THE GAME WITHIN THE SIMULATION GAME THE RESEARCH METHOD CONCEPT AND PROJECT WITH GAME DESIGN IMPLEMENTATION

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ABSTRACT

The following paper discusses the idea of a double-game structure within one course. The first game is a classic top management business simulation game played in teams, while the second game is an investment game played on an individual basis. The investment game will be based on the industry data drawn from the first game and will be graded based on the average industry return ratio. This course structure should help students remain more motivated and focused than a business simulation alone and satisfies their desire to be graded based on both participation within a team and on individual performance. In order to analyze the effects of such an idea, an experiment is designed to compare groups of master's degree-level students with business simulation alone with those using the simulation with the investment game incorporated. The experiment will be focused both on the game results and students' motivation. In order to design a new game based on investment decisions, a pilot study was conducted. This paper presents an analysis of the gathered data and conclusions regarding the creation of the main experiment based on the investment game.

INTRODUCTION

Students' motivation for business simulation game classes is a pertinent issue that arises in a great deal of research (e.g., Yakonich, Cannon & Ternan 1997, Burns & Gentry 1996, 1998). With regard to the author`s recent research interests in grading systems versus the free-raider problem, one of the elements raised by students who participated in business simulation courses was the desire to be graded both on individual and team-based performance. On the other hand, business students encounter many games today within their educational process. When they play for the first time, the novelty and unfamiliarity feeds their interest; however, after the third or fourth time playing the game, students lose focus and motivation. Upon defining those two elements as a problem-based field of study, an idea arose to bring the game to the next level and build in a second game inside the classic business simulation game.

THE IDEA

The very basic question with which the author struggled was how to increase student motivation and engagement and implement individual assessment into a simulation game course structure. The first idea focused on the peer review system, but both research (Scherpereel 2009 and many others; this topic was widely discussed in many ABSEL papers) and practice did not provide clear evidence that it has a positive impact on the game, and based on the student response, they treated peer review as just another test or task. The author desired more to motivate the students than to burden them, so a gamification design (Selen & Zimmerman 2004, Koster 2005, Reeves & Read 2009, Cunnigham & Zichermann 2011) was born, and the basic idea of implementing game mechanics also into the individual assignment came to life for the first time.

This idea emerged from other smaller ideas that had already been presented, such as the ability to distribute points freely among team members in business simulation game courses, which is actually a form of social gaming (Sutton-Smith 2001). The other primary idea was a project related to a Polish stock exchange game, which didn't come into effect due to the high costs of designing the system and data input. Moreover, students in almost every course raised the question: "Can we buy our competition?" as a form of challenge and of course as a bit of mockery.

The idea that emerged from the aforementioned small ideas and readings was a second individual game that could be played alongside the business simulation game in the form of an investment game. In order to be motivating, it should be simple, incorporate performance-engagement reward, and be fun to play. The business simulation game gives data input and presents a basic level of interest/ engagement. The game is designed in such a way that any game that can produce share price and basic financial statements is suited to be the "mother" game.

The first learning objective of the investment game is not to teach students theory and practice of investing (although after we played the game, various investment strategies became present in students' behavior), but to motivating students to analyze financial statements, analyze competition, and identify their strategy more carefully. It also has the valor of encouraging potential engagement for free-riders, as students are graded individually in this game.

A second purpose of this game structure is to become an investment game that serves as a research engine in the form of gathering data on an individual level in a similar way as is presented by dynamic decision-making and human-computer interactions (Sternberg & Gonzalez et al.). We can encourage students' decisions on the individual and group levels. Furthermore, we will be able to cross analyze, draw conclusions, and measure impact on the performance of both students and teams by adding or excluding elements from the game structure.

GAME STRUCTURE, PROPOSAL, AND RULES

The double-game structure is designed for postgraduate students in principle, but it can also be implemented for undergraduate students. The business simulation course is graded on the basis of team performance, and the investment game is based on the individual scores of the participating students. The typical business simulation measures performance based on company value at the end of the game (40%), the analytical papers and strategy formulation paper (40%), and the final presentation of the team's performance with step-by-step strategy analysis (20%). The course takes between 20 to 30 hours to complete. Usually, after the initial enthusiasm fades, students experience a slowing trend in their motivation to continue through the game. Thus, a second game will be brought up, and initially all team-based performance grades will be responsible for 80% of the total score, while 20% will be based on the individual assessment within the investment game.

The "mother" game is very complex top management computer simulation in a very competitive market, and it creates a lot of data because its operating corporation has a full accounting/reporting module based on the U.S. GAAP accounting system. Additionally, the "mother" game is also placed in the dynamic environment present through a dynamic scenario (scenario played in this course was a standard scenario and was no different from that of other such courses).

The investment game was designed to be very simple. At the beginning of the course, every game participant will be granted with 100,000 virtual currency and will be free to buy shares of companies (including their own company) present in the game. Decisions to buy/sell/hold will be available to them at every decision round, and they will have to make choices before the decision round finishes. During the game, students will be free to allocate their portfolio of shares/money, and at the end of each round, the value of every student portfolio will be recalculated, and new accounts value will be printed for each student.

