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CONSISTENCY OF PARTICIPANT SIMULATION PERFORMANCE ACROSS SIMULATION GAMES OF GROWING COMPLEXITY

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ABSTRACT

The present study is a replication of an earlier study by Wellington, Faria and Whiteley (1997) that examined the relationship between participant simulation game performance over two separate simulation competitions. In the original and current study, students were exposed to two different simulation games over two semesters in two separate marketing courses – the second simulation being far more complex than the first. The present study sought to overcome a key limitation of the earlier work by employing a much larger sample size. The new study involving 189 students found that players exhibiting higher rank order performance in Merlin: A Marketing Simulation tended to outperform players exhibiting a lower rank order performance in COMPETE: A Dynamic Marketing Simulation*. Due, in part, to the larger sample involved in the present study (189 participants versus 27 in the earlier study), it was found that there is consistency in simulation participant performance across simulation competitions.*

INTRODUCTION

Poor performing students in simulation competitions often attribute the results to luck rather than skill. While luck may play a part in any simulation competition, if simulation games are a meaningful educational experience, skill must be the most important factor in determining good performance.

Past research has examined the relationship between student performance in simulation competitions and a wide range of variables. Among the variables examined have been numerous personality characteristics, locus of team control, achievement motivation, previous academic performance, time pressure, ethnic origin of team members, gender, team size, previous business experience, team organizational structure, method of team formation, and grade weighting (see for example Anderson and Lawton 1992; Brenenstuhl and Badgett 1977; Butler and Parasuraman 1977; Chisholm, Krishnakuman and Clay 1980; Edge and Remus 1984; Faria 2001; Gentry 1980; Glomnes 2004; Gosenpud 1989; Gosenpud and Miesing 1992; Hergert and Hergert 1990; Hornaday 2001; Hsu 1984; Moorhead, Brenenstuhl and Catalanello 1980; Newgren, Stair and Kuehn 1980; Patz 1990; Roderick 1984; Walker 1979; Washbush 1992; Wheatley, Anthony and Maddox 1988; and Wolfe, Bowen and Roberts 1989). Summarizing much of the past research have been major review articles by Greenlaw and Wyman (1973), Keys (1976), Wolfe (1985), Miles, Biggs and Shubert (1986), Wolfe and Keys (1990), Randel, Morris, Wetzel and Whitehall (1992), and Faria (2001).

The present study examines whether good simulation performance is repeatable in different marketing courses using different simulation games and, thus, attributable to the differing skills and abilities of the simulation participants as opposed to being due to some element of luck. The present study builds upon repeat performance results reported in two earlier studies (Wellington and Faria 1995; and Wellington, Faria and Whiteley 1997).

LITERATURE REVIEW

While only two previous studies have specifically addressed the issue reported in this paper, several related areas of research will be briefly discussed.

Several factors may explain good performance in a simulation competition. For example, it is possible that good students will consistently outperform poor students. To test this, a number of studies have examined the relationship between grade point average (GPA) and simulation performance. While some studies have reported a positive relationship to exist (Hsu 1989; Wolfe and Chanin 1993; and Wolfe and Keys 1990) many others have found no such relationship (Faria 1986; Glomnes 2004; Gosenpud 1987; Gosenpud and Washbush 1991; Norris and Niebuhr 1980 and Wellington and Faria 1994).

Learning is another obvious factor that might lead to good simulation performance and several studies have examined this relationship. Learning is generally measured by performance on end of course examinations. While two studies have reported a relationship between simulation performance and performance on mathematical problems (Faria and Whiteley 1989; and Whiteley and Faria 1990), many other studies report no relationship between superior simulation game performance and performance on course final examinations (Anderson and Lawton 1992; Washbush and Gosenpud 1993; Wellington and Faria 1991; and Whiteley 1993).

A number of studies have examined the personality traits of successful simulation game players and successful business executives (Babb, Leslie and VanSlyke 1966; Gray 1972; McKinney and Dill 1966; Vance and Gray 1967; and VanSlyke 1964). These studies have generally shown that the characteristics of successful game players conform to those of successful business executives. Additional studies have examined the decision-making styles of successful simulation participants and successful business executives (Babb and Eisgruber 1966; and Wolfe 1976). These studies reported that the decision-making styles of successful executives and game players were similar.

Several longitudinal studies have been undertaken in which a student's business game performance is compared to some measure of subsequent business career success (e.g., number of promotions, job title, salary level, number of salary increases, management level in the company hierarchy, etc.). Good simulation performance might suggest something about an individual's managerial skills and, hence, serve as a predictor of later career success. One early longitudinal study (Norris and Snyder 1982) did not find a correlation between business game performance and later career success but two more comprehensive studies have reported such a correlation (Wolfe and Roberts 1986; and Wolfe and Roberts 1993).

