Teamwork and Team Performance in Online Simulations: The Business Strategy Game

Steve Jenner
California State University Dominguez Hills
College of Business Administration & Public Policy
Carson, CA 90747 USA
sjenner@csudh.edu

Meng Zhao
California State University Dominguez Hills
Carson, CA 90747 USA

Tom H. Foote
Colorado Technical University
Colorado Springs, CO 80907 USA

Abstract

Many variables affect teamwork and team performance on assignments, including student characteristics, the delivery mode, and instructors' decisions about assignment design. In this study, the online assignment was a computer simulation of a competitive industry, the Business Strategy Game. Links between student teams' performance and the delivery mode (online versus on-campus) and some of the instructors' decisions regarding how to structure the simulation assignment were examined. Online delivery was correlated with significantly lower student team performance compared to on-campus delivery. On the other hand, while larger class size and smaller team size had negative effects on a student team's performance for on-campus courses, class size, and team size did not matter online. In other words, team performance with online delivery was not constrained by class size or team size as it was on-campus. It was determined that instructors can improve team performance by making key choices when designing and delivering online simulation assignments. For on-campus delivery, allowing more class time for more frequent teamwork discussions was found to lead to higher team performance. Larger teams of 4-6 students outperformed smaller teams using on-campus delivery.

Keywords: teamwork; team performance; strategic management; online simulation, Business Strategy Game.

Introduction

Substantial research focuses on the importance of teamwork in business management (Hackman & Wageman, 1995; Katzenbach & Smith, 2003; Wageman, 1995; Wageman & Baker, 1999). Most individuals work in a business environment that requires cooperative team efforts to successfully reach business goals. This makes the ability to work in teams a critical skill set. The recent trend towards leaner, flatter organizations, with fewer levels of hierarchy, places even greater emphasis on the need for cross-functional teamwork (Ancona, 1999). Furthermore, as working in teams gains in importance, increased diversity within the workplace creates new pressures for employees who are struggling to make teamwork effective. As a result, students need to develop skills to help them navigate the new teamwork culture that permeates industry.

Practitioners and university faculty in the field of business management generally agree that students need to develop teamwork skills. Business professors routinely require teamwork assignments in their courses. However, the challenge of assessing student learning of teamwork skills in these assignments

is formidable. Managing and controlling these teamwork assignments requires teachers to develop feedback control systems utilizing multiple forms of evidence as the basis for continuous improvement in student learning.

Online Teamwork

The performance of face-to-face and online virtual teams is similar in general, especially if members are experienced at teamwork (Parks & Sanna, 1999). Online teams take longer to exchange information, but people are less concerned about criticism of their ideas or about diversity in gender, age, and race (Levi, 2007). This could lead to higher performance for online teams. However, face-to-face meetings are very important for newly created teams in order to become acquainted and develop trust, and set team goals, roles, and norms (Hertel, Geister, & Konradt, 2005). It is also harder to motivate team members and control social loafing or "free riders" who don't do their fair share of the work with online teams. These factors could lead to higher performance for on-campus teams.

In using team assignments, self-reported team effectiveness and peer evaluations are common assessment tools, along with final reviews of oral and written reports on team projects. The team assignment in this study was the Business Strategy Game (BSG). The BSG is a computer simulation of a competitive athletic footwear industry. Participants form teams and enter inputs on ten decision screens (sales forecast, marketing plan, production schedule, financial decisions, etc.). The simulation processes the inputs of all the teams and generates a set of results in the form of reports (game-to-date performance scores, competitor intelligence, etc.). For more details, go to bsg-online.com..

Since market inception, the Business Strategy Game has been used at more than 500 schools in over 25 countries and played by approximately 500,000 students. In the BSG, overall team performance is measured by the final overall team score calculated by the computer simulation model.

In this article, we investigated the impact on the performance of student teams of the course delivery mode and the instructor's decisions about how to use the BSG. Specifically, we looked for relationships between the BSG performance scores for each team and the following variables: 1) delivery mode (online vs. on-campus), 2) team size, 3) class meeting frequency, 4) class discussion time for the BSG project and 5) class size. Our theoretical framework is shown in Figure 1, which posits that the institution's and instructor's teaching decisions such as team size, class meeting frequency, BSG project discussion time, and class size affect the student team BSG scores. However, we argue that these relationships are moderated by the delivery mode. The theoretical framework and its proposed hypotheses are further developed in the next section, followed by statistical tests, results, conclusion and discussion.

Hypothesis Development

Class Size

The class size-performance nexus has received considerable attention in the literature over the past half century (McConnell & Sosin, 1984; Shane, 1961, Simmons, 1959). Much of the literature on student learning and class size suggests that more might be learned in smaller classes. Students in smaller classes are more likely to get personalized attention and support from their instructor, and their individual learning needs are more likely to be addressed (Glass & Smith, 1979). Following this stream, a number of studies have demonstrated a negative association between class size and performance (Glass & Smith, 1980). The latest study by Bandiera, Larcinese, and Rasul (forthcoming) showed that there was robust evidence of a negative class size effect — on average, larger classes reduce student academic achievement as measured by test scores. Thus, we propose that a smaller class size will lead to better student team performance.

H1: Larger class size will have a significant and negative impact on student team performance.

