

Article

The Effects of Disciplinary Composition on Virtual Learning Group Process Dynamics: Students' Perspectives

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Abstract: This research was conducted as a collaborative project between the West University of Timișoara (Romania) and the Norwegian University of Science and Technology (Norway) to develop a transnational learning activity. The students learned in virtual collaborative study groups; developed project-based teams; shared experiences, skills, and professional competencies; and collaborated directly with their teachers, the researchers, and the labor force. Three virtual learning groups of undergraduate students ($N = 131$), presenting comparable course descriptors and disciplinary group compositions, participated in the study. This study aimed to determine the effects of disciplinary composition on virtual learning group process dynamics from the students' perspectives. This study applied a quasi-experimental between-subjects study design: quantitative methods were used to validate a research instrument and to determine statistical differences in the group process dynamic between the three groups; a qualitative method was applied to identify an in-depth understanding of the students' perception about the group learning experience. By analyzing the group dynamics in the three settings—mono-disciplinary, cross-disciplinary, and cross-cultural—the research results show the advantages of each virtual learning composition in the group dynamic and learning outcomes in terms of group skill acquisitions. The conclusions can help teachers design virtual team compositions, a crucial stage in ensuring the achievement of desired learning outcomes.

Keywords: group dynamic; virtual study groups; cross-disciplinary; cross-cultural; international learning; higher education



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1. Introduction

Student-centered learning geared toward the future labor market and real-life requirements are constant focuses for many universities. In this respect, it is very important to target not only professional and learning competencies but also soft skills, the competencies of the 21st century [1]. The world is characterized by dynamism, challenges, the unexpected, speed, and innovation. To adapt to such a world, students must be prepared to solve complex problems, to interact in diverse multicultural contexts, to make decisions, to think of innovative solutions, and to work with others. Traditionally, learning takes place in a face-to-face environment, but with the COVID-19 pandemic, the majority of university teaching has moved online. Social learning through collaboration must continue to be a central method to maintain the same quality of learning. Project-based learning has continued virtually and has raised questions about the most efficient ways to implement it virtually. The purpose of the study is to respond to the following general question: What are the best pedagogical solutions in terms of group disciplinary composition and training students with which to collaborate, to make decisions together, to create new solutions, and to be prepared for the future labor market?

A group has been defined over time in different ways, emphasizing some of the following characteristics: categorization, communication, influence, interdependence, interrelationships, psychological significance, relationships, shared identity, shared goals and tasks, size, structure, and systems [2]. Virtual learning groups maintain the same characteristics as face-to-face groups: common goal, organization, group consciousness, effective communication, and cohesion. However, they have distinct characteristics determined by the specifics of online collaboration: different schedules and learning paces, different e-learning platforms and applications, no face-to-face opportunities, secure file sharing, or different file formats [3].

Many recent studies have focused on group dynamics with diverse structures: homogeneous or heterogeneous with reference to skills, level of training, opinions, ideas, gender, personality, and cultural background [4–8]; mono-disciplinary; inter-disciplinary; cross-disciplinary; and trans-disciplinary, providing valuable insights for educators interested in using project-based teamwork in teaching. However, little is known about virtual learning group dynamics, and in the current context of online teaching, it is important to determine what are the effects of virtual group disciplinary compositions on different characteristics of group dynamics.

Research has shown that face-to-face homogeneous groups are more efficient in accomplishing tasks and in achieving goals (often requiring directivity), while heterogeneous groups have been noted for performance, inventiveness, and creativity in solving long-term problems [5,9]. Students in homogeneous groups often have difficulty in making decisions and solving problems, in assigning roles and structuring tasks, and in asking for help from tutors [10] (pp. 12–13).

In Romanian universities, students are grouped according to the specializations they follow, and the participation in didactic activities is carried out mono-disciplinarily. Another way of organizing learning groups is cross-disciplinarily. Fruchter and Emery [11] suggested that a major component of teamwork is learning to work with others from different disciplines and that cross-disciplinary learning involves an evolution from individual to collaborative thinking by team members.

A cross-disciplinary cross-cultural group is made up of students from different specializations and from different educational institutions belonging to universities from different educational systems. Groups can be heterogeneous in terms of age, level of study, specialization, and cultural background.

The present study discusses the effects of disciplinary composition—mono-disciplinary, cross-disciplinary, and cross-cultural—on virtual learning group process dynamics from the students' perspectives.

Groups of students from the same specialization, from the same field of study, who work together to solve problems and carry out projects within a specified period of time, are referred to as mono-disciplinary groups. Groups made up of students with different specializations or with different educational backgrounds are multidisciplinary groups or cross-disciplinary groups [12–14]. Schaffer et al. [9] defined cross-disciplinary team learning as a social entity of individuals who are heterogeneous in terms of expertise, culture, and experience and are committed to a project for an extended amount of time to solve open-ended problems in real-world contexts.

Cross-disciplinary learning involves an evolution from individual to collaborative thinking by team members [15] and is highly interrelated with team structure, dynamics, and collaborative learning processes that are expected to occur as any team or group attempts to solve a problem [16].

Schaffer et al. [9] mentioned that a cross-disciplinary team learning framework has three dimensions—identification, formation, and adaptation—and that there are important shifts from self-efficacy to collective efficacy, from individual process to team goal, and from knowledge acquisition to knowledge creation. Moreover, within cross-disciplinary groups, knowledge construction is more elaborate, with participants coming up with their own points of view from various fields, thus making it possible for functionally diverse

individuals that are not capable of codifying this very knowledge to resolve problems [17], a prerequisite for explicit transfer between teams.

Richter and Parette [18] (p. 39) identified two major difficulties/barriers related to cross-disciplinary learning: “(1) students fail to recognize the relationship between their own discipline and an interdisciplinary subject; (2) students fail to recognize and value the contributions of multiple technical and non-technical fields to a given interdisciplinary problem”.

