

# Decision-Making in Virtual Teams - Developing Business Intelligence across Time, Culture and Space Using Serious Games.

Gerd-Michael HELLSTERN  
University of Kassel  
Kassel / Germany  
hellstern@wirtschaft.uni-kassel.de

and

Joanna OZGA  
University of Kassel  
Kassel / Germany  
jozga@uni-kassel.de

and

Bruce A. KIBLER  
Gannon University  
Erie / USA  
kibler006@gannon.edu

## Abstract:

The goal of the research is to determine the performance of multicultural teams in a managed simulation exercise. We will build on Wong and Burtons [1] premise, examining the affects of cross-national team composition on overall team performance using several measures, e.g., frequency, mode and intensity of communication as well as cultural proximity of the participants in the classroom environment. We have conducted cross national, internationally composed business simulation instances designed to reflect real market conditions, i.e. virtual business simulations, over a three year period and results suggest that the intensity of communication increases creativity, strategy and motivation. Furthermore, we investigate the cultural proximity of the students as a component of overall team effectiveness.

Our research is based on two simultaneously occurring MBA courses, one at the University of Kassel, Germany and the other at Gannon University, USA. The multicultural personality questionnaire (MPQ): a multidimensional instrument of measuring multicultural effectiveness [2]. The questionnaire has scales for Cultural Empathy, Openmindedness, Emotional Stability, Orientation to Action, Adventurousness/Curiosity, Flexibility, and Extraversion. Supported the predictive value of the instrument of multicultural activity and its incremental value above the Big Five in predicting international orientation and aspiration of an international career, the MPQ may be used as a diagnostic tool for assessing further training needs in international acuity.

Using the latest technology and international students (this is not limited to German and U.S. citizens) on both sides of the Atlantic, we are testing the learning potential using these virtual environments while using the mediating factors of cultural proximity (MPQ) and modes of communication (skype, facebook, chat, etc.). An additional likert scale evaluation of attitudes towards the importance of specific decision making and business outcome criteria is administered at the beginning of the class and again at the end to track student learning outcomes based on attitudes towards these chosen criteria. The paper proposes an agenda for future teaching in strategic management.

## Keywords:

Virtual Team Building, Collaborative and Problem-based Learning, Business Simulation, E-Learning, Educational Software, Crosscultural Learning

## 1. Introduction

There is an ever increasing demand in international management to successfully collaborate across international barriers. Previous research on the effects of team performance, demonstrates divergent results. Although geographically dispersed teams are ubiquitous in a globalized world, there is little known about their effectiveness. Effective virtual team interaction is composed of a series of discrete communication

incidents, each configured by aspects of the team's structural and process elements [3]. As with all teams, virtual teams also rely on a foundation of mutual trust and collaboration to function effectively [4, 5, 6, 7, 8]. Not having the ready luxury of face-to-face meetings within the international academic atmosphere, as suggested by Maznevski and Chudoba [3] for effective virtual teams, alternative methods are being sought in preparing students for the challenges of the global environment. Wong and Burton [1] propose that virtual teams are defined by three key characteristics – virtual team context, virtual team composition and virtual team structure.

## 2. Course Framework

The educational effectiveness of business simulations is widely accepted in previous research [9]. The composition of teams was based on the previous experience with undergraduate students [10]. We built teams of German based and U.S. based students (with variation in nationality) which were competing against each other on the basis of the Business Strategy Game (www.bsg-online.com). The simulation demands the student teams to compete in the athletic apparel industry on a global basis, planning all aspects of production, marketing planning, financial etc. across production facilities in four geographic regions (North America, Europe/Africa, Asia and South America) and based on algorithms derived from actual market activity. Students readily have a chat function built into the simulation which enables direct and immediate contact while working. In addition, students are using 'skype' as well as 'facebook' in their team forming and decision making arenas. The students performed a total of 9 decision making rounds, two of which are practice rounds in order for students to learn the simulation and market expectations/responses to their decisions.