In the "mother" game, dividends can be paid by the board to the shareholders, ranging from 10% to 30% of the net income; if this happens, dividend funds will be transferred to the personal accounts accordingly to the number of shares possessed. Students' investment decisions have no impact on the share price in the "mother" game, as they are designed as a small investor principle (initial capitalization of the single company in the "mother" game is 50 million). Moreover, the number of shares within the whole game is constant, and students are not permitted to buy back the shares on the market (this option has been disabled in this game for purposes of simplicity, but in the future, it will be an element to be considered). The goal of the investment game will be to maximize the initial capital value, and it will be measured based on the average yield of the simulated industry plus 1%. This goal is dynamic and tangible at the same time. On one hand it forces students to take action, while on the other hand it is perceived as possible to reach. Grading results are very simple − if your portfolio value is above the threshold (the average yield of the simulated industry plus 1%), you receive 100% of available points. If not, you receive only 50% of points. There is no penalty for losing money or taking no action at all. The author agrees with the gamification principles (Koster 2005, Cunnigham & Zichermann 2011) that lack of reward and social pressure present motivation enough to maintain focus.

Names of students will be connected to accounts and will be kept confidential. However, account values will be visible to all participants during the game in the form of a ranking for comparison to the target, but they can be only identified by account number, which is known to the player only. Account numbers will be created by a random number generator and automatically assigned to each student.

THE EXPERIMENT

The new game design and its implementation in the course mechanics, social structure, and grading systems evoke many questions and unknowns; thus the author decided to test this idea on a small group of students in one course only. The main goal of this experiment is to test the game mechanics and observe students` behavior regarding the game. The second goal is to gather data on this mechanism and analyze it.

Following the experimental paradigm, there have been no hypotheses set for those studies. However, a number of research questions arose from the beginning of the project, including the following:

- Is the investment game engaging enough (interesting)?

- Is the investment game intuitive (easy to play)?

- Is the investment game's target criterion realistic, and how many players will achieve it?

- Will the investment game motivate students to analyze data more carefully?

- Will the investment game improve results in the business simulation?

The author, after obtaining university management approval, created an elective course in the advanced business strategic game, offered it to a group of master's level students in full- and part-time studies during the fall semester 2011/2012. The offer was extended to all majors except for strategic management, because this department has this course in its core program. Over the course of one month, a group of 28 students signed up for this course, and 26 students finished the course successfully (two resigned during the semester due to outside circumstances). The majority of this particular group of students was from management and entrepreneurship majors (around 60%), and the rest were from various finance majors. With regard to their grades, they have scored rather below average, with a few exceptions.

The course took place over four meetings on Sunday afternoons every 2-3 weeks during the fall semester. Both games were played as an in-class exercise. At the beginning of the class, the author explained percentages for

grading. Although the grading system was explained in detail together with the dynamic target function of the new investment game and basic rules of the game, the information about the experiment itself and reasons for this class were not communicated to the group, because the author wanted students to behave naturally, like in other business simulation courses. Secondly, the author has also omitted information regarding how to play the investment game. Afterwards, personal account numbers were assigned and distributed on small pieces of paper. The author also asked students about their experience in investing and revealed that none of them had real-life experience with investing on stock exchange or investment funds. The author has asked also the students to set their personal goals to determine if there are any differences in comparison to other groups.

Students were able to choose up to three from the catalogue of nine different goals; three students decided also to set some specific goals, such as "achieve better decision making," "understand key decisions in the company" and "win the investment game." Based on the majority of the responses, we can say that was rather typical setup. Understanding how business works, winning, having fun, and developing teamwork skills are almost always included in the top personal goals of this group of students.

The games began simultaneously after an introduction and introductory lecture about "mother" game mechanics. In the "mother" game, students divided themselves into five teams of four to six students, and at the beginning of each decision round, decision sheets for investment decisions were distributed together with other materials. Students were asked to hand them over before the decision round ends. During the whole class, nobody asked for additional explanation about decision making in the investment game.

The investment game was played amid this group with usage of Excel files in a similar matter to the way every account was calculated and kept on the university server. Students were making their investment decisions on paper through a standardized form. After every class, those Excel files were made available to them through the university system together with their companies' data and rankings.

