Measuring the Performance Ranking Curve in Marketing Simulation Games

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ABSTRACT

The present study looks at performance ranking curves to examine the issue of when performance ranking in a marketing simulation game flattens out. Past research of this phenomenon has been presented as "dominance studies" but this paper takes a different approach. The subjects for this study were 1726 undergraduate marketing simulation teams that competed in four different marketing simulation games which were used in multiple classes over a span of 15 years. The study examined "performance ranking" curves which were plotted using the correlations of ending rank order performance of teams with period by period rank order performance. These plots indicated that the strength of correlation increased over time and that final performance ranking was generally established by the fifth period. Based on these results, the authors concluded that marketing simulation competitions which focus on performance outcomes are unlikely to produce significant improvements in performance related benefits beyond the fifth decision period.

INTRODUCTION

Business simulation games have been in use in North America since 1957 (Watson, 1981). Since that time, the use of business simulation games has grown enormously. In 1961 it was estimated that more than 100 business simulations were in use in the U.S. alone and had been played by over 30,000 business executives and countless students (Kibbee, Craft and Nanus, 1961). *The Guide to Simulations/Games for Education and Training* (Horn and Cleaves, 1980) published in 1980 described 228 business simulation games then in use at universities, community colleges and by business firms for management training purposes. Various surveys of AACSB member schools undertaken from 1962 through 1998 reported that business simulation game usage at these universities grew from 71.1 percent of the responding universities in 1962 to 97.5 percent of the responding universities in 1998 (Faria, 1998). A 2004 e-mail survey sent to 14,497 university business professors, yielding 1,085 returns, reported that 47.4 percent of the survey respondents had used one or more business simulation games during their teaching careers (Faria and Wellington, 2004).

As simulation game usage has grown since 1957, there has also been a growing body of research on simulation game usage. This body of past research includes examinations of: (1) the internal validity of business simulations; (2) the external validity of business games; (3) the relative merit of simulation games versus other teaching approaches; (4) the learning, or skills training, benefits of simulation games; and (5) correlates of simulation performance.

Research into the skills training or learning aspects of business simulation games dates back almost to the earliest uses of these exercises. The reported types of learning brought about by the use of business simulation games includes goal setting and information processing; organizational behavior and personal interaction skills; sales forecasting; entrepreneurial skills; financial analysis; basic economic concepts; inventory management; mathematical modeling; personnel skills such as hiring, firing, training, leading and motivating; creative skills; communications skills; data analysis; and formal planning and report preparation skills among others. Faria (2001) provides a history and extensive list of references covering research on learning and skills training through the use of business simulation games.

Past simulation research has also examined the relationship between student performance in simulation games and a wide range of participant and team 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; Wellington and Faria, 1996; Wheatley, Anthony and Maddox, 1988; and Wolfe, Bowen and Roberts, 1989).

The issue of how many decisions students should make to gain the maximum learning benefits from a business simulation exercise has been a source of some debate. Patz (1999; 2000) reported findings using four separate total enterprise simulations in which he found final game rankings in an eight period competition were determined anywhere from periods one through six. Teach and Patel (2007) reported results from 41 simulation competitions employing eight decision rounds and concluded that many simulation competitions are decided after only three or four decision periods. Teach and Murff (2008) suggest the use of less complex simulations which might lead to greater learning and recommend the use of fewer decision rounds. In contrast, Wolfe (1978, p.149) reports that “a player’s learning curve lengthened as a game’s complexity increased.” While Wolfe (1978, p.149) did not expressly examine learning and number of decisions, he did report “After eight quarters of play, 56% of CG’s [complex games] players still felt they could have learned more from the experience, while in SG’s [simple games], approximately 90% of the players felt that their learning stopped.” When one considers the myriad of potential learning outcomes and objectives that can be accomplished using simulations, it seems unlikely that the full scope of the length of competition debate can be resolved. However, the current study sought to consider the debate from the narrower perspective of the performance outcomes of marketing simulation competitions to determine when final simulation performance outcomes were decided. The reason this consideration is important is that it can be argued that the motivation of students to compete will be affected by their performance outcomes and expectations and when they perceive the point at which the competition is decided, students will no longer be motivated to compete.

STUDY BACKGROUND AND PURPOSE

Taking a slightly different approach than past research, the current study will develop and examine a series of performance ranking curves to determine if there is a common inflexion point at which simulation competitions are decided (or won) and hence performance ranking has reached its maximum for the majority of students. Past research on performance curves in simulation games has not been common. For example, a very small sample (ten firms and 24 students) with limited examination of the “learning curve” for business simulations was undertaken by Newgren, Stair and Kuehn (1980) who reported that decision time decreased amongst simulation players as the simulation progressed. Newgren, Stair and Kuehn (1980, p. 203) characterized the learning curve as “When a given task or decision making process is repeated a number of times, it usually takes less time to complete the task or to make the appropriate decision. Such behavior is called the learning curve effect.”

