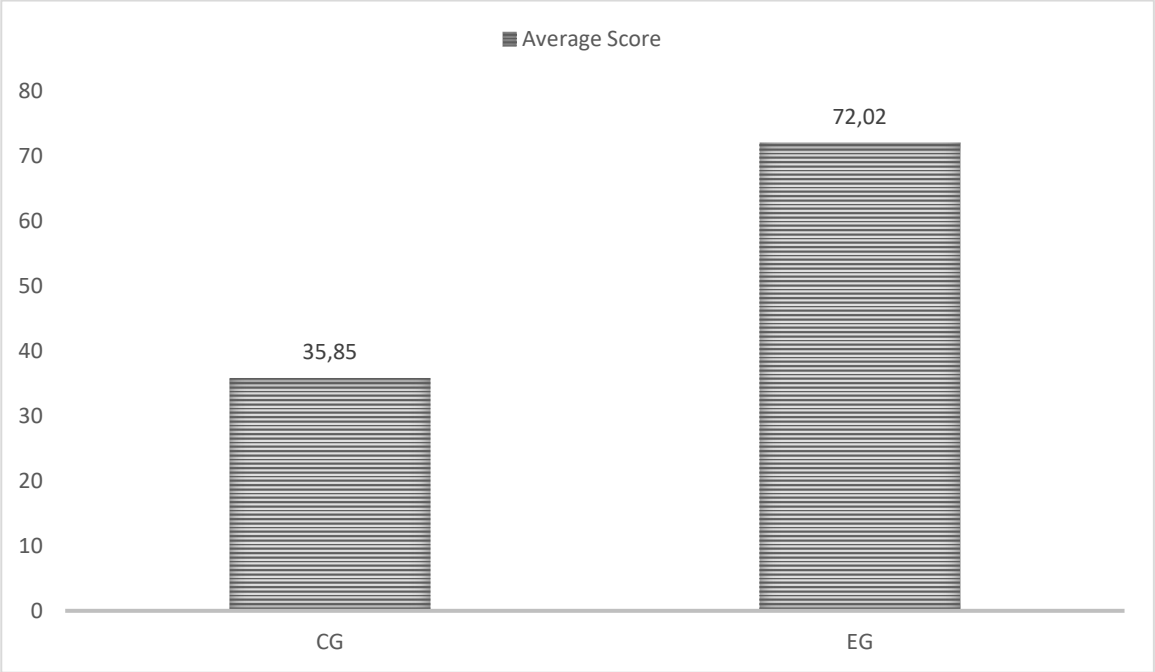

Figure 2. Average score for the final course presentation in the CG and EG on a 100-point scale

Thus, the answer to our first research question is as follows: providing students with guidelines and rules for team building in distance learning had an impact on the success of the course, a higher percentage of students with a higher final score completed the course.

When students in both groups (CG and EG) were asked to compare the difficulty of completing tasks in teams, pairs, and individually on a 5-point Likert scale based on their previous experience, the data presented in Table 4 was obtained.

Table 4

Students' Evaluation of the Level of Difficulty of Work in Different Modes

	Easy (1)	**Rather Easy (2)**	**Difficult to Answer (3)**	**Rather Difficult (4)**	**Difficult (5)**
Individual Work	8 (14%)	25 (45%)	10 (18%)	11 (20%)	2 (3%)
Work in Pairs	14 (25%)	22 (39%)	6 (11%)	12 (21%)	2 (3%)
Team Work	10 (18%)	14 (25%)	17 (30%)	8 (14%)	7 (13%)

For 3 related samples we use Friedman's test. Calculations carried out in the SPSS program show that there are 56 people in both groups, chi-square value = 7.424. The asymptotic significance is 0.024, which is less than 0.05. Hence, there are differences in the groups. We can say that students evaluate the complexity of different modes of operation in distance learning differently. We found statistically significant differences using Friedman's criterion, so pairwise comparisons can be made to identify specific differences between groups.