Class Meeting Frequency

The most challenging and also the most essential part of teaching a business management class is the transfer of tacit knowledge (Nonaka, 1994), which involves complex concepts, ideas, subjects, and

problem-solving skills. Informal communication channels such as face-to-face meetings have been found to be more useful in transmitting highly complex subject matter and more capable of conveying a variety of information (i.e., the channel "richness") (Daft & Lengel, 1986; Tushman, 1978).

Therefore, more frequent class meetings devoted to a team assignment may lead to better informal communication channels, which will in turn facilitate more effective transfer of tacit knowledge and thus increase student team performance.

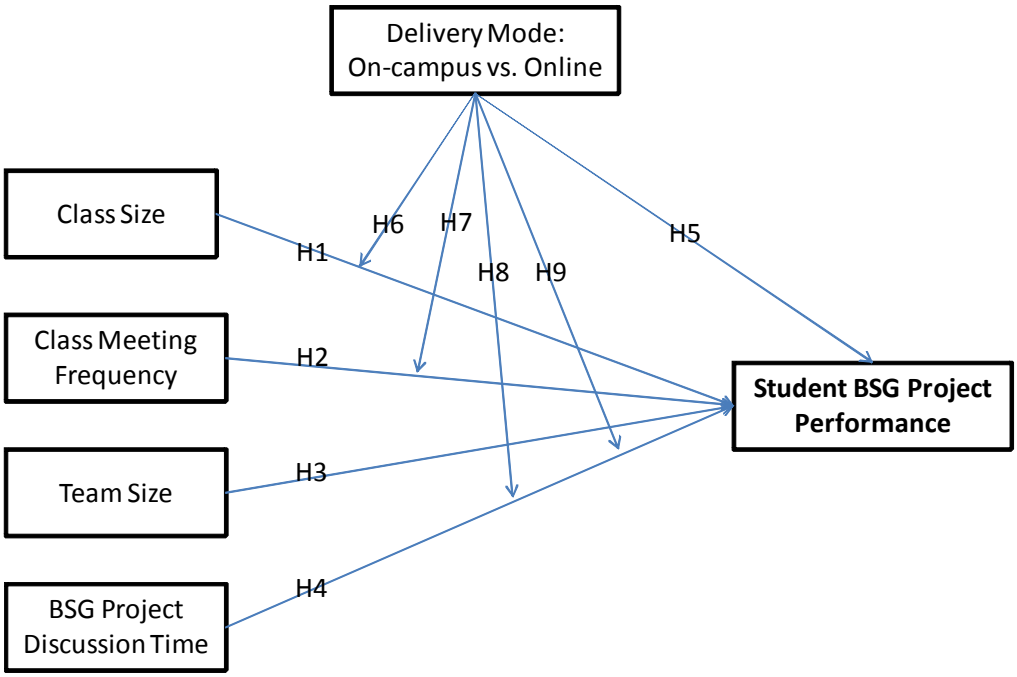

Figure 1. Teaching Decisions and Team Performance

H2: Class meeting frequency will have a significant and positive impact on student team performance.

Team Size

Numerous studies have been conducted on team size and its relationship to performance and to various factors such as team spirit, individual and team attitudes, and interaction among team members (Cummings et. al. 1974, Grofman et. al. 1984, Helms and Wyskida 1984, Wagner et al. 1987). To date, the findings suggest that smaller teams allow for closer relationships among members, a deeper knowledge of the members and a better sense of the whole picture at any given time (Cohen et al. 1992). On the other hand, there may be a preference on the part of some team members to participate in large teams in order to avoid an "intimate" environment, achieve greater anonymity and have the security of knowing that there are more people to do the work required of the group (Cohen et al. 1992). In a marketing simulation with teams of two, three, and four, team performance varied by team size, with performance significantly higher for the four-person teams (Cosse, Ashworth, and Weisenberger 1999). Yetton and Bottger (1983) noticed performance gains as group size increased from three to five members. Gains declined as team size increased with no noticeable improvement in performance observed for groups larger than five. Referring to other classroom studies, Rosser (1998) stated that team size should generally be between three and six members. Larger teams have more diverse viewpoints which may lead to better decisions and higher team performance, although they may experience greater challenges with scheduling meetings and poor participation (Cooper, Robinson, & Ball, 2003). Therefore, within the range of team size between three and six, we propose that:

H3: Team Size will have a significant and positive effect on student team performance.

BSG Project Discussion

In contrast to teacher-centered didactic approaches, in which the teacher transmits a fixed body of knowledge to learners, dialogue has been described as learner-centered and participatory, "guided by a spirit of discovery" in which participants develop greater understanding, insight, and sensitivity (Burbules, 1993, p. 8). According to Burbules (1993), dialogue involves our ability to reason, "especially our ability to solve problems, to think sensibly toward conclusions, to weigh competing considerations and to choose reasonable courses of action" (p. 11). In teaching business management, it is very common for instructors to allocate considerable class time for student discussion, especially on complex issues and tasks such as the BSG project. Therefore, a critical question is whether the allocation of the discussion time indeed helps student learning and thus improves their performance. A recent study by Smith et al (2009) showed that class discussions, and especially peer discussions, help students learn more than listening to lectures by instructors.

H4: BSG project discussion time has a significant and positive effect on student team performance.

Delivery Mode: On-Campus or Online

> The literature on the effectiveness of on-campus versus online instruction delivery is mixed (Benoit et al 2006). Some studies suggested that online delivery has advantages over on-campus delivery (e.g. Maki & Maki 2002; Twigg 2003). Some found that on-campus delivery was preferable (e.g., Wang & Newlin 2000; Waschull 2001). Other studies were inconclusive (e.g., Botsch & Botsch 2001; Hiltz 1993). According to Clark, “there are no learning benefits to be gained from employing any specific medium to deliver instruction” (Clark, 1983 & 1994).