In relation to this definition, the authors have undertaken a couple of studies where self reported beginning and ending decision times have been measured. For example, Wellington and Faria (1995) used the *Marketing Management Simulation* in a study on consistency of performance in a simulation over two separate competitions where participants played through a six decision competition and then stopped. The participants then played the same simulation again starting from the beginning and were given an opportunity to improve their performance. Top performing participants reported taking 152.55 minutes to make their first decision and then 95.24 minutes to make the last decision of the first competition and 76.20 minutes to make the last decision of the second competition. Low performing participants reported that they took 125.17 minutes to make their first decision and then 52.53 minutes to make the last decision of the first competition and 50.00 minutes to make the last decision of the second competition.

In a study using the *Merlin Marketing Simulation*, Wellington, Hutchinson and Faria (2010) report beginning decision time of top performing students on average being 89.01 minutes while ending decision time was reported to be 52.21 minutes. In contrast, the beginning decision time of lower performing students was 99.88 minutes to start

TABLE 1
SIMULATION COMPANIES BY SIMULATION GAME AND CLASS LEVEL

Game	Intro Marketing Students	Marketing Decisions and Applications Students	Strategic Marketing Management Students	Total
Marketing Management Simulation	234			234
Merlin	978			978
COMPETE		447	27	474
Stratsim			40	40
Total	1212	447	67	1726

and averaged 45.69 minutes at the end. The differences between beginning and ending decision times in both studies were statistically significant. The decision times of the top performing teams are particularly relevant because it can be argued that as a simulation competition moves on, the poor performers might simply spend less time because their position is decided and they have given up. However, top performers are under pressure to maintain their position and would be motivated to put in the necessary time to ensure that their decisions remain good enough to keep them on top. Regardless of performance, these studies indicate that participant decision times decrease significantly as simulation competitions move into later periods. As such, there may be common simulation learning curves for both high and low performers.

In contrast, Fedorowicz, Oz and Berger (1992) studied how quickly novice students could learn to use expert systems to make financial decisions. They provided the following description of the learning curve phenomenon: "A learning curve is a graphic illustration of changes in performance of repetitive tasks over a period of time. A learning curve is expressed by a mathematical equation that describes the relationship between practice and performance. Practice is often assessed in units of time or the number of times some output is produced; performance is usually measured as output units. Learning curves provide a concrete measure of the rate at which an individual or a group of individuals are learning a task" (Fedorowicz, Oz and Berger 1992, 802-803). These researchers reported that the learning curves of novice users reached the maximum decision quality level after three sessions and actually declined after the third session.

Business simulation competitions involve making a series of repetitive decisions over time to produce an objective outcome. Most simulations measure outcomes in terms of earnings and/or other performance measures. In this regard, the measure of a participant's performance is the outcome ranking of the participant. Based on this definition, the work of Patz (1999; 2000) who reports on dominance studies in total enterprise simulations can be considered a form of performance curve analysis. Patz (1999) defines dominance as the notion that winning simulation teams establish and maintain an early lead in simulation competitions. According to Patz (2000), the ending outcome for high, medium and low performing teams is established anywhere from the first to sixth decision period in eight period competitions. His study was based on ten industries variously composed of 7 to 10 teams. Bernard and de Souza (2009) replicated Patz's work on dominance using a much larger sample of 495 simulation competitions involving 3,953 simulation companies. Bernard and de Souza (2009) defined dominance as a firm having led the competition for more than 50% of the decision periods. They reported that the phenomenon of dominance was confirmed by their research and "that in all analyzed competitions, the winner companies have significantly led more than 50% of rounds" (Bernard and de Souza, 2009, p. 289).

The current study seeks to measure a performance ranking curve for marketing simulation games and provide a methodology for doing the same for other business simulation games. The purpose of the study is to attempt to measure the performance ranking curve for all game participants and not just the dominant teams. The benefit of

TABLE 2
CORRELATION OF FINAL RANK WITH DECISION PERIOD RANKS BY GAME AND NUMBER OF DECISIONS

Final Rank	D1 (n)	D2 (n)	D3 (n)	D4 (n)	D5 (n)	D6 (n)	D7 (n)	D8 (n)	D9 (n)	D10 (n)	D11 (n)	D12 (n)
All Games	.391* (1726)	.571* (1726)	.602* (1726)	.675* (1726)	.772* (1726)	.795* (1726)	.840* (1716)					
Marketing Management Simulation	.522* (274)	.656* (274)	.755* (274)	.829* (274)	.858* (274)	.937* (274)	.969* (274)					
Merlin	.354* (978)	.592* (978)	.558* (978)	.637* (978)	.790* (978)	.820* (978)	.850* (978)	.912* (971)				
COMPETE- All students	.266* (474)	.313* (474)	.529* (474)	.592* (474)	.549* (474)	.522* (474)	.640* (474)	.543* (474)	.563* (474)	.505* (474)	.543* (405)	.650* (380)
COMPETE- Decisions Students	.265* (447)	.317* (447)	.527* (447)	.585* (447)	.559* (447)	.517* (447)	.637* (447)	.531* (447)	.549* (447)	.511* (447)	.516* (378)	.634* (353)
COMPETE- Strategic Marketing Students	.293 (27)	.250 (27)	.571** (27)	.700* (27)	.357 (27)	.598** (27)	.700* (27)	.743* (27)	.804* (27)	.400** (27)	.936* (27)	.871* (27)
Stratsim Marketing	.300 (40)	.413** (40)	.737* (40)	.875* (40)	.938* (40)	.813* (40)	.883* (30)	.962** (5)				

* Significant at .000
** Signficant at .05

this methodology is that it will allow business simulation users to better evaluate how long to run their simulation competitions if performance ranking is being measured.