Directly after the end of both games, students were asked to complete a short questionnaire, which concentrated on the subjective students` opinions about both games, strategies they played, sources of information, and grading system.
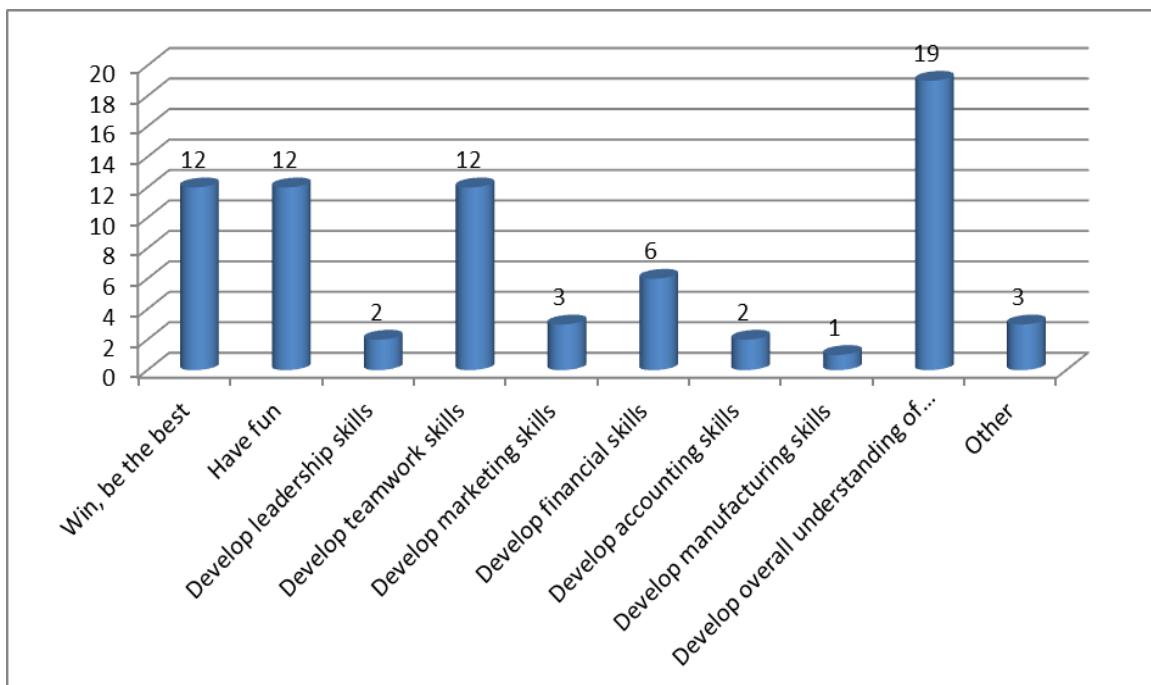
THE RESULTS

Both games were played successfully during the course, and for both games, five decision rounds were executed. The results analysis will be divided into two sections. First, the author will analyze the behavior and decision strategies of the students. Secondly, data for the both games will be analyzed.

Before we start to analyze student behavior, the author would like to quote an observed conversation among course participants in the cafeteria cue.

- *Student A looks at sheet of paper with investment accounts ranking and Student B initiates a conversation.*

GRAPH 1
STUDENTS' PERSONAL GOALS IN THE EXPERIMENT GROUP.

- Student B: How are you doing in the investment game? Are your results okay?
- *Student A is folding the ranking paper, hides it and answers*: I'm okay as long as my portfolio value is higher than yours.

This slightly anecdotal example illustrates two important behaviors that were very common among the experiment's participants. The first was unwillingness to discuss and share comments and remarks about the investment game. Although during decision rounds and coffee breaks, the subject number one was the strategic simulation game, which is quite typical to this course type, the subject of the investment game wasn't popular at all. Moreover, students that were making their investment decisions separated themselves from the group, even during lively discussions. They have been choosing also a moment to deliver the decision form with possible seclusion (none of very few other students around the tutor`s desk). The second behavior was a very competitive attitude against the portfolio value presented through the ranking. It was important to the students not only to surpass the target but also to achieve the highest possible position in the ranking. Additional behavior was observed in relation to the grading methodology; even if student did not play the investment

game at all, then he/she would still obtain 50% of the promised points. However, none of those present among the class participants chose to engage in this strategy.

In the questionnaire filled by students directly after both games were over, there were two important questions that were crucial to the formulated research questions. The first was which information was used to make investment decisions in the form of a menu of seven options plus one empty space for own items. Students could choose up to three elements. The second was an open question about the strategy they conducted in their investment game.

The top three answers are interesting, and the most popular ones related to the company's financial results and history of the company, which strongly supports the main concept and goals of this game. However, the results from the second score regarding intuition are a little disturbing and may be an element for further analysis. The author expected that team members' composition and decisions of one's own company would be much higher on the list. The reasons for this may be unwillingness to discuss the investment game decisions with others and the fact that the majority of the students in the class didn't know each other before participating in this class. Again, this is interesting topic for further study in separated groups that include friendships and those without them. In the other section, two students mentioned that their stock price dynamics