A more complex group, maybe the main challenge of the project, was the cross-disciplinary and cross-cultural group: respectively, students from different specializations with different backgrounds and those from two different universities/countries with different educational systems and ways of teaching. An important aspect mentioned by Asherman, Bing, and Laroche [19] is trust, and this term may have different meanings for different cultures. The authors linked the idea of trust with productivity in teamwork. Working and learning in cross-cultural groups can have both benefits and obstacles. With regard to the advantages, we mention the enhancement of students’ learning experiences [20–25] and the provision of opportunities to encounter new ideas and values [26]. Though not always, these trans-cultural groups work effectively. They may face different barriers related to language [27], aspects of cultural understanding and human relations, hierarchical relationships, collaboration, and institutional or cultural challenges related to human factors [28,29].

In order to be able to teach an activity more efficiently in different types of groups, be they mono-disciplinary, cross-disciplinary, or cross-cultural, social and interpersonal skills such as attentive listening, leadership skills, respectful negotiation, cooperative questioning, decision-making, confidence building, and conflict management need to be taught to enable learners to cooperate effectively in a group environment [30].

2. Materials and Methods

2.1. Research Question and Hypothesis

Based on the above arguments, the following research question was posed:

What are the differences in the virtual learning group dynamics depending on disciplinary composition (mono-disciplinary, cross-disciplinary, and cross-cultural)?

Research hypothesis:

Hypothesis 1. *Group process dynamics are different between different virtual learning groups (mono-disciplinary, cross-disciplinary, and cross-cultural).*

2.2. Design

To gain a better insight into the different characteristics of a group process dynamic in relation to disciplinary group composition, a mixed methodology was used. This study applied a quasi-experimental between-subjects study design. Quantitative methods were used to validate the questionnaire and to determine the differences in the group process dynamics between the three groups. The qualitative content analysis method was applied to assess students’ perception about the group learning experience and to better explain the quantitative results.

2.3. Participants

The data were collected from a convenient sample made up of 131 undergraduate students enrolled at the same university from Romania. The participants were enrolled in three different courses in the first semester of the 2020–2021 university year (October 2020–January 2021). The courses differed in terms of subject, number of participants, and disciplinary course composition.

The age of the participants ranged from 19 to 35 years ($M = 24.83$, $SD = 2.22$). The participants included 34 (25.95%) men and 97 (74.04%) women.

There were three research groups of undergraduate students. The first group (Group 1: mono-disciplinary) consisted of 89 students, all from the same specialization and the same study year (first year). The second group (Group 2: cross-disciplinary) consisted of 26 students enrolled in a cross-disciplinary course and in their second and third years of studies. The third group (Group 3: cross-cultural) consisted of 16 students enrolled in a transnational, cross-disciplinary, and cross-cultural course and enrolled in their second and third year of study.

2.4. Procedure

This research was conducted as a collaborative project between two comprehensive universities from Romania and Norway, developing a transnational learning activity for students. The students learned in online collaborative Romanian–Norwegian study groups; developed project-based teams; shared experiences, skills, and professional competencies; and collaborated directly with their teachers, the researchers, and the labor force. At the beginning of the collaborative project implementation period, September 2019, this joint course was the only Romanian university course organized and planned for online delivery using digital platforms and advanced VR technology for synchronic communication for distance learning. However, by the start of the first lecture, in October 2020, as a consequence of the COVID-19 pandemic restrictions, all courses from 11 faculties were reconfigured and delivered exclusively online, and interest in the digitalization of education became widespread. As a consequence, the research team extended the research to two other learning groups comprising undergraduate students attending courses organized online and presenting comparable descriptors and disciplinary group compositions (Table 1).

A group process evaluation questionnaire [31] and a learning journal were distributed to all students enrolled in the three courses (Table 2). Informed consent was also obtained, where the aims and the conditions of the study were explained. The students agreed to be part of the study. Groups 1 (mono-disciplinary) and 2 (cross-disciplinary) completed the instruments in four phases: at the pre-test at the beginning of the course after the first interaction in the learning group (week 2), at two intermediary phases (course weeks 7 and 11), and at the post-test at the end of the course after the learning projects were assessed (week 14). Group 3 (cross-cultural) also completed the instruments in four phases, but due to the five-week length of the course, they completed the questionnaire and the learning journal after each week.

Table 1. Description of the disciplinary groups' composition considered in the study.

Similarities	
-	Common transversal competencies acquired at course completion: communication skills and collaboration in teams, using digital technologies in learning and research activities;
-	Experiential learning by teamwork and project-based activities;
-	Organized online, by using web-based e-learning platforms and digital tools for synchronous communication across distance. To communicate, collaborate, and coordinate meetings and time management, students used Google Suite for education (Classroom, Gmail, Meet, Docs, Drive, Forms, Calendar), Microsoft 365 solutions (Teams, OneDrive, Word, Excel, Power Point), Zoom, Doodle, FaceBook, and WhatsApp;
-	A part of the teamwork activities was independently organized by the students, using online synchronous meetings and asynchronous distanced communication by email, web-based platforms, and social media;
-	Teachers promoted reflection as a core activity for the students by offering specific instruments—the group process evaluation questionnaire and learning journal—and by allocating time at the end of each learning phase for written reflections;
-	The participants were undergraduate students (first cycle of bachelor degree students) enrolled in the three courses in the first semester of the 2020–2021 academic year.

Table 1. Cont.

Differences		
Disciplinary group no 1 (N = 89) Mono-disciplinary group composition	Disciplinary group no 2 (N = 26) Cross-disciplinary group composition	Disciplinary group no 3 (N = 16) Cross-cultural group composition
The participant students were undergraduates at the West University of Timișoara, Romania, learning synchronically in mono-disciplinary teams of 6–8 students. The students had common academic backgrounds and were enrolled in the first year of study for the same major: Sociology. Language of communication: Romanian	The participant students were undergraduates at the West University of Timișoara, Romania, learning synchronically in cross-disciplinary teams of 6–8 students. The students were enrolled in their second and third years of study from different majors: Fine Arts, Geography, Political Studies, Law, Economic, and Business Administration, Philology, Psychology, Social work. Language of communication: Romanian	The participants were master's and undergraduate students from two countries—Romania and Norway—learning synchronically in cross-cultural, cross-disciplinary, and transnational teams of 6–8 students. The Romanian students considered for this study were enrolled in their second and third years of study and had different academic backgrounds: Fine Arts, Political Studies, Biochemistry, Informatics, Law, Philology, Physical education, Sociology Language of communication: English
Professional competencies acquired at the course completion: social problems diagnosis, analyzing social policies based on analytical and reflective approaches, and professional consultancy for programs for the inclusion of vulnerable groups.	Professional competencies acquired at the course completion: solving urban culture issues based on critical analysis and scientific argumentation.	Professional competencies acquired at the course completion: solving social problems based on analytical and reflective approaches, and critical analysis and scientific argumentation of social situations.