The BSG is played online whether the course is delivered on-campus or online. The transfer of learning about strategic management to the BSG can be the same or similar regardless of the delivery mode. Therefore, we propose that the delivery mode will not directly impact team performance.

The Moderating Effects of Delivery Mode

There have been many studies and debates on the delivery mode’s direct impact on student performance (for an integrated review, see Benoit et al 2006). However, the delivery mode’s indirect effects on student performance are largely overlooked. The indirect effects here refer to the moderating effects of delivery mode on other variables that affect student performance. In this study, we focus on the delivery mode’s moderating effects on a few institution and instructor decision variables such as class size, class meeting frequency, team size, and BSG project discussion (see Figure 1). We posit that, under different delivery modes, these decision variables have different impacts on student team performance.

It was noted that the use of various forms of multimedia also appears to play a substantial role in the relationship between class size and student performance (Karakaya, Ainscough, & Chopoorian, 2001). In Drago and Peltier’s study (2004), while the traditional courses showed significant and negative associations across all building blocks as well as overall effectiveness (even within the narrow range and relatively small classes analyzed) the online courses showed only two significant but positive relationships. Using the online delivery mode, students receive instruction in an environment which does not have the physical limits of time and space of the on-campus delivery mode. The resources available to the students in the online environment need not be reduced as the class size increases. The increased number of students in the class will increase the diversity of the students, and the interactions among students, which will have a positive effect on student performance. Therefore, we propose that:

H5: Delivery mode will have both an indirect or moderating impact on team performance, and a direct impact on team performance.

H6(a): Using the online delivery mode, the class size will not have a significant effect on student performance.

H6(b): Using the on-campus delivery mode, the class size will have a significant and negative effect on student team performance. (This is the same as H1).

Using the online delivery mode, students have greater freedom to decide the time and the frequency of reviewing the instructions and meeting with their teammates. On the other hand, in the on-campus delivery mode, the frequency of class meetings is determined by the class schedule and the teacher. Thus, meetings are not a true reflection of the students' efforts to learn and communicate in the class. Therefore, we propose that:

H7(a): Using the online delivery mode, the meeting frequency will have a significant and positive impact on student team performance. The effect will be greater than that under on-campus delivery mode.

H7(b): Using the on-campus delivery mode, the meeting frequency will have a significant and positive impact on student team performance. (This is the same as H2). The effect will be smaller than when using the online delivery mode.

In the online environment, the communication between teammates is primarily by emails and online chat, which may limit the "richness" of the communication (Daf and Lengel 1986; Tushman 1978). As such, there are greater difficulties for teammates exchanging complex ideas, concepts, and pooling their resources (Nonaka 1994). Consequently, a virtual online student team is limited in their ability to take advantage of the increased diversity and brain power as the team size increases. Therefore, we propose that:

H8(a): Using the online delivery mode, team size will not have a significant effect on student team performance.

H8(b): Using the on-campus delivery mode, team size will have a significant and positive effect on student team performance. (This is the same as H3).

Online student discussion promises to enhance reflective critical thinking (Mitchell, 2003; Wells, 1999). Online student discussion is better suited to critical reflection than oral discussion is because it has greater permanence, takes more time to produce and is under greater control of readers once they receive it (Wells, 1999; Windschitl, 1998; Beach & Lundell, 1998). However, despite the promise of online student discussion, research findings are mixed about whether it actually produces greater critically reflective thinking among students. Some studies supported this notion (Harrington & Hathaway, 1994; Harrington & Quinn-Leering, 1996; Davidson-Shivers, Muilenburg, & Tanner, 2001; Salmon, 2002). However, results from other studies call into question the potential of online student discussion with regard to critical reflection (Levin, He, & Robbins, 2006; Angeli, Valanides, & Bonk, 2003). Dodson (2000) found that students were as likely to take a monological stance as a dialogical one; their purpose for posting was to transmit information rather than to explore ideas together or debate and negotiate meaning. In the online environment, students have greater freedom to choose the actual length and intensity of their discussions on their BSG project, with limited influence from their instructors. In the on-campus environment, the length and intensity of the discussions are primarily determined by their instructors. Therefore, we propose that:

H9(a): Using the online delivery mode, team project discussion time will have a significant and positive effect on student performance. The effect will be much smaller than that under the on-campus delivery mode.

H9(b): Using the on-campus delivery mode, project discussion time will have a significant and positive effect on student team performance. The effect will be much larger than under the online delivery mode. (This is the same as H4).

Methodology

Sample and Procedure

The survey (see Appendix 1 Survey Instrument and Statistical Analysis) was administered to 137 instructors with a total of 6,632 teams at universities using the Business Strategy Game (BSG) at the end

of the Fall, 2007 semester. Working with the BSG Administrators, the authors developed a short survey. The survey was sent out and the results were collected by the BSG Administrators confidentially to ensure that the authors did not have access to the respondents' names and contact information. The survey announcement was e-mailed to about 400 BSG instructors known by the Business Strategy Game administrators to be using their product in the Fall of 2007. The message contained a link to a web page containing the survey. A total of 137 instructors responded (34%) and these instructors had a total of 6,632 students. We assume that the sample of survey responders and non-responders did not differ significantly on any relevant characteristics (e.g., age, gender, rank, or experience with the game).