GRAPH 2
STUDENTS' SOURCES OF INFORMATION FOR MAKING DECISIONS IN THE INVESTMENT GAME.
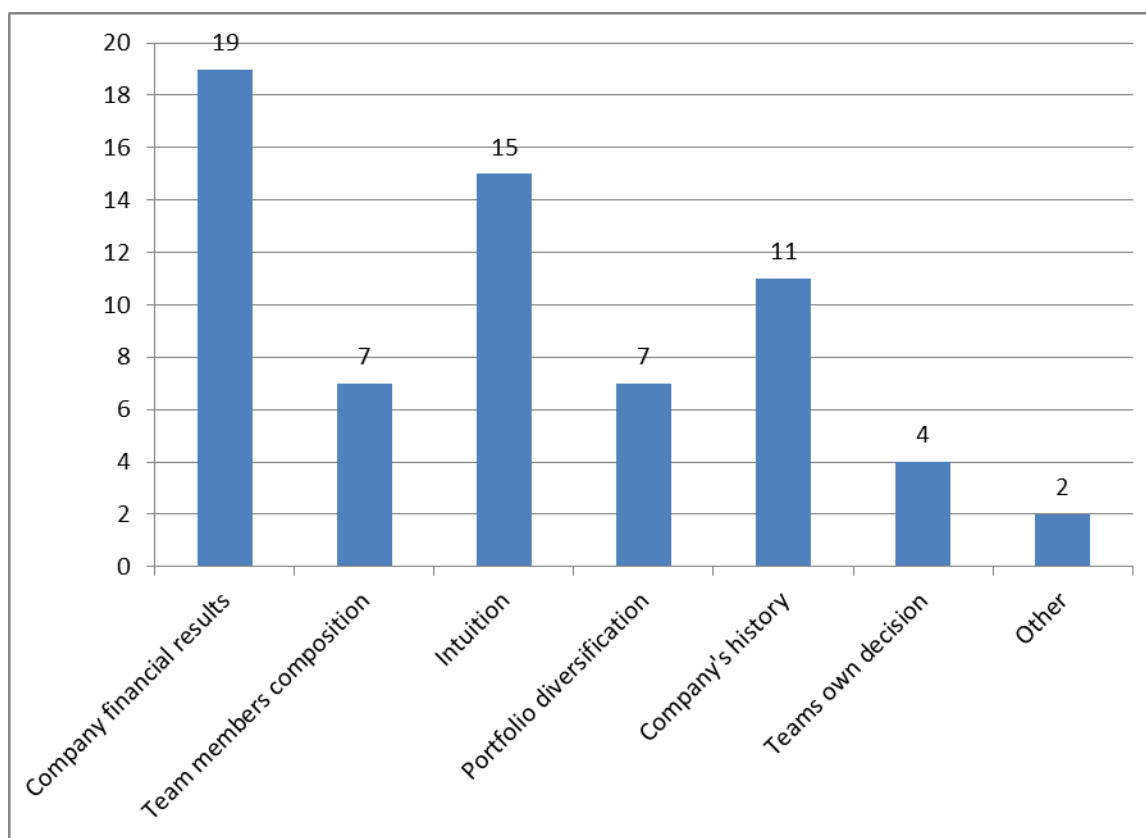
were also important aspects to them. The author will include this option in the future versions of the questionnaires.

In the open question about strategy, three strong trends can be observed. The first observed within several answers is strategy, which starts with speculative strategy and then transforms into security strategy in the end. All students finished the game with investment portfolio values, more or less above the average value of the portfolio. The second trend related to the number of people who in the end applied a purely speculative approach. They have been looking only at the financial results, perspective dividend, and share price growth potential. In this group, the final game results oscillated (with some exception) below the group average score. Few students chose a strategy of investing mainly in their own company and buying some shares from other companies that to their understanding offered the best growth potential. Those four students achieved the top scores in the ranking.

Quantitative data support the observation from the aggregated qualitative data. Students started mostly with very rational strategies of very high portfolio diversification, and afterwards most of them tried more or less speculative strategies and then returned to a more diversified strategy. There was no statistically significant correlation between both the number of companies in the portfolio (Pearsons 0,0949) and the number of transactions (Pearsons -0,016). The author is aware that it may be because of the small data sample and will be a subject for future quantitative analysis. Other data also supports above-mentioned observations.

Data presented on the above graph also supports observations mentioned before. In the beginning, a rational strategy of perfect distribution failed to give them an advantage, because target function was based on the average industry growth ration plus 1%, thus they saw the need for better strategy. In the second round, many of them strongly improved their results. This encouraged some of them to become more speculative regarding their actions, and for many of them this proved unsuccessful, and most of them moved back to the more secured and target meeting strategy.

Further data analysis concentrates on the game results and perception of the both games from the student's perspective. In the first question on the form, the author asked participants to stress their opinion about the clearness of the games, course rules and grading system, the importance of the second research question, and why the author didn't actually explain to participants how to play the investment game. Participants provided responses on a scale from 1 (unclear) to 7 (clear), and average score reached a value of 6,54 with a standard deviation of 0,58, which supports the conclusions that the investment game is easy enough and intuitive to play. Afterwards, the author asked students to give their opinions about both games in a way in which students could compare them. In this way,