Four studies have reported that successful business simulation game firms practice strategic management (Gosenpud, Miesing and Milton 1984; Gosenpud and Wolfe 1988; Miesing 1982; and Wolfe and Chanin 1993). In these studies, strategic management was considered to exist when the team developed clear goals, analyzed the external environment in which they were operating, understood their strengths and weaknesses, developed clear strategies as part of a formal plan, monitored their performance, and took corrective action when needed.

The research studies cited above have suggested that good simulation performance might be related to student grade point average, student learning in the simulation competition, the personality characteristics of the simulation participants, the decision-making style of the participants, or the degree of formal planning of the superior performing teams. As well, several longitudinal studies have suggested that good simulation performers will be more successful in later business careers. If any, or all, of the above is true, this would suggest that good simulation performers should be consistently good over time in repeated simulation competitions and that good simulation performance is attributable to factors other than luck.

To test this idea, Wellington and Faria (1995) studied 555 students in two rounds of a simulation competition. The students played *The Marketing Management Simulation* (Faria and Dickinson 1995) in a Principles of Marketing course. Student teams made six decisions, at which point the competition was restarted. The simulation teams were randomly reassigned so that new industries were created with each new industry having a first, second, third, fourth, fifth and sixth place team from the first competition. From this new start, a second round of six decisions was then initiated. The results reported by Wellington and Faria (1995) indicated that there was a medium-strong correlation (r value .4491) between participant performance in the second round of the competition with performance in the first round of the competition. The conclusion reached was that good simulation performers continue to be good performers in repeated competitions.

In a second study, Wellington, Faria and Whiteley (1997) took this idea one step further. In the Wellington and Faria (1995) study, the game participants played the same simulation game in two separate competitions. This might lead one to conclude that successful strategies in the first round of the competition were simply repeated in the second round. Wellington, Faria and Whiteley (1997) tracked participant simulation performance from a Principles of Marketing course in which *The Marketing Management Simulation* (Faria and Dickinson 1995) was used into a second Marketing Management course in which *COMPETE: A Dynamic Marketing Simulation* (Faria, Nulsen and Roussos 1994) was used. Thus the Wellington, Faria and Whiteley (1997) study examined game participants in two separate courses, taught by two different instructors, using two different simulation games. In both courses, participants performed as single member companies. In this study, a correlation of .0580 (significant at .774) was reported indicating there was no relationship between performance in one simulation game versus another.

PURPOSE AND HYPOTHESES

The purpose of the present study is to determine whether, in fact, good performers continue to be good performers as stated by Wellington and Faria (1995). While the Wellington and Faria study was well designed, one difficulty with it was that participants played the ***same*** simulation in both rounds of the competition. Hence, good performers in the first round likely repeated successful strategies in the second round. The Wellington, Faria and Whiteley (1997) study overcame the weakness of the first study by examining repeat participant performance with different teachers and using two different simulation games. In the second study, successful performance in one simulation competition was generally not repeated in the second competition. A problem with the second study, however, was small sample size (only 27 students). As such, it was felt that a follow-up study with a larger sample was needed to establish whether, in fact, there was consistency in performance across simulation games or not.

Based on past research findings, the following two hypotheses will be tested:

H1: In a second round of a simulation competition using a different simulation game, players exhibiting higher rank order performance in the first round of the competition will outperform players exhibiting lower rank order performance.

H2: Performance in one round of a simulation competition will be strongly related to performance in the second round of a simulation competition even with the use of a different simulation game.

METHODOLOGY

The subjects for the research to be reported here were 189 students who took both a Marketing Management course in which *COMPETE: A Dynamic Marketing Simulation* (Faria, Nulsen and Roussos 1994) was used and, in an earlier semester, took a Principles of Marketing course in which *Merlin: A Marketing Simulation* (Anderson, Beveridge, Lawton and Scott 2004) was used. In addition to the simulation game being different, the instructors in the two courses were different. The *Merlin* simulation is quite suited for use in introductory marketing courses while *COMPETE*, being more complex, is better suited for use in upper level marketing courses.

In the Marketing Management course, all 189 course participants played the *COMPETE* simulation as single person regional managers in order that performance could be tracked from the previous simulation competition on an individual participant basis. In the earlier Principles of Marketing course, participants had played as single member companies. Participants were divided into industries of four or five companies, with each participant managing a region, for the *COMPETE* competition and played through a ten to twelve period competition. *Merlin* participants had been divided into industries of six, nine or twelve single person companies for the competition and participated in an eight period game.