Results

Descriptive Statistics

The descriptive statistics for the key variables are shown in Table 1. The measurement instrument of the key variables and their coding are provided in Appendix 1 of this paper. In addition, Online is a dummy variable, which has only two levels (for online delivery mode, online=1; and for on-campus delivery mode, online=0). In the dataset, there are 29.1% with online=1, and 79.9% online=0.

Table 1. Descriptive Statistics for Key Variables

Teaching Method	Variables	N	Minimum	Maximum	Mean	Std. Deviation
Online=0	Team Performance (GTD Score)	4697	0	110	78.53	20.25
Online=0	Class Size	4697	5	55	30.65	12.88
Online=0	Meet Freq	4697	0	3	1.52	0.71
Online=0	Team Size	4697	1	6	3.30	0.76
Online=0	Discuss	4697	1.5	13	6.62	3.66
Online=1	Team Performance (GTD Score)	1935	0	110	83.51	71.77
Online=1	Class Size	1935	5	55	31.87	13.58
Online=1	Meet Freq	1935	0	3	1.15	0.95
Online=1	Team Size	1935	1	6	3.42	1.16
Online=1	Discuss	1193	1.5	13	7.52	4.13

Statistical Analysis

We tested our theoretical framework and its associated hypotheses using a multiple regression analysis. The criterion/dependent variable in the regression model is team performance (i.e. GTD score). The results are shown in Table 2. The R square for the regression is 5%, with F value = 32.573 (d.f. = 9, 5558), p value = .000. The R square is small but statistically significant at the 1% confidence level. The small R Square was expected, however, as individual and team efforts, aptitudes, and competence were expected to play a much more important role in deciding performance than the characteristics of the teaching method. Furthermore, from a technical standpoint, not including student aptitude-related variables in our model does not pose a serious methodological problem, as the primary purpose of the

model is to test our theoretical hypotheses, not make predictions. Because the missing variables pertain to each individual student's aptitude/competence, they are not correlated with the current regression model's independent variables, which are decided by the institutions and instructors, not the students. Therefore, the omitted variable bias in our OLS regression estimation is close to zero, even the estimated errors might be increased. Given that our sample size is sufficiently large, the increased estimated errors are sufficiently alleviated. (for a further discussion of the omitted variable bias, see pages 89-94 in Wooldridge, 2003).

Therefore, the estimation of our regression model's parameters is not biased due to the missing variables.

Table 2. Parameter Estimates from Multiple Regression Analysis.

Explanatory Variables	Unstandardized Coefficients	Standardized Coefficients	t	P value
Constant	4.553		109.671	.000
Online	-.157*	-.217*	-2.046	.041
TeamSize	.062*	.058*	3.065	.002
Meet Freq	-.017	-.020	-1.103	.270
Discuss	.040*	.080*	4.680	.000
Class Size	-.114*	-.169*	-9.468	.000
Team Size × Online	-.078*	-.129*	-2.578	.010
Meet Freq × Online	.053*	.046*	2.053	.040
Discuss × Online	-.017	-.048	-1.211	.226
Class Size × Online	.106*	.482*	4.775	.000

Note: * indicate the coefficient estimates are significant at 95% confidence level.

Using the variable Online (i.e. Delivery Mode) as a dummy variable (Online=1 for online delivery mode, and Online=0 for on-campus delivery mode), we can convert the results in Table 1 into a comparison between online vs. on-campus delivery modes (see Table 3).

Table 3 Comparison between Online vs. On-Campus Delivery Mode

	Constant	ClassSize	MeetFreq	TeamSize	Discuss
Online	4.396	-0.008	0.036*	0.016	0.023*
On-Campus	4.553	-0.114*	-0.017	0.062*	0.040*

Note: * indicate the coefficient estimates are significant at 95% confidence level.

Based on the results in Table 2 and Table 3, we summarize our findings as follows:

On-Campus Delivery Mode

1. The coefficient estimate for Class Size (see Table 3) is statistically significant and negative, and thus supports H1 and H6(b). That is, using the on-campus delivery mode, an increase in class size is correlated with lower student team performance.
2. The coefficient of Meet Freq is not statistically significant (See Table 3). Therefore, H2 and H7(b) are not supported. That is, using the on-campus delivery mode, an increase in class meeting frequency

was not found to have an impact on student team performance. Even though the finding does not support our hypothesis, it is consistent with the rationale behind our hypothesis development. As we explained in our hypotheses development section, the frequency of class meetings is not voluntary and does not necessarily reflect student's effort in learning and communicating in the class. Therefore, it was expected that the effect of Meet Freq would be smaller or not significant.

3. The coefficient of Team Size is statistically significant, and positive (See Table 3). Therefore, H3 and H8(b) are supported. That is, using the on-campus delivery mode, an increase in team size is associated with higher student team performance.
4. The coefficient of Discuss is statistically significant and positive (See Table 3). Therefore, H4 and H8(b) are supported. That is, using the on-campus delivery mode, an increase in class time for team discussion will lead to higher student team performance.

