Does nationality composition affect student groups' collaboration and performance? A cross-case analysis

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ABSTRACT

A Dutch STEM university is aiming to create an inclusive international classroom where diversity is appreciated as an indispensable element of the quality of learning. One aspect of the international classroom is to enable students to acquire international collaboration skills through working in mixed nationality student groups. In a previous interview study, we found that group composition of nationalities has consequences for collaboration, in which having just one 'token' international member group seems particularly ineffective. This paper presents a follow-up observation study that compares collaboration and performance in three compositions of mixed-nationality student groups. We analyzed online meeting recordings, evaluation questionnaires, and self-reflection reports. In the cross-case analysis, we focused on: 1) members' participation in the meetings (frequency of utterances), 2) disagreement episodes (triggers and solutions), and 3) group performance (teachers' grading and students' perceived performance). The results suggest that in the group with one international member, group meeting conversations were skewed towards the domestic Dutch students. This group

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encountered more process-related disagreements, competitive disagreement solutions, experienced a low level of trust, more emotional discomfort (such as pressure), and experienced less satisfaction. By comparison, in the other two groups where nationality was more equally distributed, members evenly contributed to meetings. These groups were observed to have more task-related disagreements, more information elaboration and agreement solutions, and higher levels of trust, satisfaction, and group belongingness. This observation study contributes to awareness of student diversity effects that allow teachers to take the next step towards facilitating mixed-nationality student groups in the international classroom.

1 INTRODUCTION

1.1 Research background: creating an international classroom

Many future engineers will work in multidisciplinary and international teams on open engineering problems. This requires engineering education in an international context, working in diverse teams, and gaining international collaboration experiences. A Dutch STEM university, located in the center of one of the worlds' leading technology hubs, is currently working towards creating a diverse and international classroom, resembling the make-up of the high-tech labor force [1]. Recently, the university has formulated its policy on the international classroom. The policy defines "International classroom" as: a learning space of a group of students in which 1) different nationalities with different cultures are represented, 2) the common instruction language is English, which is not the first language of most students present, 3) students and staff engage in and appreciate diverse and mixed nationality teams, and 4) the diverse learning environment is (created) such that it enables students to gain international and multicultural experiences and enhances the education quality.

The lack of interaction between domestic and international students in project courses has become a common concern in most English-speaking countries, such as the US and UK [2]. The most often referred challenges of working in a mixed nationality student group have been reported to comprise language barriers, academic culture differences, and a negative experience with and/or a stereotype view of international students [3]. In the Netherlands, this could be even more complex since English is not the native language for both domestic and (most) international students. This research project aims at exploring the challenges and gains in international student teams as well as finding factors that facilitate/hinder students' collaboration and group performance in the current international classrooms. By achieving the research aim, it contributes to strengthening the international classroom and facilitating the successful implementation of the international classroom at the university. It also contributes to engineering education, i.e., forming effective culturally diverse work teams in project courses. As outlined in the SEFI position paper (2018) [4]: "substantial progress must still be made to achieve the SEFI vision: diversity, equality, and inclusiveness are essential to enriching engineering education experiences and generating innovations that can drive the development of creative solutions to address the world's challenges. [4]"

1.2 Our initial studies on student group work in the International classroom

The project started with an inventory study of the degree of current internationalization per subject /course [5]. The inventory study identified subjects and courses that involved student group work as well as a substantial number of international students suitable for our next studies. Based upon the above inventory of suitable subjects and courses, we selected ten master students from different study programs who had mixed nationality student group work experiences for an in-depth interview. These ten students included five Dutch students and five international students (one Portuguese, one Pakistani, and three Chinese).

Our interview study showed some issues in group compositions and group collaborations in the current international classroom [6]. Firstly, forming a mixed nationality group is not naturally happening as we wish to see. Domestic and international students often sit separately in the classroom, and they tend to form a group with those who are similar to them. Secondly, becoming the only international member in a domestic Dutch student group has brought great challenges to the international students. International students as a minority group in some courses often face a situation that they have to join a group with a majority of domestic Dutch students. As a token international member in a group, domestic Dutch students are more inclined to switch to speak Dutch and thus make the international member feel *frustrated*, *distanced*, and *excluded*. Thirdly, domestic Dutch students often perceived the extra efforts taken to effectively collaborate with international students in one group, due to different cultural backgrounds and language issues.