GRAPH 3
AVERAGE NUMBER OF COMPANIES HELD BY PORTFOLIO
AND AVERAGE NUMBER OF INVESTMENT DECISIONS (BUY AND SELL)
in the round.
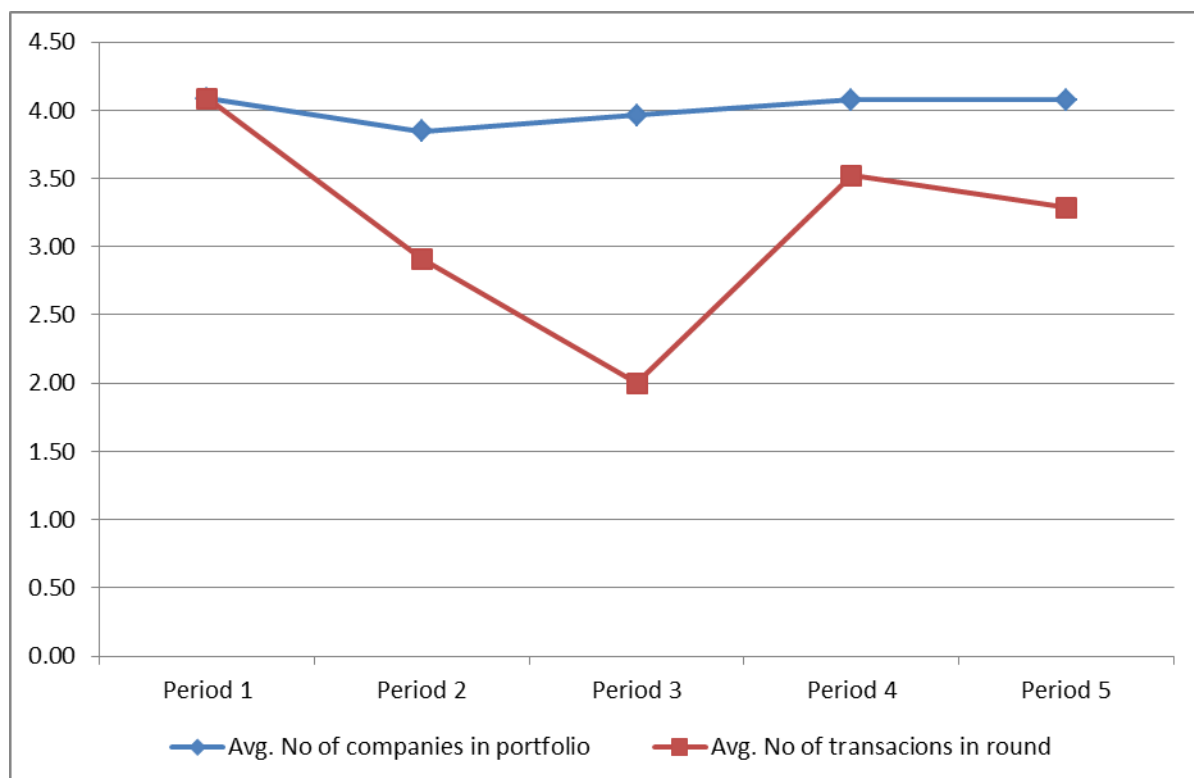
the author also created a benchmark for the investment game, which is the "mother" game. Game participants again scored both games on a scale from 1 (dislike it a lot) to 7 (like it a lot). The investment game reached an average resulting score of 6,42 with a standard deviation of 0,76, and strategic management simulation reached average result of 6,04 with a standard deviation of 1,02. Although this is not a strong difference, it is statistically significant. Dependent t-test for paired samples gave the result of p=0,048, which is on the border of acceptance. The conclusion is that students liked the investment game more than the strategic simulation game; a probable explanation for such results can be a feeling of novelty. On the other hand, the results of the strategic simulation game satisfaction survey are quite typical of other courses, and enjoyment oscillates close to result 6.

Author also asked game participants to judge the educational value of both games for them again in a way that they can compare both games. Game participants scored both games on a scale from 1 (lack of educational value) to 7 (very high educational value). The investment game reached an average result of 5,88 with a standard deviation of 0,82, and the strategic management simulation reached average result of 5,92 with a standard deviation of 1,08. This time the difference is very little and it is not statistically significant. A dependent t-test for paired samples gave the result of p=0,394. This is a little surprising for the author, who expected a clear advantage of the strategic management simulation game; another explanation of this data could be the fact that game participants had no experience with investing and thus the game had educational value for them. It is also worth mentioning that there was no statistically significant correlation between both games' results and their judgment, which suggests that they were truly speaking their mind.

The last question in the questionnaire regarded the level of participation in the investment game in the final grade. Students scored on a scale from 1 (very low) to 7 (very high), and the average score in this section was 4,71 with a standard deviation of 1,24 and variance of 1,54, which clearly shows that the majority of students do not have a clear opinion about it, but the standard deviation and variance of this question was causing the biggest differences in opinions. The author decided to try a slight increase in percentage value of the investment grade participation to 30% in overall grade and then to test it once again. There was no statistically significant correlation found between both games' results and students' opinion.

Finally, analysis of the overall results for both games is needed in order to address the final research question. Firstly, students' data for investment portfolio value have been analyzed.

In the presented data, the "Perfectly diversified portfolio" is an artificial portfolio created by the author, which consists of a perfect distribution of funds in all five companies and includes capital accumulation over time. This portfolio is set as a benchmark for comparison purposes. There are huge differences between the highest and the lowest results. Although average values lie below the benchmark portfolio, the difference was not significant. Moreover, five students reached very high values on their investment portfolio, and values they reached exceeded

