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Learning effects of an international group competition project

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This study investigates the effects of collaboration and competition on students' learning performance in a course of business statistics. The collaboration involved a simultaneously organised group competition project with analysis of real-life business problems among students. Students from the following schools participated: JAMK University of Applied Sciences in Finland, Universidad Complutense de Madrid in Spain, and Sabanci University in Turkey. The results support earlier literature on positive impacts of group collaboration on learning performance but deny any negative impacts of competition. It is also found out that learning performance may be influenced to a certain degree by cultural differences in perceptions towards collaboration and competition. Overall the international competition and the touch to real-life business problems stimulate students' engagement and result in enhanced learning towards becoming 'intelligent consumers of business statistics'.

Keywords: learning; collaboration; international competition; business statistics; real-life project

Introduction

Business Statistics is a first-year course in the curricula of many bachelor degree programmes in Business Administration. The course aims to develop students' skills in making meaningful analysis of large data-sets to solve managerial problems. Due to its high level of involvement with large chunks of data and unfamiliar terms with mathematical formulas, this course is vulnerable to become a boring, number-crunching exercise for some students. In this situation, the resulting learning performance is likely to be poor as students feel demotivated and at times frustrated in front of meaningless data-sets. To avoid such instances, teachers of business statistics should exhibit creativity to engage their students.

Creativity in the classroom involves the application of knowledge and skills in new ways to achieve desired learning outcomes (Burke, 2007, p. 36). Learning may be explicit or implicit. Explicit learning can be achieved through activities such as reading textbooks, listening to lectures, seeing pictures and watching videos. Implicit experiential learning can be achieved through life experience, games and other hands-on activities which increase students' engagement (Dewey, 1938; Kolb, 1984).

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The proposition to involve students in meaningful activities is also rooted in activity theory (Engeström, Miettinen, & Punamäki, 1999; Vygotsky, 1978). ‘Students learn concepts best by doing – seeing, smelling, hearing, touching and tasting as well as thinking, either creatively or logically’ (Burke, 2007, p. 35). Such classroom activities include game simulations, problem-based learning exercises and case competitions, and group work is encouraged in these activities in order to meet students’ social needs (Sachau & Naas, 2010). Following these lines of thought an international group project competition was designed by the authors of this paper and implemented simultaneously at their business statistics courses in their home universities, namely JAMK University of Applied Sciences (JAMK hereafter) from Finland, Universidad Complutense de Madrid (UCM hereafter) from Spain and Sabanci University (Sabanci hereafter) from Turkey. Teams made up of three students competed first against teams in their own university, and they were evaluated by the corresponding course teacher. The top three performers from each university were then evaluated by the three teachers jointly, and the best three teams were awarded. The task for each team was to identify a real-life managerial problem and solve it by using appropriate statistical data analysis tools. Earlier research indicates mostly positive but also some negative results about the effects of collaboration on learning performance (Griffin, Griffin, & Llewlyn, 2004; Krause & Stark, 2010; Orlitzky & Benjamin, 2003). It seems that the effects of competition on students’ learning performance can be negative (Lam, Yim, Lay, & Cheung, 2004; Wang & Yang, 2003). By applying intragroup collaboration and intergroup competition simultaneously, this research aims to contribute to a better understanding of the impacts of collaboration and competition on learning performance. Conducting the empirical study in an international setting also allows analysing whether the effects of collaboration and competition on learning performance differ in different cultural contexts. To achieve these objectives, performance results from the activity were compared with results from other activities and triangulated by a survey with the students at each university.

The paper continues with literature review and development of a conceptual model and accompanying hypotheses. This is followed by description of the project and applied methodology. Afterwards, results are presented and discussed, and finally avenues for future research are suggested.

Literature review

Constructivist learning theory assumes that knowledge is not independent of the learners’ values and beliefs (Dewey, 1938). Cultural influences are important for the learning process since it is based on interaction with the social environment. Teachers should take into account learners’ previous knowledge as well as their social backgrounds and use methods emphasising social interaction.

According to experiential learning theory, learning results in behavioural changes through the process of action, experience, reflection and theoretical analysis/conceptualisation (Kolb, 1984). A familiar learning approach under this theory is learning by doing which is accomplished through conducting meaningful activities. The activity is a facilitator of learning between the learner and the subject to be learned (Vygotsky, 1978). This approach is based on the assumption that it is through making mistakes and reflecting upon them that individuals learn. Group work is especially helpful in this approach as learners verbalise their

understanding, receive immediate feedback from their peers and reflect upon their actions (Teasley, 1995).