In sum, our interview study showed the current challenges of mixing Dutch and international students in international classroom group work and indicated the consequences of student diversity for group collaboration and performances. Based on the results, we concluded that the vision of international classroom has not yet been achieved. It provides a starting point to further compare group collaboration behaviors and group performances with members of varying nationalities (nationality balancing group and token international member group) to see the consequences.

1.3 Current study design: observing students' collaboration behaviors and group performances

This is a follow-up study of the interview study, aiming to explore the student diversity consequences on group work by observing students' collaboration behaviors and group performances across three types of compositions of mixed-nationality student groups.

Group diversity composition

Diversity refers to differences between team members, and it could refer to any attribute of differentiation. Given that our study is about diverse student groups in international classrooms, we limited our explorative focus primarily on differentiation in *nationality* (place of birth) but also taking into account *gender and expertise* differentiations. Based on this, we selected three student groups to observe their collaboration behaviors and group performances. Suppose there are four students in one group. Group 1 would then consist of only one international student, and the remaining three are Dutch students. Group 2 consists of two international students

who have the same nationality, and the remaining two are Dutch students. Group 3 would then consist of two international students with different nationalities, and the remaining two are Dutch students.

Intragroup collaboration behaviors

Nationality diverse students have often been reported to bring a variety of perspectives and approaches to the group, which contributes to the quality of learning and decision making, compared with homogeneous groups [7]. However, nationality diverse groups encountered more challenges such as misunderstandings and caused discomfort, poor interactions, a lack of trust, and perceptions of more interpersonal conflict [8]. “Disagreement”, different perspectives among group members, is found to be one of the key processes in mixed nationality student group work collaboration behaviors, from our interview study results. Such group conflicts have been studied extensively in the educational field. For example, Lahti et al. [9] observed small groups of student teachers’ collaborative learning and found three types of conflicts: “content-specific argumentation between different views and conceptions” (task-related conflict), “conflicts concerning responsibilities and the division of tasks” (process-related conflict), and “interpersonal issues” (relationship-related conflict) (p.151) [9].

In general, task conflict is seen to positively affect individual learning and team performance, as it stimulates members’ engagement into explaining, arguing, and negotiating their positions while coordinating their opinions on the task. In contrast, process and relationship conflicts are seen as negatively affecting team performance [10]. Dealing with conflicts in a group has been shown to enhance learning, enhance critical thinking, and lead to higher-quality solutions to complex problems [11]. Aarnio et al. [12] have created a framework to identify how student groups handle their conflicts using the following dimensions: elaborated/not elaborated, individual/collaborative, and conforming/competitive [12]. “A conflict episode is not elaborated on, if students either accept counter arguments immediately (Conforming), or adhere to their original conclusions without explaining them, and reject others’ ideas without showing interest in them (Competitive). A conflict is elaborated on when one student explains the justification of his/her opinion (Individual), or when two or more students contribute to resolving the conflict using argumentation (Collaborative). Elaboration of conflicting ideas can also be competitive if students give a rationale for their ideas only to prove that they are right” (p. 219) [12]. In the current study, we used the above knowledge conflict solution dimensions to analyze how student groups handled their intragroup disagreements.

Group outcomes

Social categorization holds that people are more positively inclined toward those who are similar to them rather than dissimilar, and as a result, the more homogeneous the workgroup, the higher member commitment, and group cohesion will be leading to higher group performance [13]. The information/decision-making perspective holds that the diverse groups are more likely to process a broader range of task-relevant knowledge, and leads to creative and innovative ideas and solutions [14].

We choose to measure group outcomes by focusing on *group report grade*, *satisfaction with the group*, and *experienced inclusion*. In general, group performance and affective outcomes, i.e., satisfaction are important group work outcomes that lead to success and continuation of group work [15]. Besides, we added group inclusion as a third outcome, as it is an important concept in diversity groups. In our study context, we wanted to know how students in diverse groups feel included by the group, particularly from the perspective of the international students.