Online Delivery Mode

1. The coefficient of the variable Online is statistically significant and negative (See Table 2). Therefore, H5 is supported. That is, the online delivery mode is associated with a poorer student team performance than the on-campus delivery mode is, if the delivery model's moderating effects (i.e. interacting effects) on other variables' relationship to student team performance are not considered.
2. The coefficient of the Class Size is statistically insignificant (See Table 3), and thus, H6(a) is supported. That is, using the online delivery mode, an increase in class size did not have an impact on student team performance. The finding is consistent with our theoretical rationale, which argued that the class size effect in the online environment will not be negative compared with using the on-campus delivery mode (i.e. H6(b)).
3. The coefficient of the Meet Freq is statistically significant, positive, and significantly greater than that under on-campus delivery mode (See Table 3). Therefore, H7(a) is supported. That is, using the online delivery mode, an increase in the frequency of student meetings was associated with higher student team performance.
4. The coefficient of Team Size is statistically insignificant (See Table 3), and thus H8(a) is supported. That is, with online delivery, an increase in the team size did not have an impact on student team performance.
5. The coefficient of the variable Discuss is statistically significant and positive, but much smaller than the coefficient for on-campus delivery (See Table 3). Therefore, H9(a) is supported.

Discussion

Is online teaching and learning less effective than on-campus delivery? When considering the effectiveness of a team activity, our research suggests that it may depend on the effect of other variables which can be controlled by teachers and institutions. The design of courses and assignments can increase the effectiveness of the online delivery mode. More class meetings, more class time for student teams to discuss their projects, and larger team size (up to a maximum of 6) can make online delivery more effective in terms of team performance. Using on-campus delivery, larger class size can sacrifice student team performance; for online delivery, class size did not matter. It should be noted that these findings pertain only to performance on a team activity.

Is team performance a reliable measure of teamwork? Is it possible to achieve a high team score without high team performance? The BSG Team Scores may not reliably measure teamwork or team performance in spite of the claims of many instructors who use this assignment in courses on strategic management.

However, this team score may not reflect a real team effort. A dominant star player can lead a team to high performance. The remaining teammates can simply stand back and let the star take over, free riding on the leader's brilliant performance.

Requiring teams to submit Decision Records detailing how the members worked interdependently toward shared goals is a promising approach to measuring teamwork. Decision Records make individual team members accountable for their weekly contributions to the team effort. In one case, Decision Records revealed that the winning BSG team was dominated by one member with a powerful understanding of

how to win within the context of the BSG software model. (See the single-leader unit in Appendix 2 Decision Records of Two Teams.)

Teachers who choose to assign team assignments need to do a much better job of managing such assignments. Too often they rely on self-reported team effectiveness and peer evaluations as assessment tools. Evaluations of oral and written reports on team projects are also commonly used for grading, but they may be the result of dividing up the task without working as a team.

More direct observation of teams at work would also be helpful in assessing the effectiveness of teamwork behaviors. For example, the online instructor could monitor e-mails and online chats between team members to assess the team's shared goals and interdependent behavior (e.g., building on each other's ideas in discussions). Other team member behaviors to observe include making commitments to perform tasks, doing his or her fair share of the work, producing work of acceptable quality and actively participating in team discussions and decision making (Levi, 2001). Besides relying on instructor observations, executive judges could lead class team meetings to assess teamwork.

Other evidence of individual efforts could include quizzes on the teamwork assignment (e.g., knowledge of the BSG rules and how to interpret the reported results) and website activity logs tracking the frequency and amount of time spent by each team member.

Conclusion

The design of courses and assignments can increase the effectiveness of the online delivery mode. More class meetings, more class time for student teams to discuss their projects, and larger team size (up to a maximum of 6) can make online delivery more effective in terms of team performance. Using on-campus delivery, larger class size can sacrifice student team performance; for online delivery, class size did not matter. Thus, the delivery mode's indirect effects on student performance were demonstrated.

Compared to the traditional on-campus delivery mode, teaching online had a negative impact on a student team's performance in the BSG. Online teaching's direct effect (that is the main effect) on a student team's performance was negative. That is, teams of students in online classes had lower performance than students in traditional on-campus classes.

Requiring teams to submit Decision Records detailing how the members worked interdependently toward shared goals is a promising approach to measuring teamwork. Decision Records make individual team members accountable for their weekly contributions to the team effort.

References

Ancona, D. (1999). *Managing for the future: organizational behavior and processes*. Southwestern.

Angeli, C., Valanides, N., & Bonk, C. J. (2003). Communication in a Web-based conferencing system: The quality of computer-mediated interactions. *British Journal of Educational Technology*, 34, 31-43.

Bandiera, O., Larcinese, V., and Rasul, I. (forthcoming). Heterogeneous Class Size Effects: New Evidence from a Panel of University Students. *Economic Journal*.

Batts, D. (2008). Comparison of student and instructor perceptions of best practices in online technology courses. *Journal of Online Learning and Teaching*, 4, 477-489. Retrieved from http://jolt.merlot.org/vol4no4/batts_1208.htm.

Beach, R., & Lundell, D. (1998). Early adolescents' use of computer-mediated communication in writing and reading. In D. Reinking, M. C. McKenna, L. D. Labbo, & R. D. Kieffer (Eds.), *The handbook of literacy and technology: Transformations in a post-typographic world.* Mahwah, NJ: Lawrence Erlbaum. 93-114.

Benoit, W. L., Benoit, P. , Hemmer, K. and Benoit, J. M. (2006). Meta-Analysis of the Effects of Traditional Versus Web-Assisted Instruction on Learning and Student Satisfaction. *Annual Meeting of the International Communication Association*. Dresden International Congress Centre: Dresden, Germany.