GRAPH 4
**STUDENTS' DISTRIBUTION FROM THE TARGET MEETING PERSPECTIVE.**
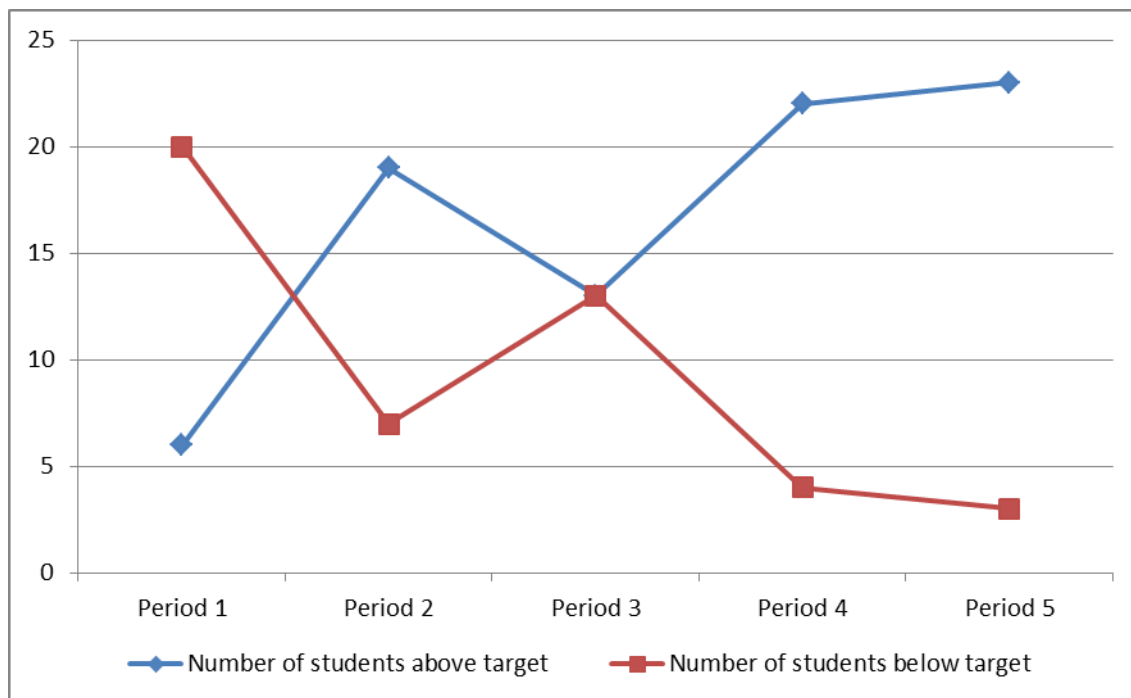
benchmark values by great amounts, which was very surprising.

Growth ratios of the investment portfolio were much higher than growth ratios in the played industry; this is probably caused by two aspects. First of all, the "mother" game scenario creates market and economy growth from periods 1 to 3; afterwards, a recession and market shrink occurs in order to challenge the game participants with economic crisis. Secondly, after the third period, students accumulated a substantial amount of capital, from which part was held in the form of cash. Starting from period 3 and beyond, students had to beat the target and started to invest more aggressively, and they had already enough information and experience to do it more effectively. Looking at the target function from an experience perspective, we can say that it was relatively easy to reach after all. Although the author's intention was the introduction of a system that creates incentive to play rather than making it very challenging, the level of aggressiveness of target function and the level of challenge should be a subject for further studies. Perhaps a more challenging target function will give students more motivation to play better.

The results in the strategic management game were quite good for this type of course. The results from the experimented game as compared to those of other games played by master's level students were not much different regarding students` behavior. However, the strategies they exercised in the game were very consistent and consequent and thus quite conservative. On average in such groups, one of the companies bankrupted due to misunderstanding/ misperception of the game mechanics or free-rider team member problem. In the experimented game, none of the teams bankrupted, although one team was constantly struggling with low results but was never threatened by bankruptcy. Graph 7 enables comparison of results from the experimented game with a benchmark group. The benchmark game was played by students from the strategic management specialization, which is considered to be the most prestigious and desirable by most of the management students and grade entry level is the highest from all specializations. However, there is no clear evidence between average grades and results in business simulation games (Pisarek & Pitura 2009). Both courses were delivered within the same semester with exactly the same scenario executed. The only difference was that, in the benchmark game, students have been graded based on the team result only, and they have been playing in seven teams of four to five students. The author does not perceive those differences as significant, because game values and