The results of the pairwise comparisons of individual, pair and team work evaluations using the Wilcoxon test are presented in Tables 5 and 6. The critical values (T) for the sample of 28 individuals for the chosen level of statistical significance (p=0.05 or p=0.01) are 130 and 101.

Table 5

Results of the Empirical Values of the Wilcoxon Test for the Pairwise Comparison of Students' Assessments of Work Difficulty in the Control Group

	Individual Work	**Work in Pairs**	**Teamwork**
Individual Work	x	155 (zone of insignificance)	176 (zone of insignificance)
Work in Pairs	155 (zone of insignificance)	x	69 (zone of significance)
Teamwork	176 (zone of insignificance)	69 (zone of significance)	x

The empirical value of Wilcoxon test between pair work and team work (69) is less than the critical value (101) for the level of statistical significance p=0.01. This indicates that CG students rated teamwork as more challenging compared to pair work at a statistically significant level.

Table 6

Results of Empirical Values of the Wilcoxon Test for the Pairwise Comparison of Students' Assessments of the Work Difficulty in the Experimental Group

	Individual Work	**Work in Pairs**	**Teamwork**
Individual Work	x	160 (zone of insignificance)	165 (zone of insignificance)
Work in Pairs	160 (zone of insignificance)	x	100 (zone of significance)
Teamwork	165 (zone of insignificance)	100 (zone of significance)	x

In the EG, the empirical value of Wilcoxon's test between paired and team work (100) is less than the critical value (101) for the level of statistical significance p=0.01. Thus, the EG students also rated teamwork as more difficult compared to pair work at a statistically significant level.

The relationship between assessments of the complexity of teamwork and having experience in online teams is shown in Table 7. At the same time, students in the CG and EG are equally divided by the presence/absence of such experience (50:50 - presence/absence of experience).

Table 7

Evaluation of the Degree of Difficulty of Teamwork in Distance Learning and the Availability of Similar Experience

	Very Easy (1)	**Rather Easy (2)**	**Difficult to Answer (3)**	**Rather Difficult (4)**	**Difficult (5)**
Had Experience of Online Teamwork Before	5 (18%)	11 (39%)	11 (39%)	0 (0%)	1 (4%)
No Previous Experience of Online Teamwork	5 (18%)	3 (11%)	6 (21%)	8 (29%)	6 (21%)

The results of statistical analysis show that the relationship between having experience in online teams and teamwork difficulty score is statistically significant. The Chi-square value (17.613) exceeds the critical value (13.277) for the significance level of p=0.01. Students with experience in online teams are more likely to rate teamwork as easy or rather easy. Approximately 57% of students with experience rate the work as “very easy” or “rather easy” while only 29% without experience do the same.

The results of the questionnaire regarding the problems encountered during teamwork in the CG and EG are presented in Table 8.

Table 8

Results of Answers to the Question About Intrateam Interaction in the CG and EG

Features of Intrateam Interaction	**CG**	**EG**
	«yes»	«yes»
Agreements were reached before work began	12 (43%)	28 (100%)
There was an opportunity to share ideas between team members	8 (29%)	28 (100%)
Felt supported by other participants	8 (29%)	20 (71%)
Work within the team was evenly distributed	6 (21%)	22 (79%)
Project deadlines were delayed due to a team member's failure to meet the schedule	16 (57%)	12 (43%)
Responsibility for the outcome rests with all team members	18 (64%)	26 (93%)

Students from the CG and EG face different problems and features during teamwork in distance learning. All respondents (100%) from the EG said that they were able to agree on coordination and communication within the team. However, 29% felt that they did not get enough support from other team members. Other problems such as uneven distribution of tasks (21%) and rescheduling (43%) were also encountered. These problems may indicate the need for better organization and coordination within teams.

In the CG teams, 43% of the participants were able to reach agreements before starting work, but 29% of the participants were able to share ideas and felt supported. In the CG teams, 79% had problems with the distribution of work within the team, which requires attention to the methods of task distribution and organization of teamwork.

In addition to common goals, the very concept of a team implies the responsibility of each member for the final work of the group. However, according to the questionnaire results, 36% (in the

CG) and 7% (in the EG) of respondents did not feel personally responsible for the overall achievements of the group.

