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Group Assignments as a Class Element to Promote Performance in Virtual Groups

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Abstract

One of the responsibilities of business schools within universities is to prepare students be successful in business. Success in business often requires students to be effective working and collaborating in virtual teams: groups who are geographically dispersed with members who have never met. Schools have become aware of the need for students to work in teams, but need to investigate the structure and design of courseware to build collaboration skills within students. The goal of this research was to determine if there is an optimal number of group assignments that will result in better group learning performance. This research investigates the optimum number of group assignments needed to promote effective work within virtual teams, by examining performance on a final assignment of a business case. The findings are that students who have at least a medium exposure (three) to group assignments performed significantly better on the business case and cost risk benefit analysis then students with no group assignments prior to the business case. This is significant because it can aid in the pedagogical development of undergraduate and graduate courses in information technology.

Keywords: Group performance; group collaboration; virtual groups; self-regulated learning.

1. INTRODUCTION

A group becomes a team when it can produce excellent results. One question we can ask is what class work elements can be used to improve group academic and business performance. As businesses and teams become more global and dispersed or virtual, we need to address the instructional designs in graduate business classes that will facilitate students becoming effective team members and delivering better teamwork products in these settings. Ives and Jarvenpaa (1996) and Gilbert (1996) suggested that online technologies would change business education and instructors, and predicted the widespread deployment of virtual teams in classes, with students becoming more active in their own learning and research. However, Arbaugh et al. (2009) indicated that this transition has not moved as quickly as those authors' predicted**.**

There are reasons linked to this slow adoption. At the university levels, a concern often raised by business school scholars is that research in education has not been perceived as valuable by business and education, and research has not addressed the applicability of education research and pedagogical best practices to business. Educators have had little to guide them when making decisions regarding the elements of comprehensive design of classes. Yet, currently business schools are expected by professional organizations to be involved in learning and

education research and to apply this research to their organizations (Arbaugh et al., 2009).

Although a significant body of research over the past twenty years has indicated hybrid or blended courses can result in more positive student outcomes than face-to-face and purely online courses (Arbaugh & Benbunan-Fich, 2007; Arbaugh et al., 2009; Benbunan-Fich & Arbaugh, 2006; Means et al., 2013; Zhao et al., 2005) it has not investigated the most effective blend of course elements to improve student outcomes. These elements can include face-to-face and online time; the use of technologies; and, a particular concern of this research, the level of student interaction or group work (Zhao et. al., 2005) and group goal setting (Buller & Bell, 1986).

From an operational perspective, learning management systems and web delivery have revolutionized higher education. The proliferation of online educational tools has begun to have a dramatic effect on higher education and corporate education and training. However, there is a need for teams to be able to interact effectively through online collaboration tools to learn as a group. There has been limited research in the area that addresses the effectiveness of learning through online group collaboration to enhance student performance. This research presents the results of a study to assess the level of group experience on the quality of group deliverables.

It would be beneficial for educators and corporations to examine one of those pedagogical elements, level of group assignments, or student interaction, as effect on student performance, as demonstrated by group-based performance on a business case and cost risk benefit analysis. This paper will present a quantitative assessment of level of group performance as a consequence of level of assignments.

2. LITERATURE REVIEW

A review of significant research during the 1990s regarding online/hybrid learning and collaboration offered some general conclusions. The studies showed the delivery of business education using hybrid technology compared significantly better to face-to-face education; asynchronous communication stimulated group communications in online environments; and collaborative team relationships could be developed in online, virtual groups (Arbaugh et al., 2009). These findings bode well for corporate environments that rely more heavily than ever on the performance of disparate, virtual groups.