METHODOLOGY

The current study followed a post-test quasi-experimental design. The subjects for the research were 1726 simulation teams composed of undergraduate students who played four different marketing simulation games including: *The Marketing Management Simulation* (Faria and Dickinson, 1995), *Merlin: A Marketing Simulation* (Anderson, Beveridge, Lawton and Scott, 2004), *COMPETE* (Faria, Nulsen and Roussos, 1994) and *StratsimMarketing* (Kinnear and Deighan, 2009) which were used in multiple classes over a span of 15 years by three separate instructors. The *Marketing Management* and *Merlin* simulation games would best be classified as being of medium complexity and they were used in an introductory marketing class taken by a broad cross section of business and non-business students. The *COMPETE* simulation game was used in a second year marketing decisions and applications class with a broader mix of students including second year business students and also in a fourth year strategic marketing management class. The *StratsimMarketing* simulation game was used in a fourth year strategic marketing management class (see Table 1).

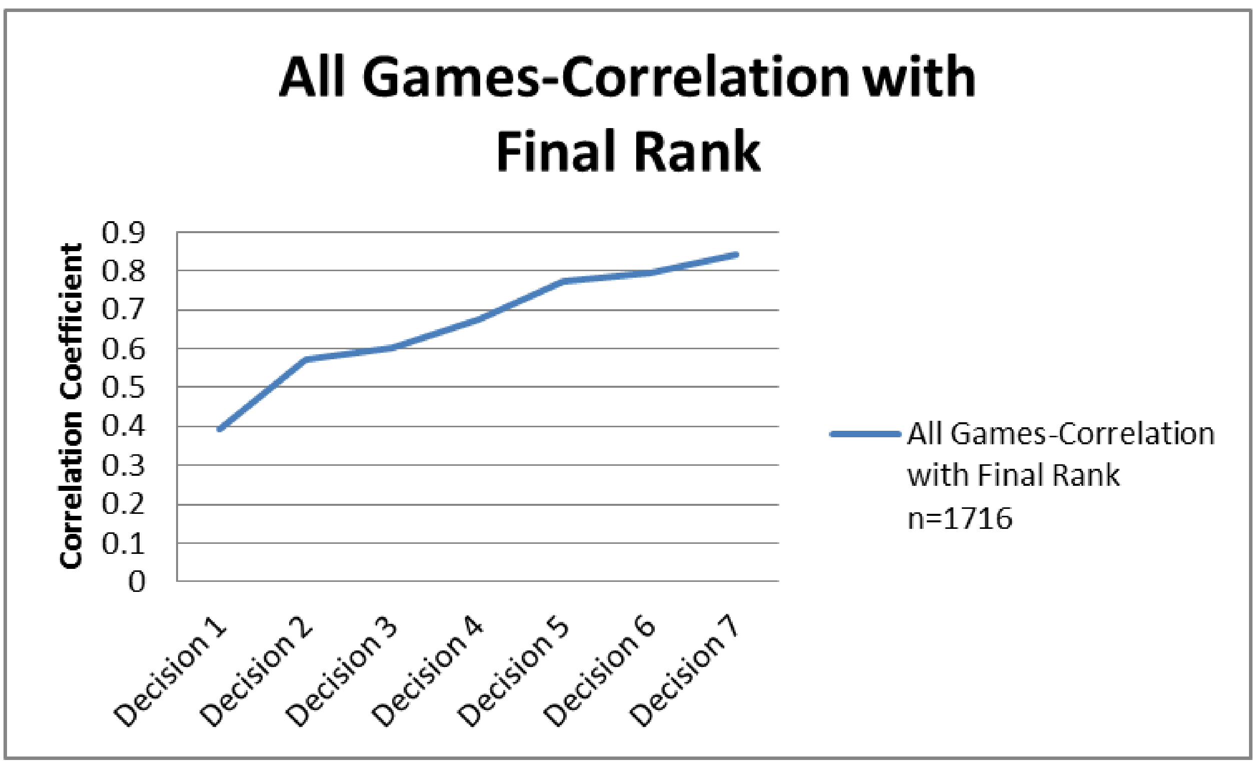
The data gathered for all simulation teams across all of the simulations and classes consisted of their decision period earnings rank position in each decision period of the simulation game and the final cumulative game ending earnings performance rank the team achieved. The data analysis was very simple. The final game ending rank of each team was correlated with the decision period earnings ranks of each team for each decision period throughout the various competitions. The resultant correlation coefficients were then recorded in table format (see Table 2) and then plotted on graph to create a performance ranking curve in order to view the decision point at which the correlation between final performance rank and decision period performance rank tended to flatten out and thus demonstrate the inflexion point. The inflexion point would show the decision period at which most of the performance outcomes and expectations associated with simulation game would have been achieved.