1.4 Research aim and research questions

So, building upon our previous interview study, this study aimed at comparing student intragroup collaboration behaviors and performances across three types of group diversity (mainly nationality) composition, and thus exploring how the group diversity composition influences group collaboration process and performance. By identifying the differences in group collaboration behaviors and group performances, it is expected to contribute to enhancing teachers' awareness of diversity effects in composing student groups in the international classroom.

To achieve the above research aims, two research questions were formulated as:

RQ1. Do student-group intragroup collaboration behaviors differ across types of group diversity composition, and if so, in what way?

RQ2. Do student-group performances differ across types of diversity composition, and if so, how?

2 METHODOLOGY

2.1 Participants

This study was approved by the Ethical Review Board of the university <ERB2020IEIS46>. Participants in this study were 13 master students (three student groups) from a multidisciplinary course offered by the Department of Industrial Design. We purposefully selected this course, because it contained a group assignment (counting towards 50% of the final grade), and there were a relatively large number of international students enrolled in this course. Students need to design a recommender system for food as a group in eight weeks.

Group 1 consisted of three Dutch students and one Chinese student; Group 2 consisted of two Dutch students, one French and one Chinese student; Group 3 consisted of two Dutch, two Chinese, and one Indian student. These 13 students agreed to participate in this study and gave their informed consent.

2.2 Data collection

The research data consisted of 1) student groups' meeting video recordings, 2) a short performance evaluation questionnaire, and 3) students' reflection reports – evidence for individual learning goals and the reflection on group process.

Since students' meetings were organized online, we chose to use the non-participant observation method to collect video data to maximize students' comfort in the online learning environment. One student from each group was assigned the task of video

recording their meetings (with all group members present) three times: a first group meeting, a second group meeting halfway along with the deadline, and a third meeting before group assignment submission.

A short digital questionnaire was sent to all students to measure their perceived group performance after receiving the last meeting recording, and students were required to complete the questionnaire before they received their group grades. The questionnaire scales included *expected group performance*, the *satisfaction of working in this group*, and *group work inclusion*.

To obtain additional evidence for individual learning goals and the reflection on the group process, students were asked to voluntarily share their self-reflection reports with the researcher, which is a mandatory deliverable in the course. In the end, we received 11 (out of 13) self-reflection reports.

2.3 Data analysis

A cross-case analysis was used to compare the intragroup collaboration behaviors and performances with three foci: 1) member participation (frequency of utterances), 2) disagreement episodes (triggers and solutions), and 3) performance (teachers' report grade and students' perceived performance).

The unit of analysis for video data is a disagreement episode, defined as a series of interactions where students deal with disagreements on assignments. A disagreement episode begins from a situation where a student utters an idea that is contradicted with a counterargument, non-confirming, or a critical question by another student [16]. A disagreement episode ends when students agree on the issue, change the topic, or confirm what is claimed.

The number of utterances by each student was calculated to understand group members' participation in the group conversations in each case. We did not specify the types of utterances; whatever the student said was counted once.

The means of questionnaire scales were calculated to compare group outcomes across three cases. Open coding method was used to analyze students' learning gains from their self-reflection reports.

3 RESULTS

Table 1 displays an overview of three cases' information, including group composition, group disagreement episodes and handling disagreements, and group outcomes. We gave an interpretation of group diversity compositions across three cases, followed by presenting two research results to two main research questions.