Work since 2000 work has centered on the development of general frameworks for effective online and blended business education, but there has been very little testing of these frameworks, and virtually no investigation of the structure of class elements such as level of group interactions. Zhao et al. (2005) examined 51 studies and found that a mixed, blended approach, in which 60%–80% of learning was delivered via "technology", had significantly more positive student performance when compared to face-to face instruction and pure distance learning. In an attempt to identify specific operational elements of blended and virtual groups, the authors recommended examining courses elements of time, instructional resources, and interactions among students to determine if levels of these class elements contributed to outcomes. They indicated that experimental research to test designs is needed for empirical evidence to support course design practice. For example, with regard to elements, the appropriate blend for instructor interaction is not always clear. Balotsky and Christensen (2004) examined traditional and information technology mediated education and proposed the need to develop teaching pedagogy that more accurately promotes the development of skills required for student success in the business environment. They argued that since the business environment is a mix of traditional, face-to-face, and distributed IT- mediated alternatives, institutions should offer this mix in their curriculum to address not only student educational options, but also as to reflect workplace demands and enabling technology. As with Zhao et al. (2005), the authors pointed out that pedagogical issues, such as lectures, collaborative assignments, knowledge construction, in-class and out-of-class constructions had not been extensively examined. Walker (2003) found that the instructor's role in hybrid environments moved to one of facilitator to student directed learning, and provided a pathway to virtual work environments. Brower (2003) raised awareness of the risk of level of instructor intervention in online collaborative environments, as a possible impediment to student directed learning.

There is a large body of research regarding students working in virtual teams and how this provides for collaborative activities that serve as an opportunity for learning to better performance in virtual groups. Group collaboration tools within learning management systems such as WebCT, Blackboard and E-College have increased drastically (Kartha, 2006). These tools support group work for both traditional and online classes,

by supplying a virtual collaborative environment. Course management tools provide logistical enablement, but students learn more when they participate in group endeavors through the exercising of cognitive processes that require resolution of conflicts or disagreements in group discussions, assimilation of knowledge, and discussion/negotiation (Benbunan-Fich and Arbaugh, 2006; Benbunan-Fich & Hiltz, 2003; Piccoli, Ahmad, & Ives, 2001; Webb, 1982). In a study of 40 MBA courses Arbaugh and Benbunan-Fich (2007) found that students perceived learning was higher in courses designed with group learning activities, and with instructor-led content (group-based objectivism), when compared to individual oriented courses. Students achieve higher perceptions of learning in courses where knowledge is transmitted through the system, and students are engaged in collaborative assignments. The authors found that the absence of knowledge construction and group collaboration has a negative effect on student performance. The authors also determined that a significant number of studies indicate participant engagement, whether it is between participants and/or between participants and the instructor, is one of the strongest predictors of positive student performance. Arbaugh et al. (2009) reported studies of learner–learner interaction and instructor-leaner interactions both showed positive results in learner outcomes in online courses.

In terms of participant interactions, two meta-analysis of a combined nearly 100 experimental or quasi-experimental studies found that student performance was better in blending learning, when compared to face-to-face instruction, but revealed that an essential mix for class elements of time, resources, and interactions in classes has not been measured. In addition to the afore-mention work of Zhao et al. (2005), Means et al. (2013) analyzed 45 studies to determine that students in blended, online learning out-performed students in face-to-face classes; and purely online classes did not indicate an advantage over face-to-face classes. The authors concluded that research has not adequately investigated the appropriate blend of online and face-to-face delivery approach or the extent of collaborative group learning needed to affect performance.

3. RESEARCH METHODOLOGY

Our research centered upon the following research question: Is there an optimal number of group assignments that will result in better group learning performance? To address this, the results of a business case and cost-benefit/risk analysis were utilized.

The research hypothesis to be tested was as follows:

H_1: There will be no significant difference in student learning, as defined by group performance on a business case and cost risk benefit analysis, between groups with High (H) exposure, Medium exposure (M), and Low exposure (L) to the classroom element of group collaboration/participant interaction. High exposure is defined as six group collaboration assignments prior to the business case and cost risk benefit analysis; Medium exposure is defined by group collaboration on three assignments. Low exposure was the groups with no exposure to group collaboration on assignments.