FINDINGS

The correlations between final cumulative ending ranking and period by period rankings for all teams in all of the simulation games combined and for each of the simulation games alone are reported on in Table 2 and plotted in Figures 1 through 7 to provide a graphic representation of the findings.

The results shown in Table 2 indicate that with the exception of the first period of the *Stratsim* game, all of the correlations between the period rankings and the final cumulative ending ranking are significant at the .01 level and the vast majority are significant at the .000 level. The findings presented in Table 2 also show that, as might be

Figure 1
Graph of Correlation of Quarterly Rank Performance With Final Rank Performance For All Games



expected, the correlation between ending rank order performance and period by period rank order performance increases as the games progress. However, the change in the strength of the correlations flattens out or reaches its inflexion point by the fifth period for the graph showing results for all games combined (Figure 1) indicating that for the majority of simulation teams their finishing position is determined by this point in the competition.

The graphical representations in Figures 2 through 7 show that for the individual simulations, the correlation between ending rank and period when the correlations tended to flatten out is either the fourth period (Figures 2, 4 and 6) or the fifth period (Figures 3 and 7). The simpler games (*Merlin* and the *Marketing Management Simulation*) exhibited ranking performance curves that continued to grow in correlation as the competitions proceeded towards the end. These results could be due to the fact that these simulations were used in the Introductory Marketing course where students had the lowest beginning knowledge of marketing. Interestingly, consistent with Wolfe's (1978) findings, the more complex simulation games (*COMPETE* and *StratsimMarketing*) exhibited curves that seemed to dip and then begin to grow again after the middle competition periods. This might indicate that after some initial learning in the complex simulations were levelling off, there was an "aha" point where the participants grasped the strategy implications of what they were doing and performance began to grow again.

While these findings are interesting, they represent a first try at measuring the plateauing of performance outcomes and expectations in relation to performance ranking and suffer from a number of limitations. Firstly, the simulation competitions involved students at different levels of marketing knowledge. The data was drawn from a wide range of student cohorts over a number of years of instruction. The innate abilities of these different groups of students could well be different. Secondly, the simulation competitions went various lengths depending on the simulation and course ranging from six to twelve decision periods. This would clearly influence the decision strategies of game players and could well have biased the findings. Finally, and most importantly, while an attempt was made to measure performance outcome growth in the simulation competition, in fact, only ranking performance correlations from period-to-period were measured. While these correlations may have stopped growing at a certain point in the competition that only means that the final rankings in the competitions were falling into place. It does not mean that learning has stopped. In fact, all participants/teams could still be learning, their ranking position just isn't changing. This issue needs to be addressed in much greater detail through further research. As such, the interpretation of the findings from this study should be viewed in light of these cautions.

DISCUSSION AND CONCLUSIONS

The research reported here sought to determine when the performance ranking curves of marketing simulation participants flattened out. The study involved four different

Figure 2
Graph of Correlation of Quarterly Rank Performance With Final Rank Performance For Marketing Management Simulation Game