In the *Merlin* competition performance was measured in terms of game-to-date earnings with the participants ranked from first to last place within their industries (e.g., from first to sixth, ninth or twelfth depending on industry size). The same was true in the *COMPETE* competition in which participants were ranked from first to fourth or fifth in their region. In order to make these rankings more commensurable, a collapsed ranking designation of high (1), medium (2) and low (3) was created for the *Merlin* firms and a collapsed ranking designation of 1 to 4 was created for the *COMPETE* firms (see Table 1). The collapsed rankings for *Merlin* were based on the industry size and assigned as follows: high (rank of 1 or 2 for six teams; 1 to 3 for nine teams; and 1 to 4 for twelve team industries), medium (3 or 4 for six teams; 4 to 6 for nine teams; and 5 to 8 for twelve team industries) and low (5 or 6 for six teams; 7 to 9 for nine teams; and 9 to 12 for twelve team industries). Similarly, the collapsed rankings for the *COMPETE* companies were also based on industry size as follows: first place was ranked 1, second place was ranked 2, third place was ranked 3, and both fourth and fifth place was ranked 4.

H1 was tested two ways. Firstly, because the data were ordinal and involved *Merlin* collapsed rank order performance as factor variables versus a collapsed *COMPETE* rank order performance, it is most appropriate to use a non-parametric procedure. As such, the Kruskal-Wallis One-Way Analysis Of Variance By Ranks test was used because it fit the data type best. However, when samples are large as in this case (189 students with at least 52 participants in each ranking group), "parametric tests are robust to deviations from Gaussian distributions. . . . Unless the population distribution is really weird, you are probably safe choosing a parametric test when there are at least two dozen data points in each group" (Motulsky 1995). Consequently, the parametric ANOVA procedure was also used to compare *Merlin* collapsed rank order performance as factor variables versus the collapsed *COMPETE* rank order performance. The decision to use ANOVA was based on the fact that its output is more illustrative than that from the Kruskal-Wallis tests and, presumably, it would

TABLE 1

COLLAPESED RANKINGS FOR *COMPETE* AND *MERLIN* PARTICIPANTS

COMPETE Rank	N	%	*Merlin* Rank	N	%
1	35	18.5	1 High	79	41.8
2	43	22.8	2 Medium	58	30.7
3	41	21.7	3 Low	52	27.5
4 and 5	70	37.0			
Total	189	100%	Total	189	100.0%

TABLE 2

KRUSKAL-WALLIS ONE-WAY ANALYSIS OF VARIANCE BY RANK

Merlin Simulation Ranking	N	Mean Rank COMPETE Simulation	
1 (High)	79	86.41	
2 (Medium)	58	93.36	3
(Low)	52	109.88	

Kruskal-Wallis Test Results

Test Statistics (a, b)

Chi-Square	6.346
Df	2
Asymp. Sig.	.042

a Kruskal Wallis Test

b Grouping Variable: *Merlin* Rank

produce the same test results.

H2 was tested by computing Spearman's Rho, a nonparametric rank-order correlation, between both the straight *Merlin* cumulative performance versus the *COMPETE* cumulative performance ranks and also for the collapsed *Merlin* and *COMPETE* ranks. For both hypotheses, a .05 level of significance was set as the measure of acceptance for the statistical tests.

FINDINGS

The overall findings from the Kruskal-Wallis One-Way Analysis Of Variance By Ranks test, and the ANOVA procedure, are reported in Tables 2 and 3. The findings for the nonparametric rank-order correlation analyses are reported in Table 4. The findings result in the acceptance of H1 but not H2.

To test H1, the simulation teams were divided into rank order groups based on their order of finish (collapsed rankings of high, medium or low) in the *Merlin* competition and their collapsed order of finish (from first to fourth) in *COMPETE*. The significant Kruskal-Wallis test results reported in Table 2 and the significant ANOVA results reported in Table 3 lead to the acceptance of H1. Participants who were highly ranked in the *Merlin* competition did outperform less highly ranked participants in the *COMPETE* competition.

H2 examined the strength of the relationship between each simulation player's performance in the *Merlin* competition and the *COMPETE* competition. The findings from the nonparametric rank-order correlation analysis indicate that individual participant performance in the two simulation competitions is only weakly related (Spearman's rho of .135, significant at .064 for unaltered *Merlin* versus *COMPETE* ranks and Spearman's rho of .176 significant at .015 for the collapsed *Merlin* versus collapsed *COMPETE* ranks). As such, H2 is not supported.

DISCUSSION AND CONCLUSIONS

The research reported here sought to examine how consistent participant performance would be over play in two different marketing simulation competitions involving two different simulation games. The findings indicate that there is a moderate to weak relationship between rank order performance in one simulation game versus rank order performance in a second, more complex, simulation game. These findings are generally consistent with earlier findings reported by Wellington, Faria and Whiteley (1997) and are based on a much larger sample size (189 students versus 27 students). The study results do support the notion that simulation performance is consistent over time in two different simulations and, as such, luck is not a major contributing factor to simulation game performance. In this regard, the findings are consistent with those of Wellington and Faria (1995).