Table 1. Comparisons of three cases

	Case 1 (N = 4)	**Case 2 (N = 4)**	**Case 3 (N = 5)**
Group composition (Nationality, gender, department) Note: ID = Industrial Design; IE&IS =	1. Dutch, Male, ID 2. Dutch, Male, ID 3. Dutch, Male, IE&IS 4. Chinese, Female, ID	1. Dutch, Female, ID 2. Dutch, Male, ID 3. French, Male, ID 4. Chinese, Female, IE&IS	1. Dutch, Male, ID 2. Dutch, Male, ID 3. Indian, Female, ID 4. Chinese, Male, IE&IS

Industrial Engineering & Innovation Science			5. Chinese, Female, IE&IS
Frequency of utterances by each student	Dutch, Male (259) > Dutch, Male (207) > Dutch, Male (154) > Chinese, Female (97)	Dutch, Female (389) = Dutch, Male (389) > Chinese, Female (359) > French, Male (295)	Dutch, Male (290) > Dutch, Male (258) > Indian, Female (157) > Chinese, Male (101) > Chinese, Female (80)
Number of disagreement episodes	Task-related disagreement (73%) Process-related disagreement (27%)	Task-related disagreement (95%) Process-related disagreement (5%)	Task-related disagreement (100%)
Triggers of disagreement	Different perspective (54%) Different understanding (27%) Different perspective & understanding (9%) Distrust (9%)	Different understanding (66%) Different perspective (33%)	Different understanding (50%) Different perspective (37%) Different background (12%)
How disagreements handled	Elaborate, individual, agree (18%) Elaborate, collaborative, agree (54%) Elaborate, competitive (27%)	Elaborate, individual, agree (57%) Elaborate, collaborative, agree (33%)	Elaborate, individual, agree (25%) Elaborate, collaborative, agree (75%)
Group grading from teacher (N = 50 points in total)	42 points	40 points	41 points
[2]**Individual expected group performance (Mean)**	2.58 (Positive)	1.42 (Positive)	1.73 (Positive)
[2]**Satisfaction within the group (Mean)**	3.25 (Slightly positive)	1.25 (Positive)	1.87 (Positive)
[2]**Work group inclusion (Mean)**	4.17 (Slightly negative)	3.34 (Slightly positive)	4.60 (Negative)

3.1 Group compositions of three cases

Taking a closer look at our three group member compositions, Case 1 included only one international member, and she hardly shared any similarity with the remaining three Dutch members. The international student was the only female, non-Dutch, and had completed her bachelor's program in her home country. Although she was enrolled in the Industrial Design program, like two of the three Dutch students in the group, this had not created an opportunity for her to get acquainted with them in advance. Besides, she was a first-year master student and this group assignment was probably one of her first courses taken in this new country. Due to the influence of COVID-19, all teaching activities and social activities (e.g., introduction weeks for first-year students) had been scheduled online, which greatly reduced social activity opportunities. By comparison, Case 2 and 3 at least had crossed differences in nationality and gender. We added the task-division situations across three cases to better understand the composition of differences in each case. In Case 1, the group work was divided into three parts taken by two Dutch male members, one Dutch male

[2] 7-point Likert scale (1 = strongly agree; 7 = strongly disagree).

member, and one Chinese female member. Case 2 divided their group work into four parts taken by an individual member. Case 3 has divided the group work into three parts taken by one Dutch male member, one Chinese female and one Indian female member, and one Dutch male and one Chinese male member.

3.2 Comparison results of intragroup collaboration behaviors

Table 1 shows differences in international student member utterance participation and different types of disagreement episodes including triggers and solutions across three cases.

In general, Dutch members' group conversation participation was the highest across three cases. In Case 2, four members' utterance frequency was more or less equally distributed. By comparison, Case 1 and Case 3 showed more skewed conversations towards two Dutch members within each case. So, the international members particularly Chinese members' utterances were low in Case 1 and 3. Although the Chinese female member's utterance was the lowest one in Case 3, it was because she only attended the last meeting for about ten minutes due to another exam. So, the Chinese female member's utterance in Case 1 was probably the lowest among the three cases.

Overall, more task-related than process-related disagreements were found across three cases, and we did not find any relationship-related disagreements. Case 1 experienced more process-related disagreements than the other two cases, which indicated more time spent on discussions about the division of the task and management of responsibilities. Case 2 has experienced the most task-related disagreements, which indicated more time spent on the elaboration of the task-relevant information. Case 3 experienced task-related disagreements as many as in Case 1.