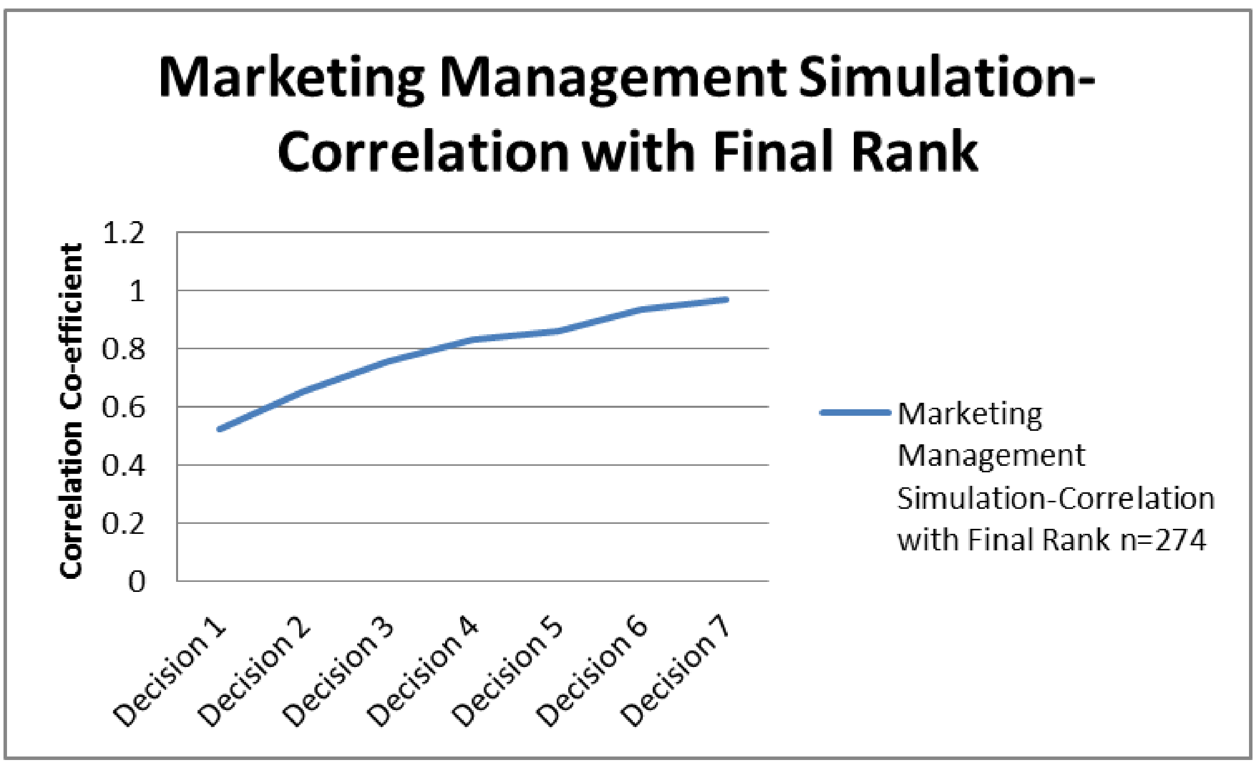


Figure 3
Graph of Correlation of Quarterly Rank Performance With Final Rank Performance For Merlin Game

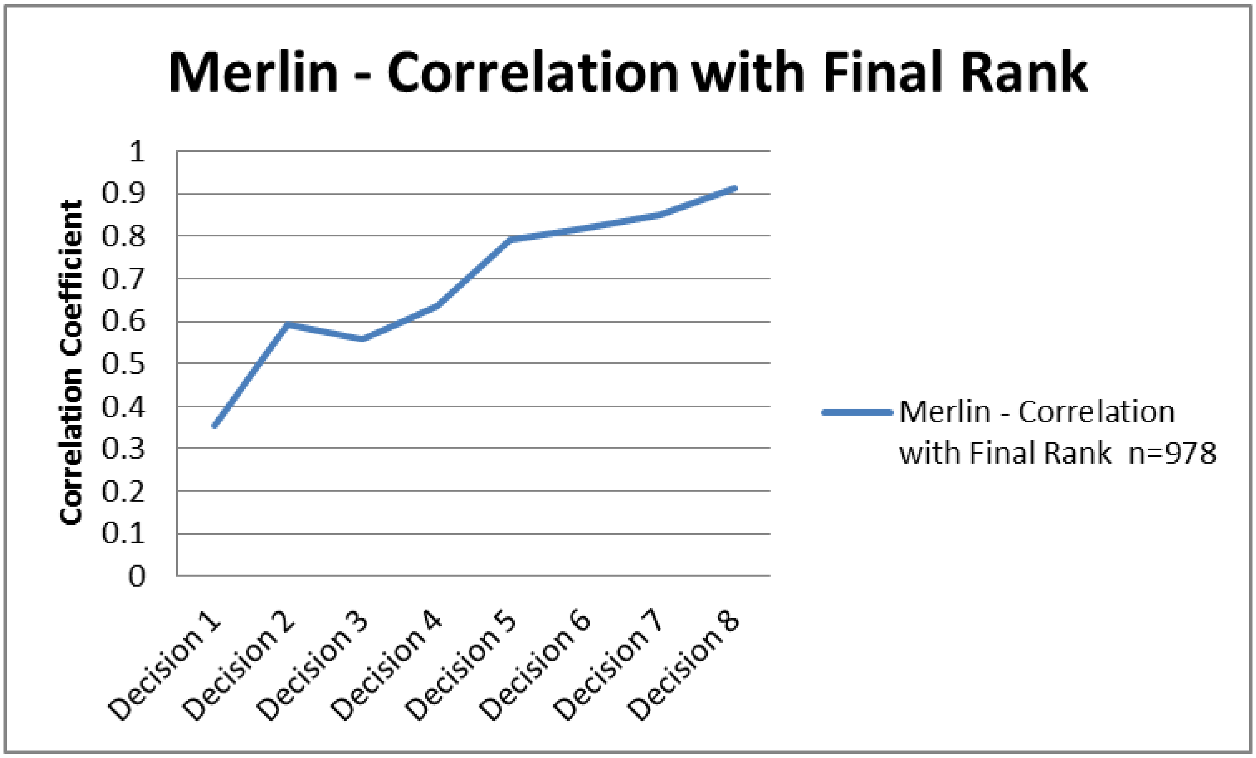


Figure 4
Graph of Correlation of Quarterly Rank Performance With Final Rank Performance For *COMPETE* Game