The stronger correlations reported in this study compared to the earlier findings by Wellington, Faria and Whiteley (1997) beg explanation. Aside from using a much larger sample, there were other important differences between this study and the earlier study. For example, the findings in this study were based on comparisons of performance between a different pair of simulations (*Merlin* and *COMPETE*) as opposed to the *Marketing Management Simulation* and *COMPETE* in the earlier study.

TABLE 3

ANOVA RESULTS OF *MERLIN* RANKING VERSUS *COMPETE* RANKING

Merlin Simulation Ranking	N	Mean Rank *COMPETE* Simulation
1 (High)	79	2.58
2 (Medium)	58	2.74
3 (Low)	52	3.09

ANOVA

Merlin Ranking	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	8.362	2	4.181	3.311	.039
Within Groups	234.855	186	1.263		
Total	243.217	188			

TABLE 4

SPEARMAN'S CORRELATION RESULTS BETWEEN THE *MERLIN* AND *COMPETE* SIMULATION PERFORMANCE MEASURES

Performance Variables	N	Spearman's Rho Correlation	Sig.
Merlin Rank vs *COMPETE* Rank	189	.135	.064
Collapsed *Merlin* Rank vs Collapsed *COMPETE* Rank	189	.176	.015

Another likely reason why the performance results varied could be due to the nature of the *COMPETE* competition in comparison to the *Merlin* competition and the differences in the manner in which the simulations were employed. The *Merlin* competition ranged from industries of 6 to 12 teams while the *COMPETE* competition included industries of 4 and 5 companies; *Merlin* has fewer product/markets (2 products x 3 regions) than *COMPETE* (3 products x 3 regions) and fewer marketing management decision parameters. Further, *COMPETE* provides far more detailed results at the end of each decision period requiring more interpretive skills and analysis. As such, the decision-making demands on the participants in *COMPETE* are somewhat greater than those in *Merlin*. In light of these facts, the findings are very encouraging. It would appear that the *COMPETE* competition presented a different challenge and learning experience from that of *Merlin* for the participants and they responded differently to it, producing different results.

As far as how the simulations were employed, in the *Merlin* competition students were simply asked to demonstrate profit maximization behaviour and were not asked to develop or report on the marketing strategy they pursued. As such, the instructive nature of the simulation was passive and the learning was retrospective. In the *COMPETE* competition, the students were also asked to demonstrate profit maximization but they were given assignments requiring them to develop, explain and justify their marketing strategies. This called for a far more active learning environment and required an *a priori* learning demonstration. As such, a more "skilled" and "planned" approach to decision making was demanded in the *COMPETE* simulation competition.

Aside from the difference in learning approach, the industry and company structures in which the simulations were played were different. In *Merlin* the total exercise involved students playing and being evaluated as individuals who were responsible for all simulation decision making for their entire company. In contrast, in *COMPETE* the students were evaluated both as individuals and groups. Although performance as individual regional managers was the comparison criterion, there were a number of common or company-wide decision variables that affected the performance of all regional managers. The three regional managers of each *COMPETE* team were responsible for performance in their region but were also responsible for overall company performance. The *COMPETE* players were part of a management team and would most likely be amenable to working together to maximize team performance as well as individual performance. As well, they had to work together to produce team reports. As such, the unit of analysis comparison may have broken down confounding the study results.

Finally, there is the possibility of an issue of restriction of range which would tend to reduce the potential strength of relationship between performance in the first simulation versus the second. Students who completed Principles of Marketing, a required course, but achieved a poor grade, would be less likely to enrol in the Marketing Management follow-up course which was an optional course. As such, the percentage of good simulation performers from the Principles class enrolling would be higher and the percentage of poor performers would be lower. Thus the potential variance in comparative performance could be reduced, producing a lower correlation value. There is clear evidence of this phenomenon in Table 1 as nearly 40 percent of the students in the Marketing Management course had achieved high rankings in *Merlin* while only 27 percent had ranked low.

Based on the findings from this research, it would seem that performance in one marketing simulation game can be a predictor of performance in a second marketing simulation game but the relationship is weak. There are several implications from this research for marketing educators who have been using, or are considering using, marketing simulation games in their classes. Most importantly, if a marketing educator is convinced that marketing simulation gaming is valuable as a pedagogical exercise (e.g., having students deal with uncertainty, providing teamwork experience, etc.) but not sure if playing more than one simulation game will add to the student's experience - this study indicates that different games do provide different experiences but will also provide some consistency of results.

In conclusion, good and bad simulation performance in one marketing simulation will likely carry over to a different marketing simulation game but the relationship is not strong. Hence, using different simulation games in different courses can certainly produce different learning experiences and different learning outcomes yet still offer some consistency in performance outcomes.

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