Students need to be motivated to get engaged (see Russell, 2008 for a broader review). Maslow (1943) points out needs as key motivation factors for human beings. According to the two-factor theory of motivation (Herzberg, 1968), hygiene factors prevent dissatisfaction, whereas factors like achievement, recognition, responsibility and promotion motivate. In expectancy theory (Vroom, 1964), motivation depends on anticipation of a reward, the importance of this reward and the expectation of achieving this reward. Expectation of achievement may depend on perceptions of one's own worth and abilities, and high perceptions of both increase one's persistence and chances of success (*ibid.*). Following attribution theory (Weiner, 1985) people usually attribute success to own abilities and failure to uncontrollable external circumstances. Thus, people will be motivated to achieve if they attribute past performances to their own efforts. The ARCS model of motivational design (Keller, 1987) argues that motivation comes through attending (A) to a task, understanding its relevance (R), being confident (C) on achieving the goals of the task and getting satisfaction (S) from the task.

Collaborative learning activities involve mutual engagement of participants in a coordinated manner to solve a problem, and this differs from pure cooperation where each participant is responsible for a part of the problem-solving according to division of labour (Roschelle & Teasley, 1995). In collaborative learning, students participate actively in small groups where they take responsibility for learning, share experiences and reflect upon their assumptions and thought processes, and the teacher is more of a facilitator and supporter (Kirschner, 2001). Student tasks during the collaborative learning process are working toward achievement of the goal, collaboration with group members, reviewing success criteria for completion of the activity, monitoring, providing help to group members and reporting (Johnson & Johnson, 1975). Teacher tasks are providing help, providing feedback and intervening in case of problems (*ibid.*). Sharing and debating ideas inside a group stimulates learning through reflective processes, and that might be superior to individual learning since nobody can have all the information required to put the pieces of a puzzle together (Cohen, 1994). Collaborative learning occurs in a process whereby group members first enter into conflicts and then resolve them by co-creating a common understanding (Doise & Mugny, 1984). Communication through dialogue and discussion is key at all stages in the learning process. Especially elaboration of conceptual knowledge is found to be beneficial for improved learning performance (Van Boxtel, Van der Linden, & Kanselaar, 2000). Figure 1 conceptualises students' collaborative learning process in the project.

In a group there will be students of different levels in mathematical talent (Gardner, 1983), but all benefit in their learning. For instance, students with relatively lower mathematical talent benefit as their peers help them, and students with relatively higher mathematical talent also benefit as they externalise their knowledge. Teachers, however, must pay attention to two conditions in order to achieve superior learning in groups (Dembo & McAuliffe, 1987; Lou, Abrami, & d'Apollonia, 2001; Slavin, 1983). The first condition is that active participation of all group members should be encouraged. This is crucial in triggering collaboration and reflective processes. The second condition is that domination by some members in the group (those of higher mathematical talent) should be prevented. Such acts of domination

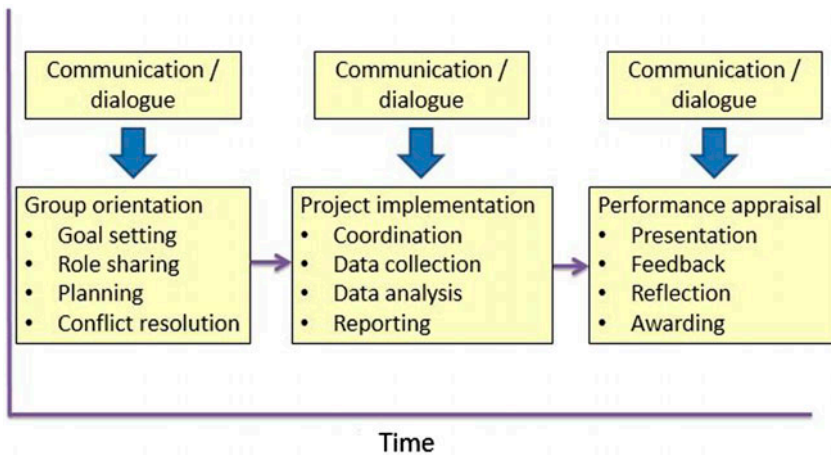


Figure 1. Student’s collaborative learning process.

may result in withdrawal of others from collaboration and thus hinder learning. This may especially happen in a statistics course (Krause & Stark, 2010).