Each decision round, company managers are faced with 53 types of decisions, spread across the functional spectrum, e.g. corporate social responsibility and citizenship (up to 6 decision entries), pricing and marketing (up to 10 decision entries in each of 4 geographic regions) or plant capacity additions/sales/upgrades (up to 6 decision entries per plant). Decisions follow the basic functional areas of a normal company, with decisions required for most areas across the spectrum. The instructor(s) is also able to dynamically set the following performance characteristics weights according to investor expectations as well as best-in-class criteria: (1) earnings per share, (2) return on equity, (3) credit rating (4) image rating, and (5) stock price gains.

To be sure that rules of the simulation are known by each of the participants we scheduled two practice rounds and then eight simulation rounds. Moreover, there were two online self-graded quizzes, which were aimed at pushing

class members to learn the simulation rules and also at giving some feedback on each participant's grasp of BSG.

## 3. Research Design

The primary objective of this research was to conduct an analysis of decision making process in virtual teams. Moreover, we would like to make recommendations for future implementations of learning strategic management in virtual environments. To accomplish these goals we used two research methods simultaneously – questionnaire of students and observation of log-ins.

A summative evaluation of the project was conducted with the 10 point likert scale questionnaire, in which we have measured the differences in learning and / or perception of relevant business concepts within strategic management in the beginning and at the end of the course. Moreover, we used the multicultural personality questionnaire (MPQ): a multidimensional instrument of measuring multicultural effectiveness [2]. The questionnaire has scales for Cultural Empathy, Openmindedness, Emotional Stability, Orientation to Action, Social Initiative, Emotional Stability, and Flexibility. Cultural empathy is reported in research literature as a core stone for successful global leadership [10, 11] and we use this variable to predict the output of the teamwork [2]. The scale for cultural empathy (18 items) measures the ability to empathize with the feelings, thoughts and behaviors of individuals from a different cultural background versus an inability to do so [2].

Secondly, we have used the team simulation scores generated via the simulation software algorithms for the teams involved in the competition (see "Tab. 1")

Table 1: Variables from Simulation

Name	Description
Duration (Intensity of Work)	Total group work effort measured on the amount of time the group members have sent with company operations program open
Frequency	Total number of log-ins of group members to launch the company operations program
Information	Number of times industry and company reports were accessed (utilization of available information)
Decision Taking	"Last-Save" Behavior (Germany vs. USA)
Interaction	Number of savings
Teamwork	Total assessment of the collaborative skills and teamwork in group based on the peer evaluation

“Tab. 2” summarizes the research model.

Table 2: Research model

Context	Interaction Process	Team Performance
Culture Window	Team communication Team decision making Team information behavior	Overall Financial Learning
Independ. Var.	Mediating Var.	Dependent variable

Therefore, there are five propositions:

P1: Intensity of work influences positively overall game score.

P2: Frequency influences positively overall game score.

P3: Utilization of available information influences positively overall game score.

P4: Interaction influences positively overall game score.

P5: Teamwork influences positively overall game score.

#### 4. Discussion of Results

Our research is based on two simultaneously occurring MBA courses with the population of 30 students in total (8 US and 22 German). 9 of them are female. They built 8 mixed virtual teams of 3 or 4 participants. The group “H” was a control group with only German students.

The simulation provides game instructors with several log-files and reports about participant’s performance, behavior and attitudes towards co-managers. “Tab. 3” shows overall game scores reached by the last simulation round.

Table 3: Overall Game Scores

Rank	Company	Overall Game-to-Date Investor Expectation Score	Overall Game-to-Date Best-In-Industry Score	Overall Score based on instructor-established 50/50 weighting
1	B	112	96	104
2	I	113	92	103
3	A	102	77	90
4	C	101	74	88
5	F	99	74	87
6	H	75	60	68
7	E	76	56	66
8	G	58	45	52
9	D	50	40	45

An overall average BSG score for the last year of the simulation was 77 and five mixed groups have reached better score than that average. None of the companies has reached the average BSG score for the worst companies, which was 42. The mixed groups performed on average better than the control group.