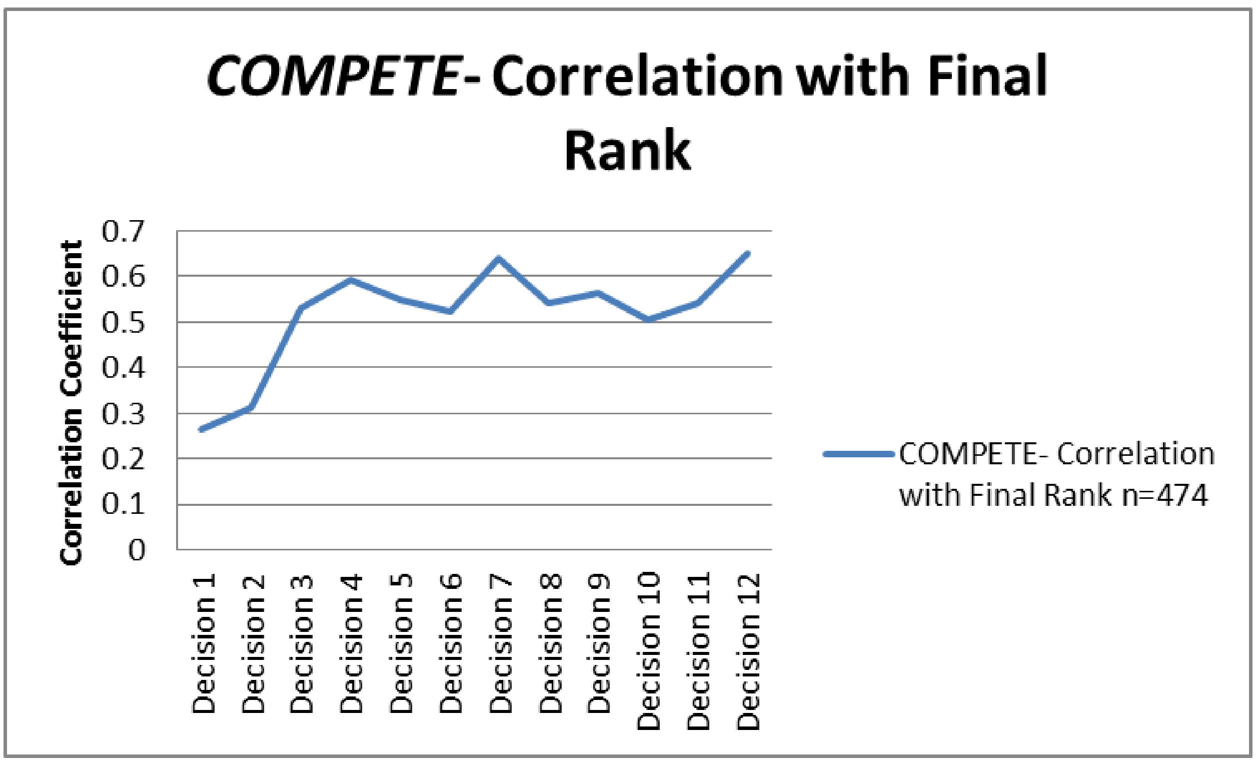


Figure 5
Graph of Correlation of Quarterly Rank Performance With
Final Rank Performance For *COMPETE* Game and Marketing Decision Students