Table 2. The study design. T1, T2, T3, and T4 reflect the time series when the research instruments were repeatedly applied.

Disciplinary Group Composition	Course Start		Learning Activities				Exam
	Group Process Evaluation Questionnaire	Learning Journal	Group Process Evaluation Questionnaire	Learning Journal	Group Process Evaluation Questionnaire	Learning Journal	Group Process Evaluation Questionnaire
Mono-disciplinary	T1	Learning phase 1	T2	Learning phase 2	T3	Learning phase 3	T4
Cross-disciplinary	T1	Learning phase 1	T2	Learning phase 2	T3	Learning phase 3	T4
Cross-cultural	T1	Learning phase 1	T2	Learning phase 2	T3	Learning phase 3	T4

2.5. Research Instruments

A group process evaluation questionnaire and a learning journal were distributed and self-administrated by all students enrolled in the three courses.

The group process evaluation questionnaire, adapted from Russ Christianson [31], assesses the group dynamic on a five-point Likert scale. Each of the nine items assess a group dynamic characteristic: goals, openness, mutual trust, attitudes toward difference, support, participation, decision-making, flexibility, and use of member resources.

A learning journal is a tool used for reflecting on the user's learning style and on their thoughts, emotions, beliefs, values, and experiences that influence the learning process and their progress over time [32]. By integrating a reflective journal into the course, the teachers aimed to help their students become self-regulated learners [33] (p. 10). A reflective journal allows students to think about their learning approaches and processes, to assess the students' conceptions of learning, and thus to unveil aspects of their learning experiences that otherwise remain invisible/unknown [33,34]. Through these collections of notes,

observations and thoughts built up through the participatory observations made by the students enhance their learning through the very process of thinking and writing about one's own experience. Reflection encourages students' engagement in teamwork, learning, and participation by directly observing the self and peers' behaviors and that of the group process [35–37]. In the context of applying and developing relevant skills required by professional bodies, the need for higher education preparing students more effectively for reflective learning and for engaging with early career practitioners to develop long-term habits of effective life-long learning arises [38]. Many studies showed the usefulness of self and peer assessment in relation to group dynamics and processes [35,39–41].

Both instruments, the learning journal and the group process evaluation questionnaire, were completed by the students online. A semi-structured type of learning journal was used to better focus on the research themes of interest. Six reflection themes were proposed in the learning journal. In this study, we analyze only two of them: "How did I perceive the team collaboration" and "Personal thoughts, emotions, and reflections".

After collecting the students' reflections, the narrative answers from the learning journals were mapped and the fragments derived from the research question were selected for further analysis. In the next phase, the categories referring directly to the nine dimensions of the group dynamic were identified. The categorized fragments obtained were analyzed with a focus on the changes registered from a learning phase to the next during the entire learning process (from T1 to T4). Finally, students' reflections about the nine dimensions of the group process dynamics were compared to the disciplinary group compositions of the three learning groups considered (mono-disciplinary, cross-disciplinary, and cross-cultural).

The group process evaluation questionnaire was translated and adapted into Romanian and distributed online to the students. As the group process evaluation questionnaire has yet to be validated on a Romanian population, we conducted a validity analysis, assessing the reliability coefficients and a Confirmatory Factor Analysis (CFA). A reliability analysis for the entire scale and per item was conducted. The internal reliability exceeded >0.80 for all items. The questionnaire was found to be reliable (9 items, $\alpha = 0.88$). Cronbach's α per item ranged from 0.81 to 0.92, indicating a good reliability per scale and per items.

We tested the replication of the original group process evaluation questionnaire model with one factor. To test the model, we considered Model Chi Square (χ^2 , p -value > 0.05 for the null hypothesis) relative chi-square (χ^2/df) values lower than 5 [42], Comparative Fit Index (CFI) values higher than 0.90 (CFI ≥ 0.90), and a Root Mean Square Error of Approximation (RMSEA) lower than 0.08 (RMSEA < 0.08) [43].

The original one-factor structure adequately fit the sample ($\chi^2/df = 2.61$, $\chi^2 = 70.7$, $p < 0.01$ for the null hypothesis) (Table 3).

Table 3. Test for the exact fit.

χ^2	df	p
70.7	27	<0.001

The model fit statistics are reported in Table 4.

Table 4. Test for the exact fit of the questionnaire using the one-factor model.

CFI	TLI	RMSEA	RMSEA 90% CI	
			Lower	Upper
0.913	0.884	0.111	0.0798	0.143

The one-factor model fit adequately—CFI = 0.90, TLI = 0.87, and RMSEA = 0.11—proving that the model fit acceptably. We can affirm that the questionnaire is reliable for the Romanian student population.

3. Results

3.1. Hypothesis Testing

A one-way analysis of variance was conducted to determine if the group dynamic at the beginning of the course differed between the three groups ($N = 131$) (Table 5). The independent variable, group type, included three groups: Group 1—mono-disciplinary ($M = 39.3$, $SD = 5.27$, $N = 89$), Group 2—cross-disciplinary ($M = 39.1$, $SD = 5.60$, $N = 26$), and Group 3—cross-cultural ($M = 40.4$, $SD = 5.42$, $N = 16$). The results suggest that, at the beginning of the course, the group dynamic scores do not differ significantly ($F = 0.336$, $p = 0.71$).

Table 5. One-way ANOVA (Welch's) between the three groups at the beginning of the course.

Groups	M	SD	Test of Homogeneity of Variances		ANOVA	
			Levene Stat.	Sig.	F	Sig.
1 Mono-disciplinary	39.3	5.27	0.94	0.74	0.33	0.71
2 Cross-disciplinary	39.1	5.60				
3 Cross-cultural	40.4	5.42				

To determine the group dynamic characteristics at the beginning of the course for all three groups, the means and standard deviations for each of the nine characteristics were calculated. In Table 6, a comparison between the characteristics is presented.