Participants

One hundred and twenty eight (128) full-time MBA students enrolled in an Information Systems strategy course in a major university in the northeastern United States in four courses from the Fall 2015 semester through Fall 2016 participated in this study. The students were all 'fifth-year' MBA students with limited work experience. The students were similar in age with an average age of 22. The course was offered in a traditional, face-to-face, 16-week semester. Most of the students had an undergraduate degree in business. Each student in the course had access to the group collaboration tools in Blackboard, and was required to use this tool for assignments and collaboration. The same instructor taught all of the sections of this course and utilized the same case for analysis.

Design

Students were randomly placed in one of three group types to be exposed to the level of group collaboration/participant interaction learning. For the most part students were placed in groups of three, although one groups had two members, due to one student dropping the course. Group collaboration/participant interaction is operationally defined as the number of online group assignments. There were six assignments in this class. Two of these assignments concern a fictitious company, in which an information systems group fails to establish a business case for an e-commerce implementation.

In the experimental groups, students worked in teams of three on assignments. In the High (H) groups, students collaborated on all six assignments, and submitted each assignment as a group. Groups with a Medium (M) blend

collaborated on three assignments, and submitted three assignments as a group and three of the assignments individually. In the control or L group, students worked alone on the assignments. There were 43 groups in this study: 14 each of H and M groups, and 15 L groups.

The dependent variable in this study was performance on the design of the business case and cost risk benefit analysis. This course is entitled Information Systems Strategy, and is the study of business analysis and information systems. A major theme of this course is establishing a return on investment for information systems projects, as a quantitative business justification for any information systems project. The return on investment is operationalized through a Business Case analysis and cost risk benefit analysis. For the final requirement in the class, the students need to establish a justification for the failed e-commerce implementation that they studied from the beginning of the course.

For this final requirement, all students worked in groups and submitted their results as a group, including students in the L groups. The total Business Case/ Cost Risk Benefit score for each group was based on the combined scores of these two submissions. The business case was evaluated based on a rubric developed from Components of a Business Case from Pearlson and Saunders (2013). (See Appendix A: Rubric for Business Case). For this scale, groups can score a maximum of 50 points, based on 0-5 points for 10 business case elements, with the scale based on higher scores for quantitative return on investment formulas and measurable and observable factors in various components of the business case. These ten components are Executive Summary, Assumptions and Rationale, Program Summary, Financial Discussion and Analysis, Benefits and Business Impacts, Schedule and Milestones, Risk and Contingency, Conclusions and Recommendations, and Appendices. Two raters evaluated these categories, and the score for this component for each group was the average of their rating. The rater inter-rater reliability on these scores was 77.5%.

The Cost Risk Benefit submission was evaluated based on a rubric developed from Pearlson and Saunders (2013) (See Appendix B: Rubric for Cost Risk Benefit Analysis). This scale was open-ended, in that students supplied cost, risks, and benefits based on "Doing New Things", "Doing Things Better", and "Stop Doing Things". The rating scale was the same as was used for the Business Case. Two raters evaluated these categories independently, and the score for this component for each group was the average of their rating. The rater inter-rater reliability on these scores was 80.0, using the simple percent agreement calculation. Cohen's Kappa coefficient was also calculated and the result was 0.77. Cohen's Kappa is a generally more accurate measure as it takes into account agreement that is the result of random chance (Cohen, 1960).

4. RESULTS

The result of the research indicated that there was a significant difference in the student performance on the Business Case and Cost Risk Benefit Analysis. The source of this variability was between the High and Low groups and Medium and Low groups in the assignments, with the High and Medium Groups scoring significantly better than the Low Groups.

Table 1 shows the average scores for the students for the High, Medium, and Low Groups on the dependent variable. Each of the students in every group received the same score as the group the for the Business Case and Cost Risk Benefit analysis.

Table 1. Performance on Business Case/Cost Risk Benefit Analysis

Level of Assignment	N =	Mean Score for Total of Business Case/Cost Benefit/Risk Analysis
High	41	77.4878
Medium	42	73.5000
Low	45	65.5333

Table 2 shows analysis of the student performance on the business case and cost risk benefit analysis. The overall F value shows significance for the Total Business Case/ Cost Risk Benefit Analysis ($F=7.61$, $p < .01$) across the population.