Botsch, C. S., & Botsch, R. E. (2001). Audiences and outcomes in online and traditional American government classes: A comparative two-year study. *PSOnline*, 135-14.

Burbules, N. (1993). *Dialogue in teaching: Theory and practice*. New York: Teachers College Press.

Clark, R. (1983). Reconsidering Research on Learning from Media. *Review of Educational Research* 53(4) 445-459.

Clark, R. (1994). Media will never influence learning. *Educational Technology Research and Development.* 42(2) 21-9.

Cohen, A. R., S. L. Fink, N. Gadon, & R. D. Willits (1992), *Effective Behavior in Organizations*. 5th edition, Homewood, IL: Richard D. Irwin, Inc.

Cooper, J.L., Robinson, and Ball (eds.) (2003). *Small group interaction in higher education: lessons from the past, visions of the future*. New Forums Press: Stillwater, OK.

Cosse, T.J., Ashworth, D.N., & Weisenberger, T.M. (1999). The effects of team size in a marketing simulation. *Journal of Marketing Theory and Practice*, 7(3), 98-106.

Cummings, L. L., George P. Huber, & Eugene Arendt (1974), "Effects of Size and Spatial Arrangements on Group Decision Making." *Academy of Management Journal*, 17(3).

Daft, R. L. and R. H. Lengel (1986). Organizational information requirements, media richness and structural design. *Management Science*, Vol. 32 No. 5, pp. 554-71.

Davidson-Shivers, G. V., Muilenburg, L. Y., & Tanner, E. J. (2001). How do students participate in synchronous and asynchronous online discussions? *Journal of Educational Computing*, 25(4), 351-366.

Dodson, M. M. (2000). Monologic and dialogic conversations: How preservice teachers socially construct knowledge through oral and computer-mediated classroom discourse. In T. Shanahan & F. V. Rodriguez-Brown (Eds.), *National reading conference yearbook* (Vol. 49, pp. 137-152). Chicago: National Reading Conference.

Drago, W., & Peltier, J. (2004). The Effects of Class Size on Effectiveness of Online Courses. *Management Research News*, 27(10), 27-41.

Glass, G.V., and Smith, M.L. (1980). Meta-analysis of research on class size and achievement *Educational Evaluation and Policy Analysis,* 1(1) (Jan. - Feb.): 2-16.

Bernard, G., Feld, S.L. & Owen, G. (1984). Group Size and the Performance of a Composite Groups Majority: Statistical Truths and Empirical Results. *Organizational Behavior and Human Performance*, 33, 350-359.

Hackman, J.R., and Wageman, R. (1995). Total Quality Management: Empirical, conceptual, and practical issues. *Administrative Science Quarterly*. 40.

Harasim, L. M. (1995). Online Education: An Environment for Collaboration and Intellectual Amplification. In L. M. Harasim (Ed.), Online Education: Perspectives on a New Environment, (pp. 39-64). New York: Praeger.

Harrington, H. L., & Hathaway, R. (1994). Computer discussion, critical reflection and teacher development. *Teaching and Teacher Education*, 10, 543-554.

Harrington, H. L., & Quinn-Leering, K. (1996). Considering teaching's consequences. *Teaching and Teacher Education*, 12, 591-607.

Helms, C. P. & Richard M.W. (1984). A Study of Temporary Task Teams*. IEEE Transactions on Engineering Management*, 31(2), 55-60.

Hertel, G., Geister, S., & Konradt, U. (2005). Managing virtual teams: A review of current empirical research. *Human Resource Management Review*, 15(1), 69-95.

Hiltz, S. R. (1993). Correlates of learning in a virtual classroom. *International Journal of Man-Machine Studies*, 39, 71-98.

Karakaya, F., Ainscough, T.L., & Chopoorian, J. (2001). The effects of class size and learning style on student performance in a multimedia-based marketing course. *Journal of Marketing Education*, 23(2), 84-90.

Karau, S.J., and Williams, K.D. (1993). Social loafing: A meta-analytic review and theoretical integration. Journal of Personality and Social Psychology. Oct 65(4) 681-706.

Katzenbach, J. R. & Smith, D. K. (2003) *The wisdom of teams: creating the high-performance organization*. New York: Harper Collins.

Levi, D. (2007). *Group dynamics for teams*. 2nd ed. Thousand Oaks, CA: Sage.

Levin, B. B., He, Y., & Robbins, H. (2006). Comparative analysis of preservice teachers' reflective thinking in synchronous versus asynchronous online case discussions. *Journal of Technology and Teacher Education*, 14, 439-460.

Maki, W. S., & Maki, R. H. (2002). Multimedia comprehension skill predicts differential outcomes of web-based and lecture outcomes. *Journal of Experimental Psychology: Applied*, 8, 85-98.

McConnell, C.R., & Sosin, K. (1984). Some determinants of student attitudes toward large classes. *Journal of Economic Education*, 15(3), 181-190.

Mitchell, J. (2003). On-line writing: A link to learning in a teacher education program. *Teaching and Teacher Education*, 19, 127-143.

Moreland, R.L., Levine, J.M., & Wingert, M.L. (1996). Creating the ideal group: Composition effects at work. *Understanding Group Behavior.*

Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science*, Vol. 5 No., pp. 14-37.

Parks, C. & Sanna, L. (1999). *Group performance and interaction*. Boulder, CO: Westview.Robyn, E. (2000). Creating tribes. *College Teaching*, 48(2), 65-68.