Table 6. Comparison of group dynamic characteristics between the three groups at the beginning of the course.

Group 1—Mono-Disciplinary	Group 2—Cross-Disciplinary	Group 3—Cross-Cultural
I5 Support ($M = 4.53$, $SD = 0.81$)	I3 Mutual trust ($M = 4.65$, $SD = 0.62$)	I2 Openness ($M = 4.62$, $SD = 0.5$)
I7 Decision-making ($M = 4.51$, $SD = 0.78$)	I2 Openness ($M = 4.57$, $SD = 0.80$)	I9 Use of member resources ($M = 4.62$, $SD = 0.61$)
I8 Flexibility ($M = 4.43$, $SD = 0.73$)	I5 Support ($M = 4.46$, $SD = 0.81$)	I5 Support ($M = 4.56$, $SD = 0.72$)
I4 Attitudes toward difference ($M = 4.42$, $SD = 0.86$)	I8 Flexibility ($M = 4.46$, $SD = 0.70$)	I6 Participation ($M = 4.56$, $SD = 0.63$)
I3 Mutual trust ($M = 4.42$, $SD = -0.85$)	I4 Attitudes toward difference ($M = 4.34$, $SD = 0.93$)	I3 Mutual trust ($M = 4.5$, $SD = 1.21$)
I9 Use of member resources ($M = 4.41$, $SD = 0.75$)	I9 Use of member resources ($M = 4.30$, $SD = 0.94$)	I4 Attitudes toward difference ($M = 4.5$, $SD = 0.73$)
I2 Openness ($M = 4.27$, $SD = 0.85$)	I1 Goals ($M = 4.23$, $SD = 0.81$)	I1 Goals ($M = 4.43$, $SD = 0.72$)
I1 Goals ($M = 4.24$, $SD = 0.72$)	I7 Decision-making ($M = 4.19$, $SD = 0.89$)	I7 Decision-making ($M = 4.31$, $SD = 0.94$)
I6 Participation ($M = 4.05$, $SD = 1.04$)	I6 Participation ($M = 3.84$, $SD = 1.04$)	I8 Flexibility ($M = 4.31$, $SD = 1.07$)

A one-way analysis of variance was conducted to determine if the characteristics of the group dynamic at the beginning of the course differs between the three groups ($N = 131$). The results suggest that, at the beginning of the course, the group dynamic scores do not differ significantly in eight of the characteristics, but differ in one, i6 Participation ($F = 4.80$, $p = 0.01$) (Table 7).

Table 7. One-way ANOVA (Welch's) between the three groups in participation at the beginning of the course.

Groups	M	SD	Test of Homogeneity of Variances		ANOVA	
			Levene Stat.	Sig.	F	Sig.
1 Mono-disciplinary	4.06	1.04	1.84	0.05	4.80	0.01
2 Cross-disciplinary	3.85	1.04				
3 Cross-cultural	4.56	0.62				
Group differences						
Groups	Mean differences					Sig.
1–3	−0.50					0.03
2–3	−0.71					0.02

To check for individual differences in participation, a between-groups post hoc comparison using Games–Howell was selected. The test indicated that the mean score for participation in the mono-disciplinary group ($M = 4.06$, $SD = 1.04$) was significantly different from the mean score of participation in the cross-cultural group ($M = 4.56$, $SD = 0.62$). The participants in the cross-disciplinary group ($M = 3.85$, $SD = 1.04$) differ significantly from the cross-disciplinary, cross-cultural course in terms of participation. The mean differences were significant at the 0.05 level. However, no significant differences were found between the mono-disciplinary and cross-disciplinary courses. This means that, from the beginning, all members of the cross-cultural group were significantly more involved in discussions than those from the other two groups.

The other characteristics of the group dynamics do not differ significantly; however, we can see (Table 6) that there are differences between the groups of characteristics.

At the beginning of the course, after the first working session in the groups, Group 1 (mono-disciplinary) showed the greatest support ($M = 4.53$, $SD = 0.81$) and the best decision-making ($M = 4.51$, $SD = 0.78$). This means that, from the beginning, the members were comfortable giving and receiving help and that all members were involved in decision-making.

Group 2 (cross-disciplinary) showed the greatest mutual trust ($M = 4.65$, $SD = 0.62$) and openness ($M = 4.57$, $SD = 0.80$). This means that, from the beginning, the members trusted one another and did not fear ridicule or reprisal and that they could express their thoughts, feelings, and ideas freely.

Group 3 (cross-cultural) showed the greatest openness ($M = 4.62$, $SD = 0.5$) and use of member resources ($M = 4.62$, $SD = 0.61$). This means that, from the beginning, the members could express their thoughts, feelings, and ideas freely and that each member's abilities, knowledge, and experience were fully utilized.

A one-way analysis of variance was conducted to determine if the group dynamics at the end of the course differed between the three groups ($N = 131$) (Table 8). The results suggest that, at the beginning of the course, the group dynamic scores differed significantly ($F = 3.95$, $p = 0.02$).

Table 8. One-way ANOVA (Welch's) between the three groups at the end of the course.

Groups	<i>M</i>	<i>SD</i>	Test of Homogeneity of Variances		ANOVA	
			Levene Stat.	Sig.	<i>F</i>	Sig.
1 Mono-disciplinary	38.1	7.66	3.54	0.03	3.95	0.02
2 Cross-disciplinary	41.5	4.67				
3 Cross-cultural	40.6	7.02				
Group differences						
Groups 1–2	Mean differences −3.41				Sig. 0.01	

The participants of the mono-disciplinary course ($M = 38.1$, $SD = 7.66$) differed significantly from the cross-disciplinary course ($M = 41.5$, $SD = 4.67$) in terms of group dynamic. The mean differences were significant at the 0.05 level. However, no significant differences were found between the mono-disciplinary and cross-disciplinary courses. This means that, at the end, members of the cross-disciplinary group were significantly more dynamic than the members of the mono-disciplinary group.

To determine the group dynamic characteristics at the end of the course for all three groups, the means and standard deviations for each of the nine characteristics were calculated. In Table 9, a comparison between the characteristics is presented.