Table 2. ANOVA for Total Business Case/ Cost Risk Benefit Analysis Score

Source	DF	SS	MS	F	Pr > F
Model	3	4075.01	1358.34	7.61	0.0001
Error	124	22131.41	178.48		
Corrected Total	127	26206.42			

Since the F test indicated an overall effect of the only dependent variable, paired-comparison t-tests were utilized to find the source of this variability between groups. Tables 3 and 4 shows the t-Test analysis on two of the three levels of groups in the business case and cost risk benefits. There was significant difference in the Total Business Score between the Blended Groups between the High (M = 77.49) and the Low Group (M= 65.53), ($t = 4.31$, $p > .01$), and between the Medium (M=73.50) and the Low Group, (M=65.53) ($t = 2.71$, $p > .01$). There was not a significant difference between the High and Medium Groups.

Table 3. T-Test for Total Business Case/ Cost Risk Benefit Analysis Score: High vs Low Groups

Group	N	Mean	SD	t Value	Pr > t
High	41	77.49	13.29	4.31	.0001
Low	45	65.53	7.25		

Table 4. T-Test for Total Business Case/ Cost Risk Benefit Analysis Score: Medium vs Low Groups

Group	N	Mean	SD	t Value	Pr > t
Medium	42	73.50	14.93	2.71	.0008
Low	45	65.53	12.42		

5. CONCLUSIONS

Studies designed to assess course outcomes as a consequence and mix of process and elements of the course experience are emerging (Kim et al., 2015: Kock et al., 2007; Lapsley et al., 2008). As blended learning becomes more widespread, best practice around blends by discipline will require quantification by elements (Allen, Seaman, & Garrett, 2007; Proserpio & Gioia, 2007; Webb & Poe, 2005). Researchers have called for the design of studies of effectiveness of frameworks for business education and business schools. (Arbaugh, 2008a; Arbaugh, 2008b; Arbaugh et. al, 2009; Arbaugh, 2014); Heckman & Annabi, 2005, McDonald, 2011).

The purpose of this research was to assess the impact of group collaboration, by using an experimental design, with an objective, not "perceived", scale. These results are encouraging in addressing the pedagogy concerning the quantification of the mix of activities that best promotes student learning; in this case, the number or amount of collaborative group assignments that will affect the subsequent group performance on a critical learning task. These results indicate that the groups who had at least three group assignments scored significantly higher on the Total Business Case and Cost Risk Benefit Analysis than groups who had no collaboration experience with each other. Though group learning has long been used within MBA programs, this provides quantitative support to validate the effective level of implementation to achieve team growth. Teams that had six group assignments did not perform significantly better than the groups that had three assignments, but did perform better than groups with no collaboration experience. This data suggests that the number of assignment collaborations needed to enhance group performance is three, but is inconclusive in terms of whether more assignments (in this case, six) results in significantly better performance. This, of course, requires further examination. This study is significant in that the test subjects came from a variety of undergraduate disciplines. Within each business discipline, utilizing group collaboration tools online has become increasingly important. This provide empirical support for educators when designing their courses.

Cook & Campbell as reported by Edmonds & Kennedy (2013) describe three conditions that must be present to establish cause and effect. They include: (1) covariation (the change in the cause must be related to the effect), (2) temporal precedence (the timing of the effect must be subsequent to the cause), and (3) no plausible alternative explanations. The results of this investigation meet these three conditions.

There are a number of limitations in this research. This research was done with a hybrid class, which is primarily face-to-face. Studies in the future should address other blends of classes, particularly online. This preliminary effort to quantify the optimum blend of group collaboration exercises to promote learning in virtual groups, could ultimately affect the design of future hybrid or blended courses.