Studies have looked into different factors that may influence team performance. Diversity of group members was suggested in some research to increase creativity and positively affect team performance (Amabile, 1989), whereas in other research it was also shown to possibly trigger negative affective reactions and withdrawal of some group members (Ely, 1994; Maznevski, 1994). Similar mixed results appear on the relationship of sex composition, group size and group performance (Ely & Thomas, 2001; Krause & Stark, 2010; Orlitzky & Benjamin, 2003).

It seems that effects of competition on learning performance are perceived to be negative (Wang & Yang, 2003). This is because competition shifts the focus from learning goals to performance goals which restricts choices and can as a result destroy creativity (Amabile, 1989; Ames & Ames, 1984). Lam et al. (2004) find out that in times of competition students tend to choose easier tasks, and this leads to inferior learning. The negative impacts are more on less able students who know that they cannot win the competition (Vallerand, Gauvin, & Halliwell, 1986). Since their attention is focused on the end result rather than on the process of the activity, these students may lose interest in the task more easily (Lam et al., 2004). Failure in front of others may raise emotions of anxiety and affect students’ self-esteem.

Conceptual model and hypotheses

Our research targets to contribute to the literature on learning through analysing the impacts of collaboration and competition on learning performance in a multicultural context. Input variables in the model are collaboration, competition, cultural perceptions towards collaboration and cultural perceptions towards competition while the output variable is learning performance (see Figure 2).

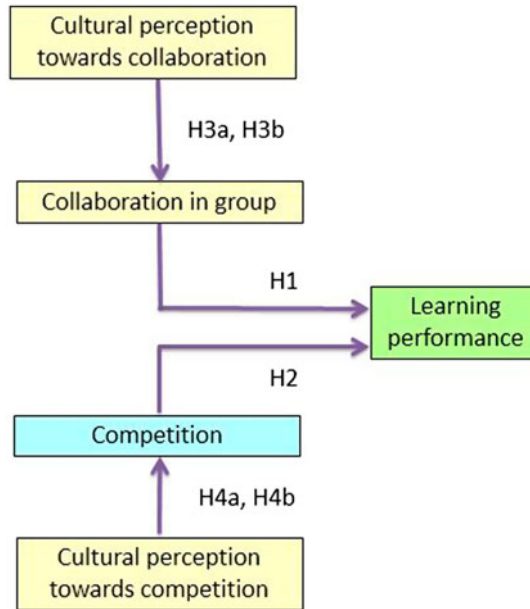


Figure 2. Conceptual model.

First of all, literature suggests that collaboration has a positive impact on learning, and this is reflected in the first hypothesis.

Hypothesis 1: Collaboration among students leads to improved learning performance.

According to earlier literature competition has a negative impact on learning as reflected in the second hypothesis.

Hypothesis 2: Competition among students results in poorer learning performance.

Finally, the cultural aspect is interesting as perceptions towards collaboration and competition may differ from culture to culture and thus have different impacts on learning performance. This thought is reflected in the following four hypotheses.

Hypothesis 3a: There are differences in cultural perceptions towards collaboration.

Hypothesis 3b: Different cultural perception of collaboration has an impact on learning performance.

Hypothesis 4a: There are differences in cultural perceptions towards competition.

Hypothesis 4b: Different cultural perception of competition has an impact on learning performance.

Project description and methodology

The purpose of the international group competition project was to teach students how to do a ‘real-world’ statistical analysis. The process included coming up with a

relevant research question, collecting relevant data, conducting descriptive analysis and making conclusions based on the analysis.

In this project, groups were formed of three students. There were total of 17 groups from Finland, 15 groups from Spain and 17 groups from Turkey. Groups were required to identify managerial issues that required solutions using data analysis methods. Their project proposals were reviewed by their own teachers and approved. At the end of the project groups had to produce final reports. The reports included project description, description of the data (variables, measurement units, etc.), data collection process, all computer outputs, interpretation of the results and conclusions.

Groups also had to make 10 min-long presentations which were video recorded. Project reports along with presentation videos were assessed first by their respective course teachers. Assessment criteria and their respective weights were quality and practical soundness of data analysis (30%), clear and professional presentation in allocated time (30%), effective answering of the research questions (20%), clear project definition (10%), managerial implications (5%) and structure of the report (5%). The top three groups were selected from each university to be further evaluated by the international committee of the three teachers. Each teacher came up with a ranking for the nine selected groups, and a final ranking, aggregating the individual rankings, was obtained. The best three groups were given plaques stating their outstanding performance.