A one-way analysis of variance was conducted to determine if the characteristics of the group dynamics at the end of the course differ between the three groups ($N = 131$). The results suggest that, at the end of the course, the group dynamic scores do not differ significantly in six of the characteristics but differ in three: I6 Participation ($F = 4.86$,

$p = 0.009$), I7 Decision-making ($F = 6.84$, $p = 0.001$), and I9 use of member resources ($F = 2.47$, $p = 0.05$) (Table 8).

Table 9. Comparison of group dynamic characteristics between the three groups at the end of the course.

Group 1—Mono-Disciplinary	Group 2—Cross-Disciplinary	Group 3—Cross-Cultural
I8 Flexibility ($M = 4.42$, $SD = 0.86$)	I5 Support ($M = 4.76$, $SD = 0.51$)	I2 Openness ($M = 4.75$, $SD = 0.57$)
I3 Mutual trust ($M = 4.39$, $SD = 1.04$)	I7 Decision-making ($M = 4.76$, $SD = 0.51$)	I4 Attitudes toward difference ($M = 4.62$, $SD = 0.71$)
I5 Support ($M = 4.39$, $SD = 0.94$)	I9 Use of member resources ($M = 4.76$, $SD = 0.51$)	I5 Support ($M = 4.5$, $SD = 0.96$)
I1 Goals ($M = 4.33$, $SD = 0.96$)	I2 Openness ($M = 4.65$, $SD = 0.79$)	I7 Decision-making ($M = 4.5$, $SD = 0.81$)
I2 Openness ($M = 4.32$, $SD = 1.09$)	I8 Flexibility ($M = 4.65$, $SD = 0.62$)	I8 Flexibility ($M = 4.5$, $SD = 0.89$)
I9 Use of member resources ($M = 4.32$, $SD = 0.98$)	I4 Attitudes toward difference ($M = 4.61$, $SD = 0.57$)	I9 Use of member resources ($M = 4.5$, $SD = 0.89$)
I4 Attitudes toward difference ($M = 4.29$, $SD = 1.11$)	I3 Mutual trust ($M = 4.53$, $SD = 0.91$)	I1 Goals ($M = 4.43$, $SD = 0.89$)
I7 Decision-making ($M = 3.96$, $SD = 1.17$)	I1 Goals ($M = 4.42$, $SD = 0.94$)	I3 Mutual trust ($M = 4.43$, $SD = 1.2$)
I6 Participation ($M = 3.62$, $SD = 1.24$)	I6 Participation ($M = 4.30$, $SD = 0.92$)	I6 Participation ($M = 4.31$, $SD = 1.01$)

To check for individual differences in participation, a between-groups post hoc comparison using Games–Howell was selected (Table 10). The test indicated that the mean score for participation in the mono-disciplinary course ($M = 3.62$, $SD = 1.24$) was significantly different from the mean score of participation in the cross-disciplinary course ($M = 4.3$, $SD = 0.92$). The test indicated that the mean score for decision-making in the mono-disciplinary course ($M = 3.96$, $SD = 1.17$) was significantly different from the mean score of decision-making in the cross-disciplinary course ($M = 4.76$, $SD = 0.51$). The test indicated that the mean score for the use of resources in the mono-disciplinary course ($M = 4.32$, $SD = 1.98$) was significantly different from the mean score of decision-making in the cross-disciplinary course ($M = 4.76$, $SD = 0.51$). The mean differences were significant at the 0.05 level. However, no significant differences were found between the mono-disciplinary and cross-disciplinary courses. This means that, at the end, all members of the cross-disciplinary group were significantly more involved in discussions and decision-making than those in the other two groups and used each member’s abilities, knowledge, and experience more.

Table 10. One-way ANOVA (Welch’s) between the three groups in participation, decision-making, and use of resources at the end of the course.

Groups	<i>M</i>	<i>SD</i>	Test of Homogeneity of Variances		ANOVA	
			Levene Stat.	Sig.	<i>F</i>	Sig.
			I6 Participation			
1 Mono-disciplinary	3.62	1.24	3.82	0.02	4.86	0.009
2 Cross-disciplinary	4.30	0.92				
3 Cross-cultural	4.31	1.01				
			I7 Decision-making			
1 Mono-disciplinary	3.96	1.17	6.95	0.001	6.84	0.001
2 Cross-disciplinary	4.76	0.51				
3 Cross-cultural	4.50	0.81				
			I9 Use of resources			
1 Mono-disciplinary	4.32	0.98	5.87	0.04	2.47	0.05
2 Cross-disciplinary	4.76	0.51				
3 Cross-cultural	4.50	0.89				
			Group differences			
			Mean differences			Sig.
			I6 Participation			
1–2			−0.67			0.01
			I7 Decision-making			
1–2			−0.80			0.00
			I9 Use of resources			
1–2			−0.44			0.009

The other characteristics of group dynamics do not differ significantly; however, we can say that there are differences between the groups of characteristics (Table 9).

At the end of the course, Group 1 (mono-disciplinary) showed the greatest flexibility ($M = 4.42$, $SD = 0.86$) and mutual trust ($M = 4.39$, $SD = 1.04$). This means that, at the end of the course, the members trusted one another and were ready to change procedures in response to new situations.

Group 2 (cross-disciplinary) showed the greatest support ($M = 4.76$, $SD = 0.51$), decision-making ($M = 4.76$, $SD = 0.51$), and use of member resources ($M = 4.76$, $SD = 0.51$). This means that, at the end of the course, the members were comfortable giving and receiving help; were involved in decision-making; and fully utilized each member's abilities, knowledge, and experiences.

Group 3 (cross-cultural) showed the greatest openness ($M = 4.75$, $SD = 0.57$) and attitudes toward differences ($M = 4.62$, $SD = 0.71$). This means that, from the beginning to the end, the members expressed their thoughts and feelings and felt free to voice their differences and to work through them.

A paired-samples *t*-test was conducted to compare the group dynamic and its characteristics in a pre-test and a post-test for all three groups. Significant differences were found only for the cross-disciplinary group (Table 11).

Table 11. Paired sample *t*-test pre- and post-test results for the cross-disciplinary group.