GRAPH 5
INVESTMENT PORTFOLIO VALUES IN THE EXPERIMENT GROUP.
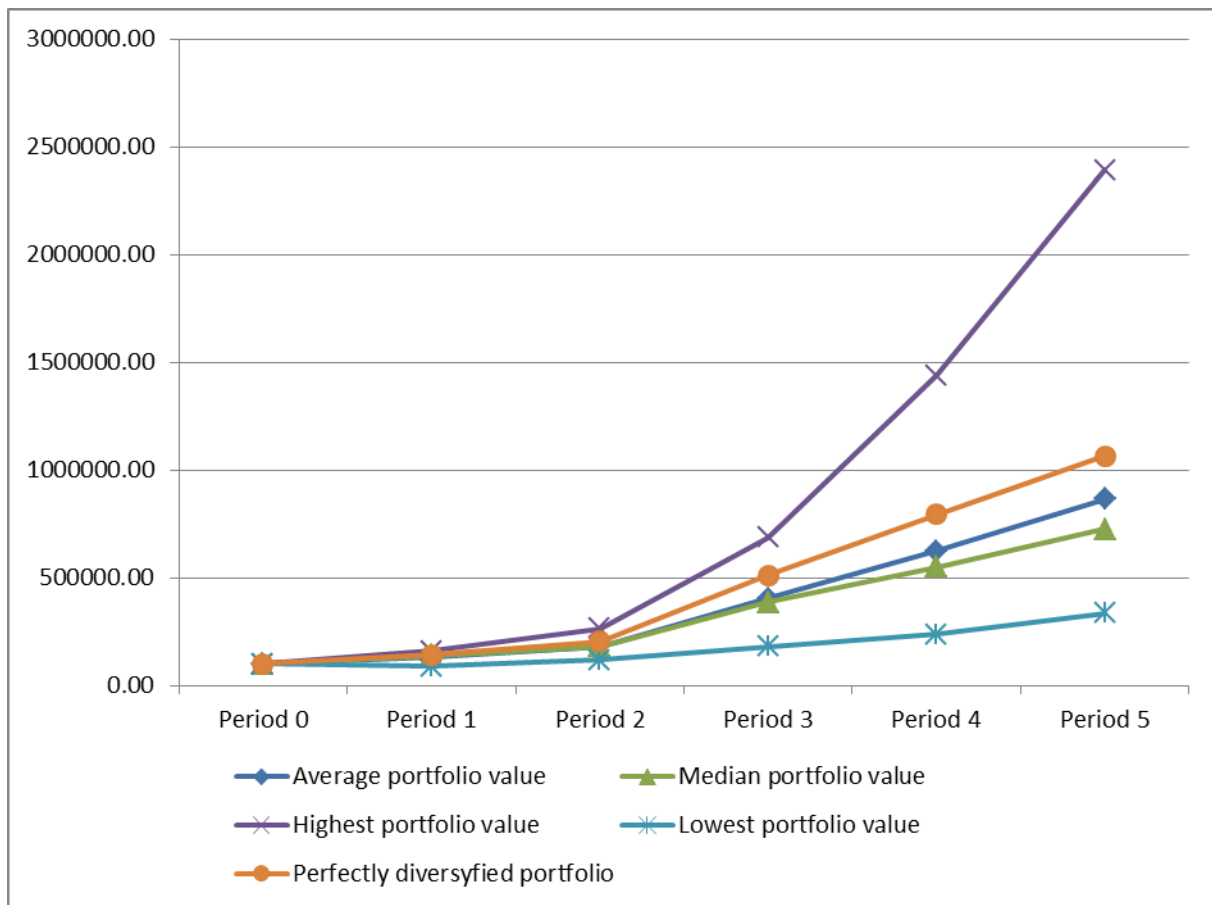
variables scale to the number of teams in the game. Furthermore, in previous studies there was no statistically significant relationship between number of teams in the game and overall results of the teams in this particular game (Gentry 1980,Wardaszko 2007). In benchmark class, one team bankrupted, and their results were not drastically different from the same course performed in previous years. Looking at the comparison of the data presented, we can say that the results related to the experimented game were much better than those of the benchmark game. The author is aware that it may be a coincidence and that further studies are required in order to confirm this result.

CONCLUSIONS

The discussion delivered above presents the whole process of creation, implementation, and testing of the idea of bringing a second game into the course of strategic business simulation. The experiment presented in the paper fully served its purpose and provided a very good test of playability and ability to collect data from game participants. The investment game is simple and intuitive to play and on the basic level provides enough fun enjoyment to engage students to play it. Although its influence on the "mother" game is still a subject for discussion, the first presented data gives enough power to continue this project with different settings, driven as conclusions from the detailed data. There are many unanswered questions, but this game can serve two purposes in the future. It can be provide incentive to students to play a business simulation games and can be an interesting research engine as a generic game in companion with any game that can
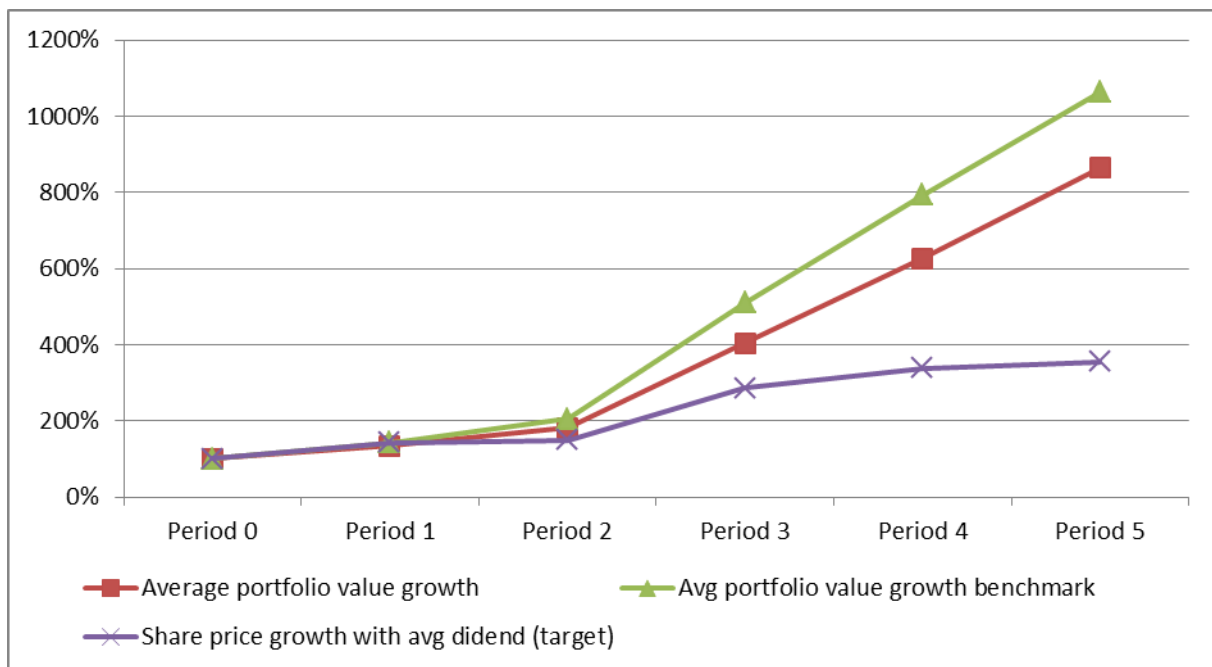
produce a share price and financial statements. This very simple experiment involving only 26 students produced an extensive amount of data. If we could create many of those games with different grading/data/actor settings, we could cross analyze those data for more detailed and statically significant results/conclusions and proofs.