The impact of collaboration on learning performance (Hypothesis 1) was tested using Wilks' Lambda test by comparing the performance results of students in this international group competition project with their respective performances in the final examination which is a purely individual performance. The project and the exam assessed same areas of knowledge covered in the course. A better grade is considered as a sign of better learning performance. In order to test the impact of competition on learning performance (Hypothesis 2), performance results in this international group competition project were compared with performances in the group projects in the same course the year before when there was no international competition again using Wilks' Lambda test.

In addition, an online survey was conducted with students in the three countries after the presentations to study the students' impressions about the project as well as their perceptions towards collaboration and competition. In the survey, students were informed about the purposes of the research and that the results would be published. Participation was voluntary, and the answers were kept anonymous by assigning each student a random code. There were closed questions with a 1–5 Likert-type scale, where 1 meant 'completely disagree' and 5 meant 'completely agree'. The responses from the three countries were compared to test for differences in cultural perceptions (Hypotheses 3a and 4a), and then they were matched against performances of these students to test for possible impacts of cultural differences in perceptions towards collaboration and competition on learning performance (Hypotheses 3b and 4b).

There are many approaches available for statistical inference such as chi-squared test, Mann–Whitney test, Wilcoxon signed-rank test or Kruskal–Wallis test (Cohen, Manion, & Morrison, 2000). Responses were analysed across three groups of respondents (from JAMK, UCM and Sabanci) using the Kruskal–Wallis test at .05 significance-level. Kruskal–Wallis models provide the same type of results as an analysis of variance, but based on the ranks and not the means of the responses (Kruskal & Wallis, 1952).

Results

Hundred and nineteen students answered the questionnaire: all 45 from Sabancı, 41 out of 47 from JAMK and 33 out of 45 from UCM. Grades of all 137 students were used in the tests. Fifty-five per cent of respondents were female. Gender percentages were very similar at Sabancı and UCM, but there was a higher female population at JAMK. There were significant differences in age distributions between the universities. Seventy-five per cent of UCM students were 18 or 19 years old, while only 6% of Sabancı students and 24% of JAMK students were younger than 20 years of age.

Hypothesis 1 argues that collaboration among students leads to improved learning performance. The survey showed that a majority of students in each university took the project seriously and collaborated in good attitude towards accomplishment of the project. The students, especially those at Sabancı and UCM, spared more time in this project compared to other similar assignments. A majority of students in each university believed that the project made a significant contribution to their learning. Combining results from group attitude, time spent for the project and contribution to learning performance, it seems that collaboration has a positive impact on learning. The impact can also be observed when group assignment grades are compared with exam grades which are both measured from 0 to 100 (see Figure 3).

Collaboration seems to have improved results significantly in Spain and Finland. To verify this finding these performance results were compared using Wilks' Lambda test (see Table 1).

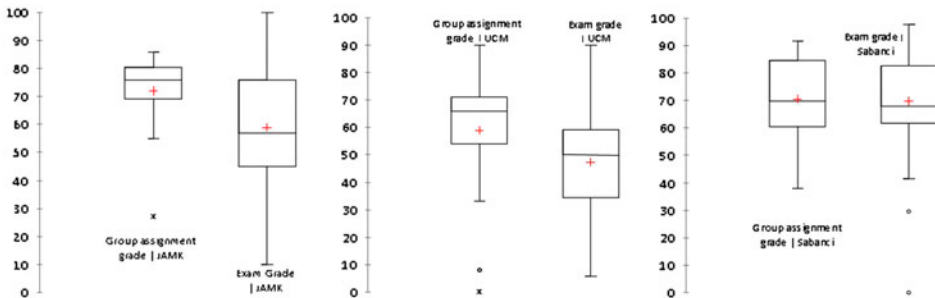


Figure 3. Group assignment vs. exam grades box plots by institution.

Table 1. Wilks' Lambda test (Rao's approximation) results for Hypothesis 1 (H1) and Hypothesis 2 (H2).

	H1	H2
Lambda	.857	.956
<i>F</i> (Observed value)	5.499	3.599
<i>F</i> (Critical value)	2.405	3.963
DF1	4	1
DF2	274	78
<i>p</i> -value	.000	.062
Alpha	.050	.050

As the computed p -value for H1 is lower than the significance level, individual scores for the group assignment are better than those for the exam, and thus Hypothesis 1 is accepted.