Rosser, S.V. (1998). Group work in science, engineering, and math. *College Teaching,* 46(3), 82-88.

Salmon, G. (2002). Mirror, mirror on my screen...Exploring online reflections. *British Journal of Educational Technology*, 33, 379-391.

Shane, H.G. (1961). What research says about class size and human development. *NEA Journal*, 50(1), 30-32.

Simmons, H.F. (1959). Achievement in intermediate algebra associated with class size at the University of Wichita. *College and University*, 34(3), 309-315.

Smith, M., Wood, W., Adams, W., Wieman, C., Knight, J., Guild, N., and Su, T.T. (2009). Why Peer Discussion Improves Student Performance on In-Class Concept Questions, *Science*, Vol. 323 no. 5910, pp. 122-124.

Tsui, A.S., Egan, T.D., & O'Reilly, C.A. (1992). Being different: Relational demography and organizational attachment. *Administrative Science Quarterly*. 37.

Tushman, M. L. (1978). Technical communication in R&D laboratories: The impact of project work characteristics. *Academy of Management Journal*, Vol. 21 No. 4, pp. 624-45.

Twigg, C. A. (2003). Improving quality and reducing costs: Designs for effective learning. *Change*, 35, 22-29.

Wageman, R. (1995). Interdependence and group effectiveness. *Administrative Science Quarterly*. 40. Wageman, R. and Baker, G. (1999). Incentives and cooperation: the joint effects of task and reward interdependence on group performance. Journal of Organizational Behavior 18:2, 139 – 158 Published Online April 28 John Wiley & Sons, Ltd.

Wagner, J. A. & Gooding, R.Z. (1987). Shared influence and Organizational Behavior: A Meta Analysis of Situational Variables Expected to Moderate Participation-Outcome Relationships. *Academy of Management Journal*, 30 (3).

Wang, A. Y., & Newlin, M. H. (2000). Characteristics of students who enroll and succeed inpsychology web-based classes. *Journal of Educational Psychology*, 92, 137-142.

Waschull, S.B. (2001). The online delivery of psychology courses: Attrition, performance, and evaluation. *Teaching of Psychology*, 28, 143-147.

Wells, G. (1999). *Dialogic inquiry: Toward a sociocultural practice and theory of education*. Cambridge, UK: Cambridge University Press.

Windschitl, M. (1998). The WWW and classroom research: What path should we take? *Educational Researcher*, 27(1), 28-33.

Wooldridge, J. M.(2003). Introductory Econometrics: A Modern Approach, 2E, Mason, Ohio: Thomson

South-Western.

Wuensch, K.L., Aziz, S., Ozan, E., Kishore, M., & Tabrizi, M.H.N. (2009). Technology and Pedagogy: The Association between Students' Perceptions of the Quality of Online Courses and the Technologies Employed. *Journal of Online Learning and Teaching*, 5, 253-262. Retrieved from http://jolt.merlot.org/vol5no2/wuensch_0609.htm.

Yetton, P, & Bottger, P. (1983). The relationships among group size, member ability, social decision schemes and performance. *Organizational Behavior and Human Performance* 32:145-59.

Appendix 1. SURVEY INSTRUMENT AND STATISTICAL ANALYSIS

Variable Definition and Coding

Variable Name	Questions	Coding
TeamSize	How many students do you normally place on each company-team? 1 = one student per team 2 = two students per team 3 = three students per team 4 = four students per team 5 = five students per team 6 = more than five students per team	 TeamSize = 1 TeamSize = 2 TeamSize = 3 TeamSize = 4 TeamSize = 5 TeamSize = 6
Discuss	Over the entire term, about how many classroom hours do you devote to in-class discussion of the simulation and/or team meetings for group discussion and decision-making? 1 = 3 hours or less 2 = 4 to 6 hours 3 = 7 to 9 hours 4 = 9 to 12 hours 5 = 13 hours or more	 Discuss =1.5 Discuss = 5 Discuss = 8 Discuss = 10.5 Discuss = 13
ClassSize	What is your normal class size in terms of total enrollment? 1 = 9 students or fewer 2 = 10 to 19 students 3 = 20 to 29 students 4 = 30 to 39 students 5 = 40 to 49 students 6 = 50 students or more	 ClassSize = 5 ClassSize = 15 ClassSize = 25 ClassSize = 35 ClassSize = 45 ClassSize = 55
Online	What is the normal method of delivery for your course? 1 = traditional classroom 2 = on-line / remote 3 = a combination of both	 Online = 0 Online = 1 Online = 1
MeetFreq	How often does your class meet? 1 = Once per week (3 or more hours per class meeting) 2 = Twice per week (75 to 90 minutes per class meting 3 = Three times per week (50 to 60 minutes per class meeting) 4 = Other	 MeetFreq = 1 MeetFreq = 2 MeetFreq = 3 MeetFreq = 0

In addition, we collected GTDscore from each student's performance in the simulate game, which will be

discussed in the next section.

Transformation of the variables in the multiple regression analysis:

1. GTDScore, TeamSize, MeetFreq, Discuss, ClassSize were transformed by taking their natural logarithm, which is a common Econometric technique. By taking a log-log function form (such as ln(y)= a+bln(x)), one can interpret the slope b in the regression model as "if x increase 1%, y increase b%."
2. The variable Online is a categorical variable, and we treated it as a dummy variable in the regression model.