The majority of disagreements were triggered by either different perspectives or different understandings across three cases. Case 1 was triggered more by a different perspective compared with the other two cases. Different perspectives indicated the exchange of information and perspectives. For example, students in Case 1 often gave counterarguments or asked critical questions like: "I think the idea wasn't correct with how the machine learning works. So it's better to move forward… It sounds good to have a unique selling point, however, we need to combine it with machine learning…" Different understanding contained the exchange of interpretations of information and perspective, to seek mutual understanding. For example, students in Case 3 displayed more exchange of understanding behaviors, like "… Yes, that means you don't like any dish that is shown on the screen right now, then you don't need to wait till the end of scrolling…"

All three cases used elaboration to handle these disagreements, namely students (individual or collaborative) explain or justify ideas to resolve the disagreements. Case 3 has experienced more collaborative elaboration to resolve disagreements than Case 1 and 2. Case 2 has experienced more individual elaboration (two group members involved) than the other two cases, and only Case 1 experienced elaboration with competitive resolution.

3.3 Comparison results of group outcomes

We compared student intragroup collaboration outcomes based on report grade, students' evaluation questionnaire results, and students' self-reflection reports.

The total grade for the group report is 50 points. Only minor differences were found in group grading across three cases: 42 points for Case 1, 40 for Case 2, and 41 for Case 3.

Differences were found in students' evaluation questionnaire results and their self-reflection reports. Case 2 showed the most positive expectation about their group performance, highest satisfaction of working in this group, and highest sense of inclusion by the group. By comparison, Case 1 showed the least positive expectation about their group performance, less satisfaction of working in this group, and less sense of inclusion by the group. Case 3 in general showed positive expectations about group performance and a higher sense of satisfaction of working in this group, however with the lowest sense of inclusion by the group.

Although Case 1 received the highest report grade across three cases, group members showed less positive expectations about group performance and less sense of satisfaction of working in this group. Students' self-reflection reports indicated that Case 1 experienced an imbalance workload distribution issue among four members, so two Dutch male members with a high level of stress of doing too much and the remaining Dutch male and Chinese female members were ambivalent about what to do. For example, one Dutch male member with a lot of pressure reported that "*There was a lot of stress within the group due to work imbalance and missing skills to help out in areas where more work was needed to be done. A team member and I tried to take on as much work as possible to keep the process going, resulting in an even bigger work imbalance. After asking guidance from the teacher, … I can focus on my learning goals and less on the work that just had to be finished*." Another Dutch male member with ambivalence about their group work reported that "*It would be wise to make explicit what my personal responsibility would be, in case I had a shared responsibility with a teammate, then I could have prevented that my teammate had already done a large share of the work before I knew it…*" From students' self-reflection reports, we found one facilitating factor of timely teacher guidance and feedback that helps Case 1 get back on track working towards a shared goal.

4. Summary and implications

This study compared intragroup collaboration and performance across three student groups, each with a different nationality composition. Case 1 consisted of one international student with three Dutch students, and Case 2 and 3 had two or three international students with two Dutch students. We observed that the Dutch students in Case 1 dominated the group meeting. This group encountered more process-related disagreements, competitive disagreement solutions, a low level of trust, more emotional discomfort (such as pressure), and experienced less satisfaction. By comparison, group meeting conversations were more evenly distributed in Case 2 and 3, particularly in Case 2. These groups had more task-related disagreements,

more information elaboration, and agreement solutions, reported higher levels of trust, satisfaction, and group inclusion. These differences contribute to the awareness of student diversity effects that allows teachers to take the next step towards facilitating mixed nationality student groups in the international classroom. Based on this study, we draw three tentative implications. Firstly, from a group composition perspective, a deliberate mix of Dutch and international students appears necessary to guarantee a feasible group composition. In particular, having one international member in a Dutch student group should be avoided if possible. Secondly, having a concrete inventory of individual member's backgrounds, expertise, learning goals, etc within the group provides a solid base for collaboration for mixed nationality student groups. Thirdly, timely teacher (coach) guidance is important to facilitate student groups (particularly with only one international member present) who experienced troubles and issues in continuing collaboration.

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