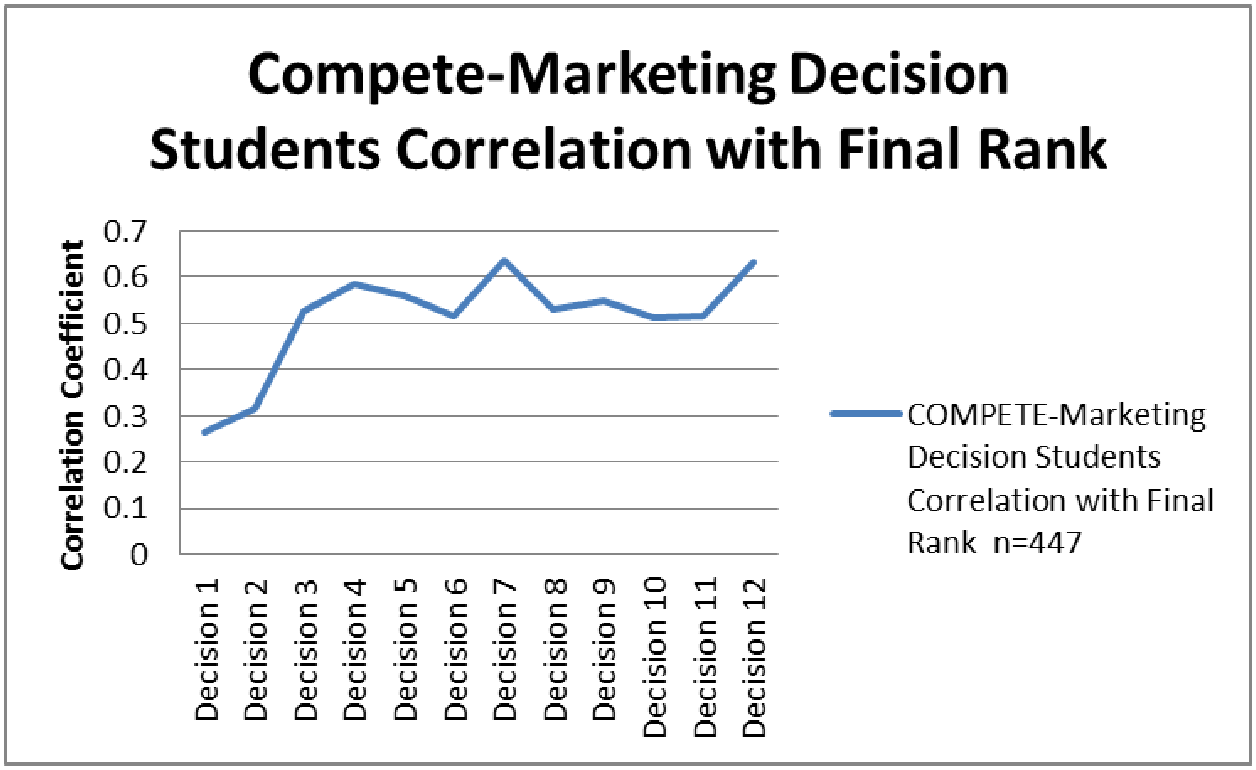
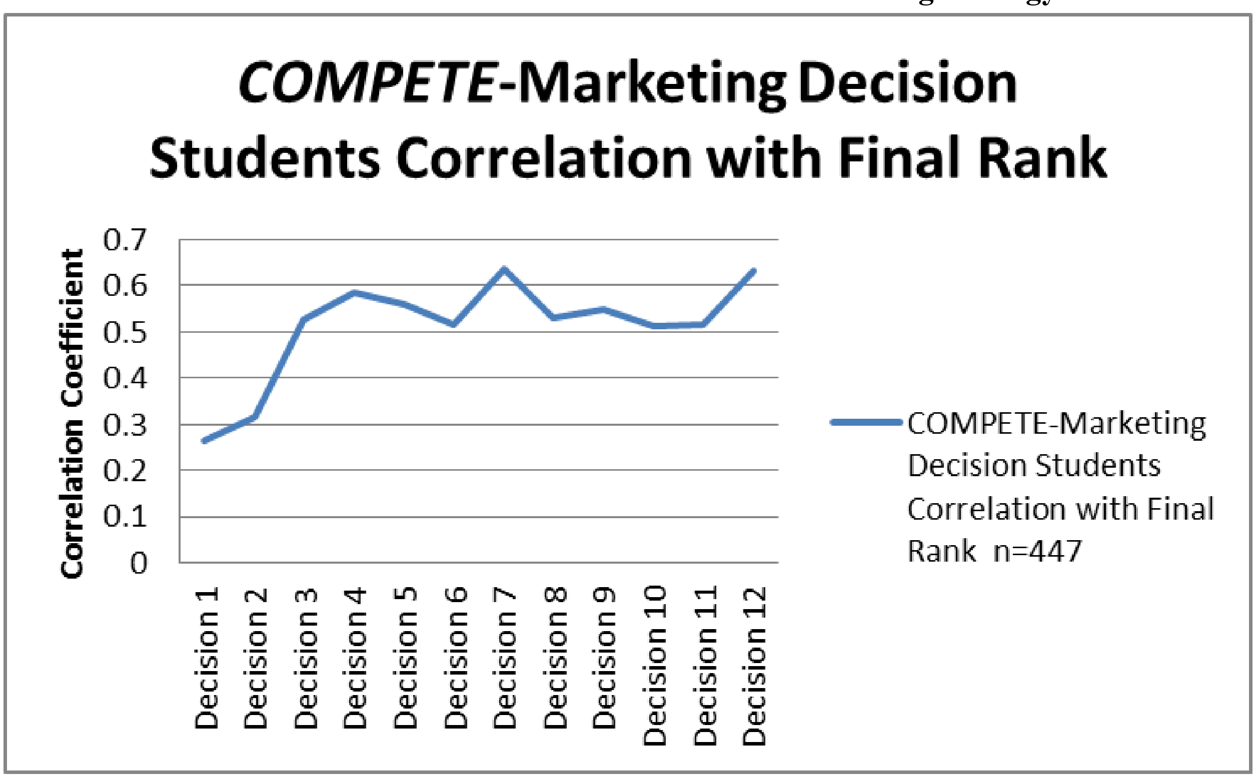


Figure 6
Graph of Correlation of Quarterly Rank Performance With
Final Rank Performance For *COMPETE* Game and Marketing Strategy Students