Regression Model:

GTDScore = f(Online, TeamSize, MeetFreq, Discuss, ClassSize, TeamSize*Online, MeetFreq*Onine, Discuss*Online, ClassSize*Online).

Appendix 2. DECISION RECORDS OF TWO TEAMS

Team 1 Decision Record of Effective Teamwork with Task Interdependence

Upon review of early results, team managers decided to make the following changes for future decisions to boost net profits to increase and win investor confidence:

1. Sustaining market share by lowering all of our prices, while improving our quality rating.
2. Decrease production in all plants to reduce tariffs and currencies fluctuation.
3. Sell off Latin American plant.
4. Focus on increasing production in the Asia Pacific plant.
5. Do an inventory clearance (at least 25% of inventory).

Team managers decided to shift their strategy toward decreasing production and increasing quality rating to boost profit shares to build investor confidence.

Our focus will continue to be for increasing earnings per share and return on equity, as well as net profits, to gain back investor confidence while maintaining market share and high image rating.

Record Changes by Tom:

- I changed every variable to trim cost and increase revenue to increase our profit in all four segments.
- I try for lower bids for celebrity to win contracts at a much lower price to control marketing cost.
- We followed Gilberto's advice for decreasing production.

Record Changes by Diane:

- Worked on and completed the 3-Year Plan for Years 14 through 16.

Record Changes by Gilbert:

- Changed plant capacity
- Confirmed the selloff of the LA plant
- Increased our quality rating to 7
- Matched production to demand
- Stopped production in the North American plant (in preparation for liquidation next year).
- Increased available models
- No loans were taken during this period

Team 2 Decision Record of a Single-Leader Unit

To help implement cost leadership we had a CEO. The other two of us were functional managers.

In Strategic Management we learned about cost leadership, product differentiation, and vertical integration. I will separate the three of them and give you examples of each.

We went after the largest amount of the private label market as possible and used cost leadership to do it. The private label, unlike the branded label, had pretty much the same quality and models available. By selling more pairs at a lower price it reduced our production cost and thus gave us more profit than the other competing groups. We transferred our low cost strategy from private label, since we thought others would attempt our previously successful strategy, to Internet Sales. This was very successful and we were able to obtain over 20% of the overall internet market.

We used cost advantages a few different ways help us be more competitive. The economies of scale cost advantage that we enjoyed came from having a larger amount of capacity in Asia than anyone else. This helped us with the set-up cost of more model production. When we set up our European and Latin America plants we started them at the smallest capacity possible so our costs were the lowest possible. Cost advantages through cost of plant and equipment were used when we bought used equipment. This advantage gave us a big push in year twelve when we were trying to expand. We used cost advantages of overhead costs by producing and selling more than anyone else.

A negative aspect to us going for cost advantages was that sometimes we were too large. We did not always sell all our private label sales because the market was not large enough. If we only concentrated on wholesale, our prices and profit margins could not be as high as others because we needed to get rid of more products. A positive aspect of cost advantage to productive inputs was having production in all areas. By doing so, we increased our production in one area where the costs were lower. For year 15 we expanded in Europe and Latin America since it cost us 20% less than the U.S. We also expanded in Asia where it was 10% less, but this was more for economies of scale.

Product differentiation was the first thing after cost leadership that helped us succeed. We tried to keep our bubble on the strategic group map away from everyone else. We were so far away sometimes that we did not even show up on the map. The main way we did this was by product features. We tried to have more models than anyone else on the market while maintaining a large amount of features. This raised our production costs, but it also allowed us to raise our selling price and our selling appeal. We used product complexity to have a higher end product than our competition. Our high end product had enhanced styling which increased its demand. Our Asian facility was the key to our product differentiation and complexity.

We focused on our relationship with the customer through marketing. We did not spend the most on marketing each year, but we used our money most effectively. Our cost per pair of shoes was usually the lowest or second lowest. We did this my making sure we didn't spend too much money on celebrities like some of the other teams did. This is what sunk many of them and helped us to prosper. We won the bidding for a couple of celebrities, but it was under our terms. We would have liked more, but many times the costs were more than the gains. Distribution channels were important to us. Deciding to sell branded products or private label products was important to us. When selling branded products, we needed to control our distribution channels mix of wholesale and internet sold shoes.

We tried to go against the rule that product differentiation and cost leadership cannot be implemented simultaneously. We usually had one part of our company as the low cost leader, while another part had the most differentiation. We had been the second lowest cost provider while having the highest product differentiation in different segments of our business. If we stayed in business long enough we may have been able to achieve both.

Vertical integration in our corporate strategy was one of the simplest parts of our business. We were a production company but sometimes we decided on warehousing more products than necessary, which was integrated in our company. One reason to do this changing of warehousing product is to control our stock price. We could lower our profits one year and then we could raise our profits the next by having no productions costs for the products we sell. If we would not have integrated the warehouse in our facility, we might have not been able to do this at such a low cost.

We also vertically integrated through foreign direct investment. We established plants in Latin America and Europe while increasing the size of our plant in Asia. We had large markets in all three areas and having plants helped us. One advantage was that we could utilize the lower cost of workers in China and Latin America. Another advantage was that we could eliminate tariffs by not exporting to these countries. The last advantage was that it was cheaper for production because of the differences in exchange rates.

Learning the principles of cost leadership, product differentiation, and vertical integration have helped my BSG team become highly successful. I would encourage everyone in business to learn all the principles.

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