The questionnaire for students also included open-ended questions about the positive and negative aspects of teamwork in distance learning. The content analysis of the results is summarized in Table 9.

Table 9

Content Analysis of Students' Answers to the Open-Ended Question of the Questionnaire: "What Positive/Negative Aspects of Teamwork in Distance Learning Can You Name?"

Respondents' Answers	**Student's Generalized Emotional Evaluation of Teamwork***	**Generalized Category**	**Frequency**
1	2	3	4
1. "On this team, you can be stubborn without anyone arguing with you" *2. "Responsibility for others"* *3. "Support of ideas"* *4. "Seeing things from different perspectives"* *5. "Help if the topic is difficult for someone in the team to understand"* *6. "Humor"*	Positive	Support and Mutual Understanding	6 (38%)
1. "No need to waste time traveling" *2. "Each student is in a comfortable working environment"* *3. "Communication in any period of time"* *4. "Ease of choice of location and time"* *5. "No need to come to a specific location"*		Comfort and Convenience	5 (31%)
1. "Efficiency of teamwork" *2. "Quickly found additional information to solve the case as everyone had computers and internet access"*		Efficiency and Flexibility	2 (13%)
1. "Expressing my thoughts and creativity" *2. "Opportunity to improve communication, brainstorming skills"* *3. "Practicing the ability to convey your thoughts and consistently argue them"*		Development of Personal and Professional Skills	3 (19%)
1. "I can't look people in the eye (video doesn't count)" *2. "Refusing to do my part of the task"* *3. "Losing the feeling of having to do*		Problems with Coordination and Interaction	6 (33%)

something rather than talking” *4. “It was hard to communicate when you can't get together and visualize your ideas, someone might be delayed in responding or not get in touch at all”* *5. “Participants refused to work, to find any information”* *6. “It is difficult to cooperate with classmates.”*	Negative		
1. “The need to take responsibility to others” *2. “Lack of interest of participants in working on the task”* *3. “Late deadlines.”* *4. “Not being able to meet the deadline.”* *5. “Not all team members can be tuned into the actual work (i.e. they are passive and don't care about the outcome)”*		Responsibility and Discipline	5 (27%)
1. “It was hard to come to one decision” *2. “Difficulty discussing and forming ideas”* *3. “With distance learning, there were problems with feedback”*		Communication and Feedback Problems	3 (17%)
1. “Lack of diligence and self-discipline of some team members” *2. “Everyone was mostly out for themselves rather than a team”*		Personal Characteristics of the Participants	2 (11%)
1. “It can be difficult to explain their ideas in the form of some kind of diagram” *2. “There may be communication and network problems, this makes it difficult to work”*		Technical Difficulties/Infrastructure Problems	2 (11%)

Note. * - emotional assessment of teamwork (positive or negative) was given by the respondents themselves during the survey.

From Table 9 we can see that the positive aspects of teamwork in distance education include support and mutual understanding (38%), as well as comfort and convenience (31%). It should be noted that more negative aspects related to teamwork in DL were listed. These included problems with responsibility, self-discipline (33%), coordination and interaction of team members (27%), and problems with communication and feedback (17%).

Discussion

Inexperienced teams can experience serious communication problems when working remotely. This slows down work and can lead to decreased motivation. At the same time, conflicts

are easier to avoid when working together online. However, the lower incidence of conflict often indicates less group discussion, which is actually necessary to create innovative solutions.

The decision-making process in a team requires more time because each participant's point of view needs to be heard. The results of Google's project "Aristotle" [8] and other studies [6] have shown the importance of such a factor for successful teamwork as "equality in the distribution of conversation sequence". However, the extra time spent on coordination and general discussions slows down work and can lead to decreased motivation. It can also lead to an unbalanced distribution of tasks within the team. These factors require faculty attention and the development of effective methods of organization and coordination within teams.