	Pre-Test		POST-TEST		<i>t</i> -Test	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Total group dynamic	39.07	5.59	41.50	4.66	−2.98	0.006
I5 Support	4.46	0.81	4.76	0.51	−2.13	0.04
I6 Participation	3.84	1.04	4.30	0.92	−3.33	0.003
I7 Decision-making	4.19	0.89	4.76	0.51	−3.26	0.003
I9 Use of resources	4.30	0.97	4.76	0.51	−2.90	0.008

There was a significant difference in the scores for the group dynamic pre-test ($M = 39.07$, $SD = 5.59$) and post-test ($M = 41.50$, $SD = 4.66$) conditions: $t(25) = -2.98$, $p = 0.006$. Additionally, significant differences were found for the support pre-test ($M = 4.46$, $SD = 0.81$) and post-test ($M = 4.76$, $SD = 0.51$) conditions, $t(25) = -2.13$, $p = 0.04$; the participation pre-test ($M = 3.84$, $SD = 1.04$) and post-test ($M = 4.30$, $SD = 0.92$) conditions, $t(25) = -3.33$, $p = 0.003$; the decision-making pre-test ($M = 4.19$, $SD = 0.89$) and post-test ($M = 4.76$, $SD = 0.51$) conditions, $t(25) = -3.26$, $p = 0.003$; and the use of resources pre-test ($M = 4.30$, $SD = 0.97$) and post-test ($M = 4.76$, $SD = 0.51$) conditions, $t(25) = -2.90$, $p = 0.008$.

3.2. In-Depth Understanding of Students' Reflections about the Group Learning Experience and the Nine Dimensions of Group Processes

3.2.1. Goals

The course framework allowed students to work independently without constant assistance from teachers and to work outside the time allocated for learning in a classroom. Autonomy in managing individual team learning activities and monitoring the commitment/engagement of teammates motivated the students to reflect on their personal learning goals and on the group dynamic (Table 12). The students noted their focus on the development of communication and collaboration skills through experiential learning in the learning journals: "To develop the ability to work in a team, to find practical solutions to the real problems of the society" (student, cross-cultural group, T2); "To work as a team and to help vulnerable people" (student, cross-cultural group, T3); and "We have to manage tasks and schedule/time" (student, mono-disciplinary group, T1). However, the learning journals provide empirical data that showed the students' different perceptions about collaboration and in their conceptions of experiential learning. Some students tried to preserve the more familiar classroom experience, in which they are passive receivers of knowledge [33]. They were more focused on the learning outcomes and strictly followed the rules and regulations

provided by the teacher, consulting the course syllabus or other given learning materials. Some students tried to adapt to the situational frame of the learning activities dynamics, which were enthusiastically joining in on the teamwork, learning by doing, and focusing mainly on the learning process.

Table 12. Students' personal learning goals for each disciplinary group composition.

Disciplinary Group Composition	Setting Personal Goals		Goals Focused on
	Categories of Personal Learning Goals	Features Used by the Students for Describing Their Personal Learning Goals	
Mono-disciplinary	professional competencies	How to diagnose a social problem: defining, prioritizing, analyzing, planning social measures, and identifying alternative solutions for social problems; analyzing social policies; recognizing diversity; and combating discrimination.	Learning outcomes
	communication and collaboration in teams	How to share ideas, thoughts, self-assessment, and personal experience and to increase effective communication with teammates and with the teaching staff; information-seeking by documentation and by taking individual interviews with vulnerable persons and with institutional representatives; and taking into account different perspectives. Planning teamwork activities; identifying motivations for active participation; assuming responsibility; and identifying roles.	
Cross-disciplinary	communication skills	How to listen; how to express your own ideas; taking into account others' perspectives; and information seeking.	Learning process
	teamwork skills	Team goal setting; how to organize the planning process; how to solve problems by actively participating in the decision process; how to assume responsibility and leadership; and role identification.	
Cross-cultural	communication skills	How to listen; how to express clearly their ideas; recognizing and discussing different perspectives and ideas; encouraging teammates to express their point of view; how to communicate their personal goal setting; and how to present the self-assessment outcomes to teammates.	Learning process
	teamwork skills and mutual understanding of cultural organizational differences	How to organize teamwork in a transnational environment; team goal setting; openness about different learning styles; and negotiating the meaning of certain organizational dimensions in the transnational environment: order and punctuality, active participation, assuming responsibility, role identification, trust, peer feedback, and expert feedback.	
	mutual understanding of the social-cultural context for the real-world cases studied	Sharing personal life experiences, thoughts, and ideas; directly interviewing vulnerable persons affected by the social problem approached; identifying more information sources from experts (teaching staff and researchers) and clients (work force representatives).	

3.2.2. Participation, Decision-Making, Flexibility

The intensity of students' participation in learning activities was perceived in significantly different ways depending on the disciplinary group composition. While some of the students noted in their learning journal that they actively participated starting at the beginning of the learning process, others recorded an increase in participation from one phase of learning to the next.

From the beginning, the cross-cultural group of students was involved and participated responsibly. Compared to students from the mono-disciplinary and cross-disciplinary groups, the cross-cultural group of students' reflections mention that they felt a high degree of autonomy when organizing their collaborative activities and made sustained efforts to

efficiently organize their time management and an effective communication between teammates. For example, while the students from the mono-disciplinary and cross-disciplinary groups mainly used the digital platforms and tools provided by the university, the cross-cultural transnational group of students combined the e-learning platforms of the partner universities with various other web-based platforms to ensure an effective synchronous communication. They reported an awareness of their effort in efficiently organizing the collaboration, the distribution of workload between teammates, and the time management:

“I found out very soon that we have to be involved to be able to work as a team” (student, cross-cultural group, time series T1); “I did not expect from us to work together so well” (student, cross-cultural group, time series T1); “It makes me responsible and I feel involved in a beneficial team-project” (student, cross-cultural group, time series T1); “We are hundred percent involved in this teamwork” (student, cross-cultural group, time series T2); “Each of us gives our interest, which helps a lot for the success of the team” (student, cross-cultural group, time series T2); and “We work hard together” (student, cross-cultural group, time series T4).