If we take data for each simulation year separately, as in “Tab. 4”, we can observe some fluctuations in scores across years. There is a correlation between stability of the score and the ranking of the company at the end of the simulation. The two winners have achieved to constantly fulfil the expectations of investors, except in year 13, which was unfavorable for all of the companies.

Table 4: Investor Expectations scores across the simulation

Rank	Company	Y11	Y12	Y13	Y14	Y15	Y16
1	B	113	116	41	117	116	117
2	I	112	115	87	100	106	114
3	A	34	104	65	108	96	104
4	C	89	116	76	99	87	105
5	F	105	113	78	112	111	90
6	H	88	108	38	109	75	56
7	E	30	85	42	101	62	82
8	G	70	104	69	96	32	43
9	D	54	66	38	70	56	45

We do not observe any correlation between duration and interaction of the group members (see “Tab. 5”). Though, when we analyze the duration and the overall score of the game there is a slight correlation (0.274). The number of game savings is an indicator of team cohesion – we observe a strong correlation (0.581) between interaction (number of savings) and the overall score of the game.

There is no general trend in the last save decisions. We observe that the last decisions were made mainly by US students, which may be explained by the due time of the decisions.

Table 5: Decision Making and Last Savings Behavior

Rank	Company	Duration	Interaction	Decision Taking	
				USA	DE
1	B	55:26	81	5	3
2	I	35:26	34	5	2*
3	A	44:33	20	3	5
4	C	53:12	111	8	0
5	F	65:57	104	1	7
6	H	28:41	123	0	8
7	E	77:00	109	3	5
8	G	39:17	214	6	2
9	D	27:53	79	5	3

\* The group "I" has completed only 7 savings

"Tab. 6" presents average decision time per person and per decision round. At the same time, average time spent in decision-making program per decision round in BSG was 2 h 25 min, and only three groups were under that average. The analysis of the correlation between average decision time per person and per decision round shows that there is a moderate correlation (0.472) between the items. Groups with high average interaction were more likely to achieve better overall scores in the game.

Table 6: Decision time per person

Rank	Company	Average Decision Time per person	Average Decision Time per person and per decision round
1	B	18:28	03:04
2	I	17:43	02:57
3	A	14:51	02:28
4	C	17:44	02:57
5	F	21:59	03:39
6	H	9:33	01:35
7	E	25:41	04:16
8	G	13:05	02:10
9	D	7:58	01:19

The analysis of the log-ins into "Corporate Lobby" and the utilization of available information (see "Tab. 7") shows moderate correlation between variables (0.445). The use of reports reflects also the scores in the overall

ranking with a strong correlation of 0.692. Groups, which used industry and company reports, were more successful than those not doing so.

Table 7. Log-ins to "Corporate Lobby"

Rank	Company	Frequency	Information
1	B	136	134
2	I	67	82
3	A	103	51
4	C	78	82
5	F	119	119
6	H	88	69
7	E	151	60
8	G	66	51
9	D	71	48

"Tab. 8" shows the average number of log-ins to "Corporate Lobby" per person and its standard deviation. We observe big differences between groups. The control group and the group "B" slightly differ in member behavior but there is no connection to team performance.

Table 8: Log-ins to "Corporate Lobby" per person

Rank	Company	Average Number of Log-ins per person	Standard Deviation
1	B	45,33	12,055
2	I	22,33	6,658
3	A	34,33	8,386
4	C	26,00	14,525
5	F	39,66	13,317
6	H	29,33	7,024
7	E	48,33	10,693
8	G	22,00	13,229
9	D	23,66	13,051

Surprisingly, we do not find any correlation between team work and overall score of the game (see "Tab. 9"). Assessment of teamwork was based on peer evaluation and shows big differences between groups. The most coherent company was group "A", followed by group "F".

Table 9: Teamwork

Rank	Company	Assessment of Teamwork Based on Peer Evaluation	Standard Deviation
1	B	65,67	38,68
2	I	43,33	38,68
3	A	91,33	5,77
4	C	29,50	21,17
5	F	92,00	6,93
6	H	48,67	34,06
7	E	65,50	26,30
8	G	49,00	34,83
9	D	66,75	42,50

The second part of the study was a questionnaire based on MPQ and aspects of business as to their impact on long term success. Students rated the different aspects of business at the beginning and at the end of the course. Questions were formulated with a 10 point likert scale. "Tab. 10" presents the most important changes in assessment of indicators on long term success among students in Germany.