Hypothesis 2 argues that competition among students leads to poorer learning performance. Students from UCM and Sabanci said that the group competition increased their motivation. A majority of students also disagreed that they had negative pressure due to competition. In addition, a majority of students liked that their project was ranked internationally. In order to test Hypothesis 2, results from the group assignment in year 2012 (when there was the international competition) were compared with results from the group assignment in year 2011 (when the group assignment was exactly the same, but there was no international competition) using Wilks' Lambda test. A total of 115 student project grades were used from year 2011: 50 from JAMK, 38 from UCM and 27 from Sabanci. As it can be seen in Figure 4, results in 2012 measured from 0 to 100 seem to be better than those in 2011.

As the p -value in Wilks' Lambda test for H2 is lower than the significance level (see Table 1), results from the 2012 group project are significantly better, so Hypothesis 2 is rejected.

Hypothesis 3a argues that there are differences in cultural perceptions towards collaboration. Hypothesis 3b suggests further that this may have an impact on learning performance. Similarly, Hypothesis 4a argues that there are differences in

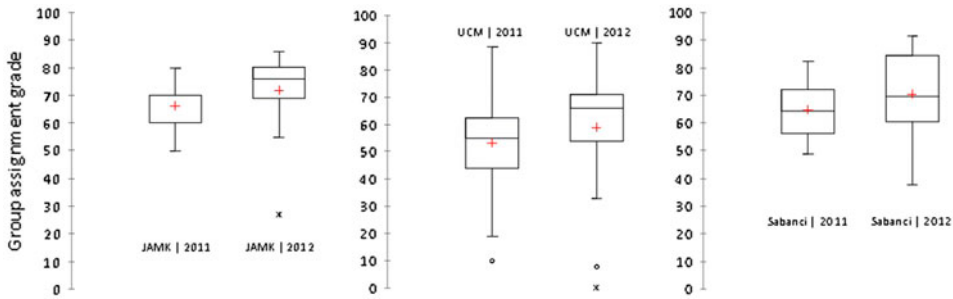


Figure 4. Group assignment grades box plots by institution.

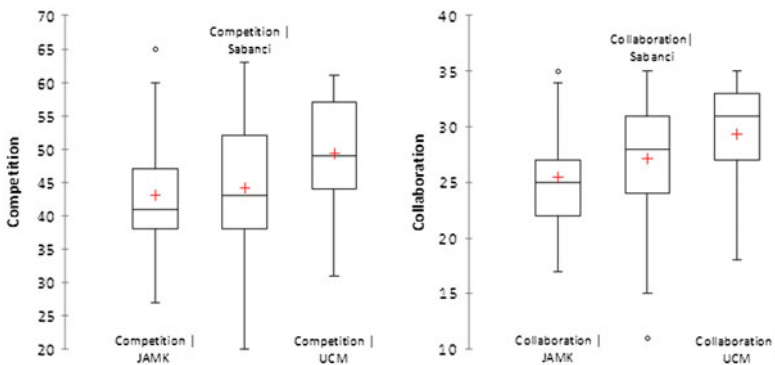


Figure 5. Competition and collaboration total responses box plots by institution.

cultural perceptions towards competition and Hypothesis 4b suggests that this may have an impact on learning performance. Differences between the three institutions for the total scores in the survey for competition and collaboration related questions can be seen in Figure 5.

Results for the Kruskal–Wallis test were obtained using R (v. 2.1.5.) for each of the survey questions individually (see Table 2).

The p -values turn out to be significant (smaller than .05) for most of the questions related to competition and collaboration. When the Kruskal–Wallis test is applied to the total score of the competition and collaboration items, both p -values are small (see Table 2). In addition, p -values for the learning performances are also significant. As a result, the null hypothesis of the medians being equal across the groups is rejected at .05 significance-level, and hypotheses 3a, 3b, 4a and 4b are

Table 2. Kruskal–Wallis test results.