Within the mono- and cross-disciplinary groups, the students’ participation was not as productive, assumed, and responsible from the beginning as that for the students from the cross-cultural group. Although the students were present throughout the learning process, many passively participated during the initial learning phase, without contributing useful content to the team; lacked reciprocity; and lacked first-hand interactions:

“We started by working on our own because we did not know each other and ended up working together as a team” (student, mono-disciplinary group, T2); “We managed to mobilize and eventually get 100%, even though at first we have to pull others to do their job” (student, mono-disciplinary group, T3); “We participated through discussions, debates, arguments” (student, cross-disciplinary group, T3); and “We learned what a team means” (student, cross-disciplinary group, T3).

After the identification learning phase, the students began to become increasingly active in their participation, started to become more involved in decision-making, and gained more flexibility. Though at first some of the mono-disciplinary group students noted that they lacked experience working with peers, after the first phase of learning, they reported that their participation in the decision-making process and their flexibility in using new learning methods intensified. Similarly, the students from the cross-disciplinary group reported an increased degree of direct involvement in decision-making once they advanced from one learning phase to the next:

“We worked together, we listened to the opinions of all our colleagues and in the end, we made a decision” (student, mono-disciplinary group, T1); “We collaborated well and usefully, even if opinions are always divided and decisions are hard to make” (student, mono-disciplinary group, T2); “I get along well with members of my team and function as a team. Everyone shares their opinions and together we find an answer with which the world agrees” (student, cross-disciplinary group, T3); and “With my team, we collaborated very well. We agreed and were able to make decisions together” (student, mono-disciplinary group, T4).

3.2.3. Openness and Mutual Trust

The students were concerned about the need to be accepted, to be liked by others, and to identify their position and roles in the team. They were interested in their teammates’ opinions and willing to express their own opinions and to listen to others to show openness and mutual trust. The students’ observations reported in the learning journals confirm the results of the group process evaluation questionnaire and show that openness and trust are strong attributes of all students, regardless of the diverse disciplinary group composition. However, differences arise in the evolution of students’ self-perceptions throughout the learning phases. Thus, some of the students perceived openness and trust as core personal attributes from the beginning:

“The communication was an open one, we listened to each other” (student, cross-disciplinary group, T1); “I feel gratitude for the trust that my teammates gave me” (student, cross-disciplinary group, T2); and “I get along with team members and we function well as a team” (student, cross-disciplinary group, T3).

Some of the students reported that, at the beginning, they felt unsure regarding teamwork and encountered difficulties in communicating openly with other students they did not know before the course. The initial learning phase was challenging for these students, especially for those who initially did not trust their own strengths or their colleagues. In the learning activities that were conducted by the students independently from the lectures, these students constantly turned to the rules, regulations, and guidelines set by the teaching staff:

“I had to overcome my emotions and start saying what I have in my mind” (student, cross-cultural group, T1); “I am anxious because I do not speak English very well” (student, cross-cultural group, T1); “I had a great stress at the first meeting with the teammates from Norway” (student, cross-cultural group, T1); “At first, my teammates were not too open in group discussions” (student, mono-disciplinary group, T1); “I asked the teacher if it was all right what I did. We asked our teammates what they did, and whether it was good or not what I had worked” (student, mono-disciplinary group, T1); “Eventually we talked to each other without shame and that brought us closer to each other” (student, mono-disciplinary group, T1); and “Team collaboration is difficult when you do not know your teammates” (student, cross-disciplinary group, T1).

This exploratory stage of identification [9] and exaggeration of similarities and differences between students are necessary to create a favorable context for in-group communication [44]. After the initial learning phase, all students appreciated that they had developed reliable relationships with the other students:

“We had a smooth communication because everyone listened to others opinions and alternative solutions” (student, cross-cultural group, T2); “I think an obstacle can be overcome with mutual understanding” (student, cross-cultural group, T2); “At first I was skeptical, but along the way I changed my attitude and became more openly communicating with others” (student, mono-disciplinary group, T2); “In my team communication was open. We listened to each other and we managed to solve any problem encountered” (student, cross-disciplinary group, T2); “The students from Norway were open and honest” (student, cross-cultural group, T3); and “I learned to be more open as usual” (student, cross-cultural group, T3).

3.2.4. Attitudes toward Differences, and the Use of Member Resources

Students measured their teamwork skills by comparing them with those of other students, identifying their differences, and using members' resources differently depending on the disciplinary group composition (Table 13). Thus, students from the mono-disciplinary group, who were in their first year of study, showed interest both in discovering their personal differences and in identifying new styles and learning situations:

Table 13. Range of attitudes toward differences between students from different disciplinary group compositions.

Disciplinary Group Composition	Range of Categories of Attitudes towards Differences		
	Personal Differences	Learning Styles Diversity	Cultural Diversity
Mono-disciplinary	second interest	first interest	no interest
Cross-disciplinary	first interest	second interest	no interest
Cross-cultural	third interest	second interest	first interest

“We are different. We have different opinions on some aspects. However, these differences in attitudes are constructive and it is important to listen, communicate and thus, strengthen our relations.” (student, mono-disciplinary group, T1); “We develop the ability to understand each other because we are different and have different opinions.” (student, mono-disciplinary group, T4).

The reflections of the students who participated in the cross-disciplinary and cross-cultural groups showed that they were interested in using the diverse competencies, knowledge, talents, skills, abilities, and personal experiences. This attraction toward diversity motivated their active participation in teamwork, increased satisfaction, stimulated a more positive conception of the self, and offered opportunities for self-realization and recognition of merits:

“The course has helped me realize how easily common ground can be found between different people and groups.” (student, cross-disciplinary group, T3); “I had to overcome the fear of speaking in a foreign language” (student, cross-cultural group, T1); and “It helped me better understand different mentalities.” (student, cross-disciplinary group, T2).

The openness to diversity and the availability to effectively use the resources of each group members were greatest for students in the cross-cultural group, the most heterogeneous in terms of professional competencies, soft skills, cultural background, and attitudes toward learning. In the cross-cultural group, the interest in recognizing and celebrating cultural diversity was a key resource for solving problems, decision-making, facilitating in-group communication, and motivating positive attitudes toward differences and innovative solutions throughout the learning process:

“We discussed cultural differences between Norwegians and Romanians” (student, cross-cultural group, T1); “We will try to use the learning techniques from Norwegian educational system” (student, cross-cultural group, T2); “I warned about differences and similarities between Romanian and Norwegian culture, as well as the current situation in both countries (about the COVID-19 pandemic effects)” (student, cross-cultural group, T1); and “I had a beautiful experience in this project: I met new people, I used my skills, I am glad that we made a good job. Thanks for this learning opportunity! It’s worth every minute of effort” (student, cross-cultural group, T4).