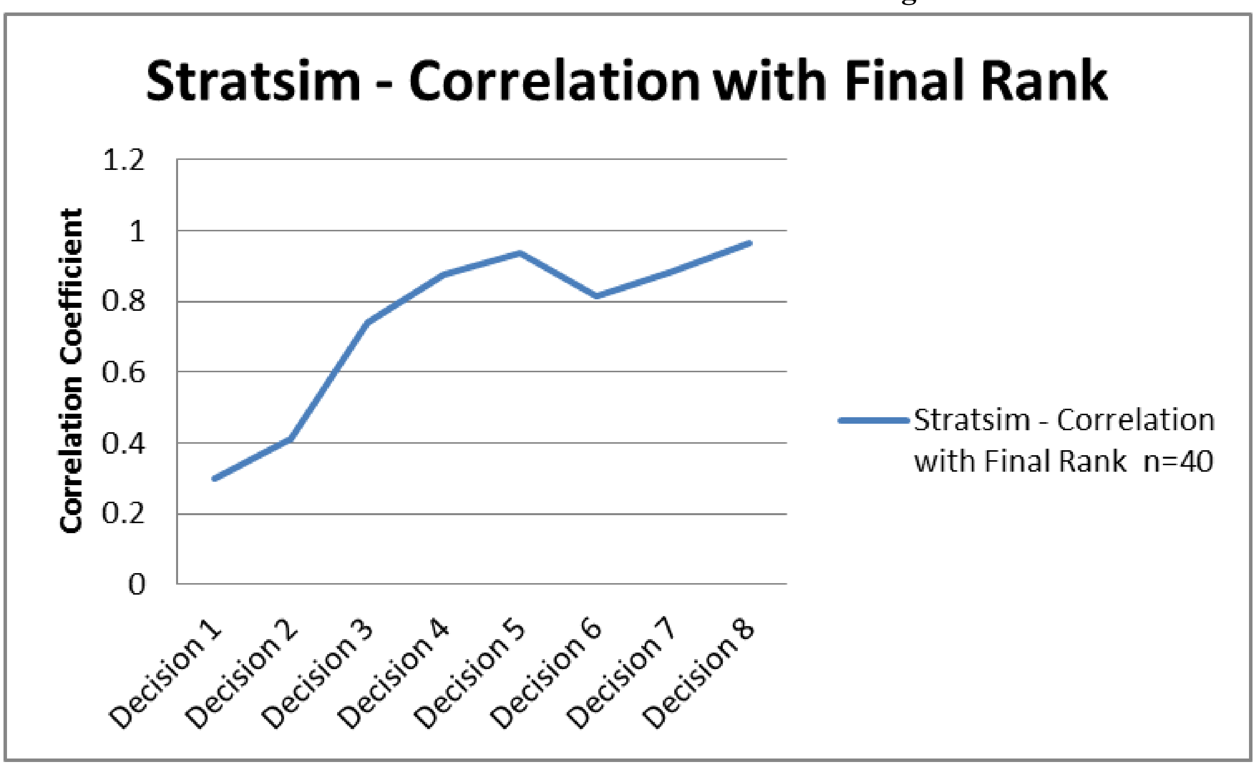


marketing simulation games of varying complexity and varying lengths of competition utilized in different marketing courses. In addition, the student teams varied in marketing knowledge and maturity ranging from a general population of business students taking an introductory marketing class, students taking a second year marketing decisions and applications class, and fourth year students taking a strategic marketing management class. Despite these differences, across the varying simulation games, varying lengths of competitions and varying student groups, the findings were remarkably consistent: the ending participant company game ranking was largely determined by the fifth period of the competition.

The implication of this finding is that when an instructor employs a simulation for which the main performance objective is competitive performance/ranking outcome, this outcome may be largely determined by the fifth decision period. In these simulation competition instances, a shorter simulation competition of up to six periods is probably best to use. It can certainly be argued that when instructors use business simulation games as vehicles to encourage students to implement strategic planning and learn to effectively utilize management decision tools, longer decision timeframes may be required. However, the effectiveness of the planning and management tools may not be demonstrable to the students unless it can be related to performance outcome in the simulation games. Although the basic conclusions of this study would seem to support the position taken by Patz (1999; 2000), Teach and Patel (2007) and Teach and Murff (2008) that short simulation competitions are a better use of participant time than longer competitions, the authors do not fully concur. The performance outcome curves of the more complex games, while flattening or exhibiting declines around the fourth or fifth period, then showed a new growth after period five. This indicates continual learning gains with the more complex simulations and could justify longer gaming periods for these simulations.

One possible explanation for the performance ranking curve growth being relatively short (4 to 5 decision periods) may simply be due to a combination of fatigue or boredom amongst good game players and loss of interest amongst poor performers. The simulation tasks become repetitive over time and could bore the game players unless some new elements are introduced to regain their interest. In the case of poor performers, they may see their ending position as inevitable. They lose motivation because they cannot seem to improve on their performance. In this instance, their level of learning is likely to remain fixed and certainly would not be enhanced by further game play. This conclusion is supported by the research on attitudes towards the simulation game experience that has shown that performance affects game attitudes with good performers developing more positive attitudes towards the simulation experience from start to finish while poor performers develop more negative attitudes towards the experience from start to finish (Wellington, Hutchinson and Faria 2009; Wellington, Hutchinson and Faria 2010; and Wellington, Hutchinson and Faria 2012). Likewise, good performers may tend to go on cruise control as they see that

Figure 7
Graph of Correlation of Quarterly Rank Performance With Final Rank Performance For StratsimMarketing Game



their competitors are not aggressively challenging them and they just have only to keep doing what they have been doing to win. For these reasons, shorter simulation competitions, especially when using simple games, would seem to make a lot of sense. Perhaps running a variety of simulations might enhance learning as recommended by Teach and Murff (2008).

However, if one is using a simulation to demonstrate pedagogy and to have student's develop and implement strategic planning principles and initiatives, then longer simulations would be justified. It seems clear that these longer simulations should be of the complex variety where there is a potential for a shifting of rank positions to keep participants interested in the competition. As well, student/ participant grades should not be based solely on final rank standings in the competition. To do so may discourage ongoing participant efforts toward the end of the competition if participants feel that their final ranking positions are set and may be too difficult to change. As well, assignments tied to learning in the simulation might be used (such as forecasts of performance, budgeting assignments, etc.) to allow students to demonstrate ongoing simulation learning. The findings reported from this study indicate that simpler simulations may not be robust enough in terms of their performance based outcomes to maintain the focus of students because the "performance outcome" is seemingly determined and stable by the fourth or fifth game period.

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