The teamwork of students in distance learning poses some challenges for instructors. Planning is affected by some purely organizational features. For example, it is necessary to control students' work in such a way that teamwork does not turn into poorly planned individual work with unbalanced workload and unfairly graded results. In general, it is more difficult to monitor the process, evaluate the contribution of each team member and give a fair assessment of their work.

At the same time, from the instructor's point of view, a number of positive aspects of teamwork in a distance format can be noted. First, teamwork promotes the development of communication skills, teaches cooperation, time management and conflict resolution. Second, it allows learners to see a problem from different perspectives, as teams include participants with different experiences and levels of knowledge, which they share when solving common problems. Third, accountability to teammates leads to greater engagement in the learning process. Increased engagement has been noted in other studies [1]. But perhaps the most important thing that distinguishes teamwork remotely is collaboration at a distance using communication technologies, which is useful in the context of today's labor market.

When planning the course, the instructors assumed that a positive aspect of teamwork in a distance course for them would be a reduction in the amount of assignment checking, which would save the educator's time. In practice, however, it turned out that a significant amount of time was spent on finding out each student's individual contribution to the teamwork, as well as assessing and monitoring the extent of their active participation. This process proved to be so resource intensive that it offset the savings that could be realized by reducing task checking.

Findings

Our experiment shows that issuing learners with guidelines and rules for team formation has a positive effect on distance course success. Students who received recommendations showed higher final grades, which confirms the effectiveness of such measures.

Students find working in teams in distance learning more challenging compared to working in pairs. This is observed both in the control and experimental groups. At the same time, students who have had similar experiences before rate teamwork as less challenging than students without experience, indicating the influence of previous experience on the perception and evaluation of the difficulty of teamwork in distance format.

The EG showed more successful results not only in achieving course outcomes, but also in reaching agreements, sharing ideas and feeling supported within the team compared to the CG. However, in both groups (EG and CG) there are problems with the distribution of tasks among participants, postponement of project deadlines, as well as problems with responsibility and self-discipline.

Conclusion

When organizing teamwork in distance learning compared to individual work, the following features can be distinguished:

1. The need for online communication, which can take place through online platforms, chats, video conferences and e-mail, which requires the development of online communication skills (key feature) [2].

2. Time management and meeting deadlines become critical. In a distance format, students often have more freedom to manage their time and can work on course assignments at different times and on different days.

3. Students must have basic skills with different tools (collaboration and communication platforms, collaborative document design) in order to successfully participate in teamwork in a distance course.

4. In teamwork in a distance course, students are often challenged to be more independent and proactive. They need to take responsibility for their work, planning and organizing tasks.

5. Conflicts may arise due to misunderstandings, different points of view and other factors. Conflict resolution skills are important for building constructive relationships in a distance mode.

6. For faculty, organizing teamwork in a distance form may require new methods of assessment and feedback. Effective ways of evaluating teamwork and ensuring fairness in evaluations for all participants must be developed.

7. Support and motivation are important. Faculty and teams may face challenges in motivating and supporting each other in a distance format.

In planning and implementing the Small Business in the Forestry Sector course, the COVID-19 pandemic brought about a major change in the teaching system when the university had to restructure its online learning processes in a matter of weeks. Since all the students of the university had to switch to distance learning format, even a part of the course could not be delivered in face-to-face format as originally envisioned. This created several challenges. Instructors had to adapt the original plan in a distance format while trying to keep students emotional, engaged, and skills assessed fairly without jeopardizing productivity.

Experts [23] predict that in the future, the demand for team competencies will be much higher than individual competencies. Skills related to intrapersonal communication such as social-emotional skills, co-creation, facilitation, and the ability to contribute to teamwork will be in the center of attention. The importance of developing student teamwork techniques in the online environment in all phases: course design, class delivery, and assessment can be noted. The research conducted provides guidelines for instructors in distance learning to optimize students' teamwork processes and ensure that they work together more effectively. I would like to direct further efforts in the study towards issues related to how instructors can evaluate the performance of each team member when working online. This includes aspects of evaluating each participant's contribution, distributing tasks evenly, and ensuring a fair evaluation.

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