Table 10: Change in assessment of indicators on long

Indicator	Change
Employee pay levels	+0,61
Corporate governance	+0,60
Core competencies	+0,51
Ethics	+0,25
Financial strength	-0,22
Marketing communication	-0,35
High dividends	-1,10

term success among students in Germany (selection)

## 5. Limits and Future Outlook

Due to space constraints it is not possible to discuss in detail all outcomes of our ongoing research, instead we tried to illustrate in a log-file analysis of the overall outcome differences the complexity of the decision-making process. We found that the relationship between team performance and interaction is more multifaceted than previous research and our initial design suggested. Therefore there are limits to the analysis of team interaction and performance as they are moderated by diverse contextual factors. We found that critical incidents during the different decision rounds decidedly shaped the final results. One important and surprising finding is that the sole emphasis on financial goals as a

measure of success fell during the social interaction among students and social organizational goals gained in importance. Obviously the significant gain is less in the skills to reach high performance but rather a significant increase in a shared understanding of team work and a shift to an understanding of organizational dynamics and processes.

## References

- [1] S.-S., Wong, & R.M. Burton, "Virtual Teams: What are their Characteristics, and Impact on Team Performance?" **Computational & Mathematical Organization Theory**, Vol. 6, No. 4, 2000, pp. 339-360.
- [2] J. P., Van Oudenhoven, & K. Van der Zee, "Predicting multicultural effectiveness of international students: the Multicultural Personality Questionnaire", **International Journal of Intercultural Relations**, Vol. 26, No. 6, 2002, pp. 679-694.
- [3] M.L., Maznevski, & K.M., Chudoba, "Bridging Space Over Time: Global Virtual Team Dynamics and Effectiveness", **Organization Science**, Vol. 11, No. 5, 2000, pp. 473-92.
- [4] S.E. Jackson, A. Joshi, & N.L. Ehrhardt, "Recent Research on Teams and Organizational Diversity: SWOT-Analysis and Implications", **Journal of Management**, Vol. 29, No. 6, 2003, pp. 801- 830.
- [5] C. B. Gibson, & M. Zellmer-Bruhn, „Metaphor and Meaning: An Intercultural Analysis of the Concept of Team-work", **Administrative Science Quarterly**, Vol. 46, 2001, pp. 274-303.
- [6] D. Harrison, K. Price, J. Garvin, & A. Florey, "Time, Teams and Task Performance: Changing Effects of Surface and Deep-Level Diversity on Group Functioning", **Academy of Management Journal**, Vol. 45, 2002, pp. 1029-1045.
- [7] J. Mathieu, M.T. Maynard, T. Rapp, & L. Gibson, "Team Effectiveness 1997-2007: A Review of Recent Advancement and a Glimpse into the Future", **Journal of Management**, Vol. 34, No. 3, 2008, pp. 410-476.
- [8] A.W. Woolley, "Playing Offensive vs. Defensive. The Effects of Team Strategic Orientation on Team Process in Competitive Environment", **Organization Science**, Vol. 22, No. 6, 2011, pp. 1384-1398.
- [9] T. Ben-Zvi, "Using Business Games in Teaching DSS", **Journal of Information Systems Education**, Vol. 18, No. 1, 2007, pp. 113-124.
- [10] G.M. Hellstern, B. Kibler, & J. Ozga, „Creating Successful Global Teams with Strategic Management Simulation Software", in: Gómez Chova, L./ Martí Belenguier, D./ Candel Torres, I. (Eds.): **INTED2010**

**Proceedings CD**, International Association of Technology, Education and Development (IATED), IATED, Valencia, Spain, 2010.

- [11] P. B. Pedersen, & M. Pope, "Inclusive Cultural Empathy for Successful Global Leadership". **American Psychologist**, Vol. 65, No. 8, 2010, pp. 841-854.