4. Discussion and Conclusions

The present research aimed to determine and describe the effects of disciplinary composition—mono-disciplinary, cross-disciplinary, and cross-cultural—on virtual learning group process dynamics from the students’ perspectives. By analyzing the group dynamics in the three disciplinary settings, we inferred the advantages of each virtual group composition for group dynamics and learning outcomes in terms of group skills acquisitions. These conclusions can help teachers design virtual team compositions, a crucial stage in ensuring the achievement of the desired learning outcomes [3].

In the line with the hypothesis, the results indicate that there are differences and particularities in the group dynamics of the three virtual learning groups, as was noticed in other studies on group composition [5,9,10,15,16]. Each has advantages, and we could choose one group composition or the other depending on the learning needs, context, and goals.

At the beginning of the learning process, no significant differences in group dynamic characteristics between the three groups were found. After the first learning session in groups, only the cross-cultural group was significantly more involved in the discussions, teamwork, and learning activities, in general. This finding is in line with previous studies on the advantages of cross-cultural groups [20–26]. The students from all groups felt from the beginning that they could express their thoughts, feelings, and ideas freely. The data suggest that, at the end of the course, the mono-disciplinary learning group members trusted one another and were ready to change procedures in response to new situations. A possible explanation would be the focus on the task and final result for the mono-

disciplinary group, in line with the study of Asherman, Bing, and Laroche [19], who linked the idea of trust with productivity in teamwork. For the cross-disciplinary group, the members were comfortable giving and receiving help; all were involved in decision-making; and each member's abilities, knowledge, and experience were fully utilized. This conclusion is confirmed by the previous studies of Schaffer et al. [9,15], who observed that in cross-disciplinary groups the evolution from individual to collaborative thinking is highly interrelated with team structure, dynamics, and collaborative learning processes. For the cross-cultural group, the members could express their thoughts and feelings and felt free to voice their differences and to work through them.

One similarity in the group dynamic characteristics that emerged from the data was that all three groups set similar goals for their project-based teamwork to focus on the development of communication and collaboration skills through experiential learning. In accordance with the conclusions of Assbeihat [45], the results suggest that group work can be accomplished only if the team members collaborate and communicate efficiently. The cross-cultural group also aimed to achieve a mutual understanding of their cultural and organizational differences, and a mutual understanding of the socio-cultural context for the real-world cases they studied. The mono-disciplinary group aimed for a more pragmatic goal: to develop professional competencies. These results emphasize the congruence between the transversal competencies acquired at course completion and the students' personal goal setting.

Additionally, a similarity between groups was that, throughout the learning, all students appreciated that they had developed reliable relationships with the other students. Initially, they differed in openness and trust in each other, and the students were concerned about the need to be accepted by others and to identify their position and roles within the team. The cross-cultural group of students perceived openness and trust as core personal attributes from the beginning. The mono- and cross-disciplinary groups initially did not trust their own strengths or their colleagues, but as the learning progressed, they also opened up and trusted their peers. This research result is in accordance with the study of Tseng and Ku [46] about the level of trust within virtual teams, which is constantly changing according to group members' willingness to be trusting and through the process of relationship development among group members.

Most differences were found in participation, decision-making, and flexibility. While the cross-cultural students were perceived as active during participation from the beginning of the learning process, those in the mono- and cross-disciplinary groups increasingly became more active from one phase of learning to the next. From the beginning, the cross-cultural group of students were involved and participated responsibly. They felt they had a high degree of autonomy in organizing their collaborative activities and took a sustained effort to organize efficiently and achieve an effective communication between teammates. The mono- and cross-disciplinary groups used mainly the digital platforms and tools provided by the university, while the cross-cultural transnational group of students combined the e-learning platforms of the partner universities with various other web-based platforms.

Within the mono- and cross-disciplinary groups, the students' participation was not as productive, assumed, and responsible from the beginning as that of the cross-cultural group. Although the students were present throughout the learning process, many had a passive participation during the initial learning phase, without contributing useful content to the team; lacked reciprocity; and lacked first-hand interactions. After the identification learning phase, the students began to progressively become active in participation, started to become more involved in decision-making, and gained more flexibility.

Additionally, distinctions were found in attitudes toward differences. All students were interested in diversity and their differences, but for various reasons. Students from the mono-disciplinary group, who were in their first year of study, showed interest both in discovering their personal differences and in identifying new styles and learning situations.

The students from the cross-disciplinary and cross-cultural groups were interested in using the diversity of competencies, knowledge, talents, skills, abilities, and personal experiences.

The virtual project-based collaborative approach was well perceived by the students and induced positive learning outcomes in terms of transversal soft skills. For an effective teamwork, the students should be initially trained in team building and cohesion skills. This conclusion is in accordance with Cañabate et al. [30], who stated that in order to be able to teach an activity more efficiently in different types of groups, social and interpersonal skills such as attentive listening, leadership skills, respectful negotiation, cooperative questioning, decision-making, confidence building, and conflict management need to be taught to enable learners to cooperate effectively in a group environment. All disciplinary group compositions contribute to developing teamwork and communication skills, but they have specific advantages. These results should be taken into consideration when designing an instructional strategy related to group composition according to the learning objectives, students' needs, and context.

With the focus of the expected learning results on developing communication and teamwork skills, all models were effective. To increase group cohesion and the acceptance of diversity, a cross-cultural approach is best. To enhance students' participation and involvement in learning, the cross-cultural model offers the best framework from the beginning. To mainly develop professional competencies, a mono-disciplinary group composition is recommended.

It was beyond the scope of this study to determine the influence of disciplinary group composition on other learning outcomes. Future studies should consider the impact of group disciplinary composition on the learning results in terms of knowledge and professional learning competencies.

The methodological choices were constrained by the specificity of the online teaching period due to the COVID-19 pandemic. All of the courses took place online, and the number of students in each group was influenced by this situation. Further research is needed to establish if different virtual settings (blended or virtual learning, or asynchronous or synchronous online learning) or different group sizes produce different results.

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