Survey question	Kruskal–Wallis rank sum statistic	p -value
<i>Competition</i>		
Having an international competition for this course increased my level of concentration for this course	6.8724	.0322
I like that my business data analysis project were ranked internationally	1.5948	.4505
I like competitions	4.9637	.0836
I like competing as group	1.1671	.5579
My two other group members took this competition seriously	4.5680	.1019
My two other group members thought that winning this competition was important	6.0328	.0490
Students in my course take this competition seriously	.3804	.8268
Students in my course think that winning this competition is important	2.3167	.3140
I wanted to create an excellent project	17.2761	.0002
I wanted to have our project be among the top groups	15.9405	.0003
Our group intended to develop our project to be among the top groups	21.3006	.0000
As a group, our intention was to create an excellent project	15.7979	.0004
I felt negative pressure because of the competition	3.1071	.2115
Total score competition	11.8422	.0027
<i>Cooperation</i>		
I enjoy working as a team in a competition	2.5090	.2852
Group project competition increased my motivation	2.1625	.3392
At the beginning, I believed that as a group we could produce a high quality project	7.8435	.0198
At the beginning, I felt that our group could produce a project that could win	18.8682	.0001
At the beginning, I believed that as a group we could spend sufficient time and effort on this project	11.5456	.0031
I work hard in group projects	9.5237	.0086
I am successful in group projects	12.7486	.0017
Total score cooperation	14.6965	.0006
<i>Learning outcomes and performance</i>		
I spent more time in this project than similar assignments in similar courses	14.2858	.0008
The level of my motivation was high in this assignment	4.1367	.1264
This project has contributed significantly to my overall learning in this course	8.4709	.0145

accepted. In other words, there are significant differences in the perceptions of students from Finland, Spain and Turkey towards competition and collaboration, and these differences may have contributed to differences in students' learning performances in the three countries.

Discussion

Our results support literature which suggests positive impact of collaboration on learning performance. This is especially the case in small groups where all group members actively participate, and no member dominates the group (Dembo & McAuliffe, 1987; Lou et al., 2001; Slavin, 1983). In the project, groups were deliberately limited to three persons to avoid possibilities of free riding, and students were asked to freely choose their group members. Free choice of group members avoids possible domination by a single member since students know each other already. It seems that collaboration also stimulates individual motivation and results in spending more time for learning. This finding, however, is subject to cultural differences, as it was seen in the results. Cultural differences may be one reason why there are also contradicting findings on the impact of collaboration on learning performance (see Krause & Stark, 2010).

Earlier literature suggests negative impacts of competition on learning performance through restricting choices and destroying creativity (Amabile, 1989; Wang & Yang, 2003). Students who think that they do not have a chance to win could be easily vulnerable to lose motivation and give up (Vallerand et al., 1986). Students can also focus on end results rather than the tasks and choose easier tasks with the aim of winning which can result in inferior learning (Ames & Ames, 1984; Lam et al., 2004). Surprisingly students in the study did not feel negative pressure due to the competition. Indeed, a majority of them said that group competition increased their level of motivation. Perhaps, it should be noted that results from Finland differed from those from Spain and Turkey in that a lower percentage of students felt that the group competition increased their motivation. One of the reasons why the results differ from earlier literature may be that competition was not applied at individual level but at group level. Collaboration at group level may have avoided any possible negative effects of competition on individual students. Indeed, attention was paid to limit possible negative effects by offering flexibility in students' choices of topics and providing tutoring throughout the duration of the project.

Our findings that there are cultural differences in perceptions of competition and collaboration and that they have impacts on outcomes and performance leads us to question earlier research as they are based on samples from a certain culture. Contradictions among earlier research may be due to differences in cultural perceptions of studied sample groups.

Our results encourage teachers to develop similar real-life international group competition projects. This may especially be a creative solution in 'dull' courses such as business statistics. The project may stimulate student engagement and result in improved learning performance. The common project was also a learning experience for the participating teachers in that they learned much from each other through sharing of resources, syllabi and ideas. Indeed, it is intended to develop this common project into a European-level platform as more interaction and sharing across borders may bring more creative ideas, build synergies and make the experience of learning a meaningful and enjoyable journey for both students and teachers.

One possible future idea would be to create multicultural teams where each group has members from different countries. Students would then be using more virtual communication possibilities and be exposed to working in real multicultural learning environments. Another possible future idea would be to develop a virtual business statistics platform to put together ideas, resources, possible research projects and research outcomes. Such a platform would be the home base to integrate efforts from different countries.

Our research is subject to limitations in generalisability in that it was conducted for the first time with a limited number of students. It is intended to repeat the same research with students of business statistics in following years, hopefully including students from other countries as well. In order to overcome this limitation, one possible solution could be to interview selected students from different countries. In-depth interviews could provide richer insights. One further complementary solution could be to conduct surveys with students at different stages of the project. This would provide a dynamic perspective and help to better understand how to handle different stages of the process.

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Notes on contributors

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Enes Eryarsoy is an associate professor who received his PhD from Warrington College of Business at the University of Florida. His research focuses on applications of operations research and data mining from business point of view.

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