6. FUTURE WORK

We will extend the research to perform the same study with students who are taking the course in an online environment, to take advantage of and study students on virtual teams, and to determine if significant differences exist based upon the delivery method of the course. Since online learning environments are equivalent in terms of

logistics and the remote nature of interaction with virtual teams in business, studies with online classes should be insightful in determining effective working environments and team achievement to be utilized in course design to train future business virtual team members. These subsequent studies can provide an opportunity to better investigate and quantify the optimum blend of group collaboration to promote learning in virtual groups. In addition, we intend to explore other variables that influence group performance within information systems graduate education.

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Appendix A. Rubric for Business Case

Section or Component	Description	Points*
Executive Summary	One or two page description of the overall business case document.	0-5
Overview and Introduction	Includes a brief business background, the current business situation, a clear statement of the business problem or opportunity, and a recommended solution at a high level.	0-5
Assumptions and Rationale	Includes issues driving the proposal (could be operational, human resource, environmental, competitive, industry or market trends, financial, or otherwise).	0-5
Program Summary	Includes a high level and then detailed description of the project, well-defined scope, objectives, contacts, resource plan, key metrics (financial and otherwise), implementation plan (high-level discussion and potential impacts), and key components to make this a success.	0-5
Financial Discussion and Analysis	Starts with financial summary then includes details such as projected costs/revenues/benefits, financial metrics, financial model, cash flow statement, and assumptions that went into creating financial statements. Total Cost of Ownership (TCO) calculations analysis would go in this section.	0-5
Benefits and Business Impacts	Starts with business impacts summary then includes details on all non-financial outcomes such as new business, transformation, innovations, competitive responses, organizational, supply chain, and human resource impacts.	0-5
Schedule and Milestones	Outlines the entire schedule for the project, highlights milestones and details expected metrics at each stage (what makes the go/no-go decision at each stage). If appropriate, this section can also include a marketing plan and schedule (sometimes this is a separate section).	0-5
Risk and Contingency Analysis	Includes details on risks, risk analysis, and contingencies to manage those risks. Includes sensitivity analysis on the scenario(s) proposed and contingencies to manage anticipated consequences. Includes interdependencies and the impact they will have on potential outcomes.	0-5
Conclusion and Recommendation	Reiterates primary recommendation and draws any necessary conclusions.	0-5
Appendices	Can include any backup materials that were not directly included in the body of the document such as detailed financial investment analysis, marketing materials, and competitor's literature.	0-5
	TOTAL POINTS	
	* Possible points for the category: 5 = FINANCIAL - Financial value can be calculated applying a cost/price or other valid financial benefit to a quantifiable benefit. 4 = QUANTIFIABLE - There is sufficient evidence to forecast how much improvement/benefit should result from the changes. 3 = MEASURABLE - Although this aspect of performance is currently measured, or an approximate measure could be implemented, it is not possible to estimate how much performance will improve when the changes are implemented. 2 = OBSERVABLE - Some discussion, but no measurement. 1 = Section acknowledged, no discussion. 0 = No acknowledgement of Section.	

Appendix B. Rubric Cost Risk Benefit Analysis *

Objective Type	Doing New Things	Doing Things Better	Stop Doing Things
Financial (5 points each)	State Benefit, Measure and Owner for each	State Benefit, Measure and Owner for each	State Benefit, Measure and Owner for each
Quantifiable (4 points each)	State Benefit, Measure and Owner for each	State Benefit, Measure and Owner for each	State Benefit, Measure and Owner for each
Measurable (3 points each)	State Benefit, Measure and Owner for each	State Benefit, Measure and Owner for each	State Benefit, Measure and Owner for each
INVESTMENT COSTS:			

* INSTRUCTIONS:
1. Complete a Cost Benefit Risk Analysis. Each entry is worth up to 5 points.
There is no limit to the number of "Doing Things" that can be identified.
2. For each benefit entered, the possible points are Financial =5, Quantifiable = 4, Measurable = 3, Observable =2, No measurement =1. See examples in Figure 7.7.
3. Each "Doing Thing", benefit, measure, and benefit owner must be stipulated to receive credit.
4. Total Investment Costs count for 10 points.