Future investment games will be placed in the Internet so the labor-intensive excel calculations will be redundant. They will also automatically store all decisions, data, and actions of the participants playing them. After the migration to the Internet, such games can be offered not only to students in the business simulation courses but virtually almost to anyone, from participants in a contest or a promotion of the university. Its main advantage would be the ability to play with other live actors and more unpredictability in its core then a stock game based on the predetermined algorithms. Future options can also implement a feedback mechanism for the students playing "mother" games and the influence on the stock-exchange reactions on their performance. This would bring us one step closer to more realistic simulations.

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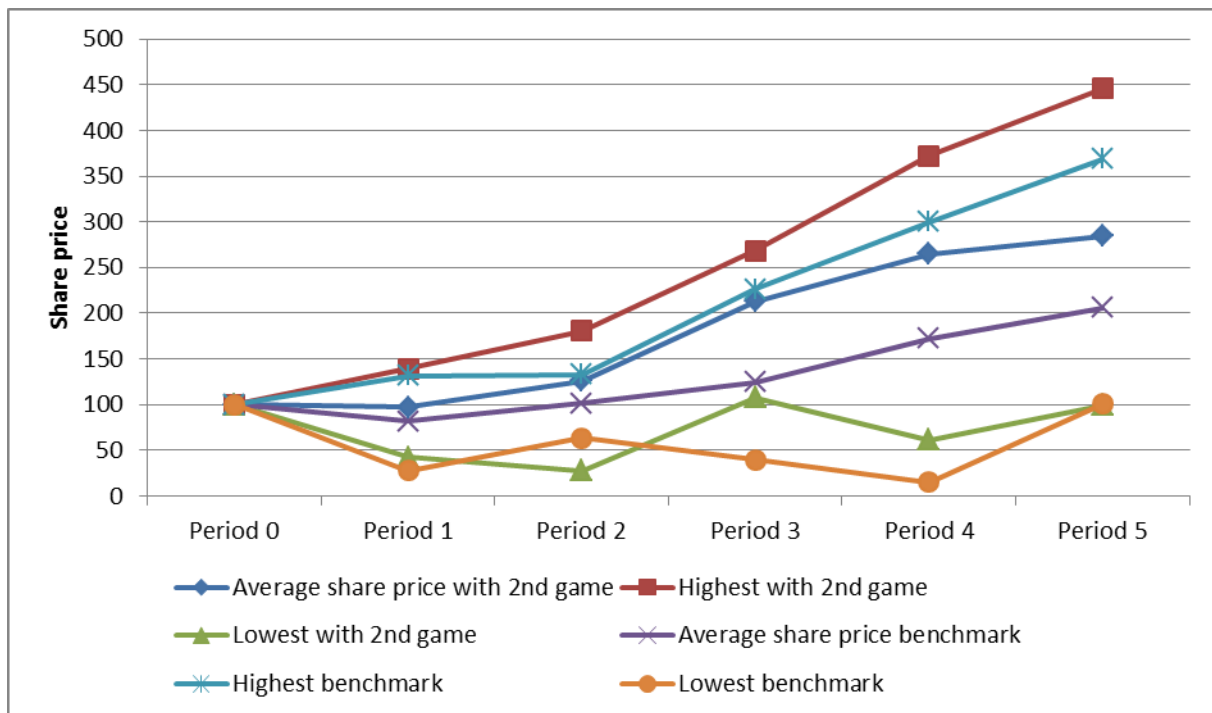
GRAPH 6
GROWTH RATIOS COMPARISON IN EXPERIMENT GAMES.

- ■ Average portfolio value growth
- ▲ Avg portfolio value growth benchmark
- ✕ Share price growth with avg didend (target)

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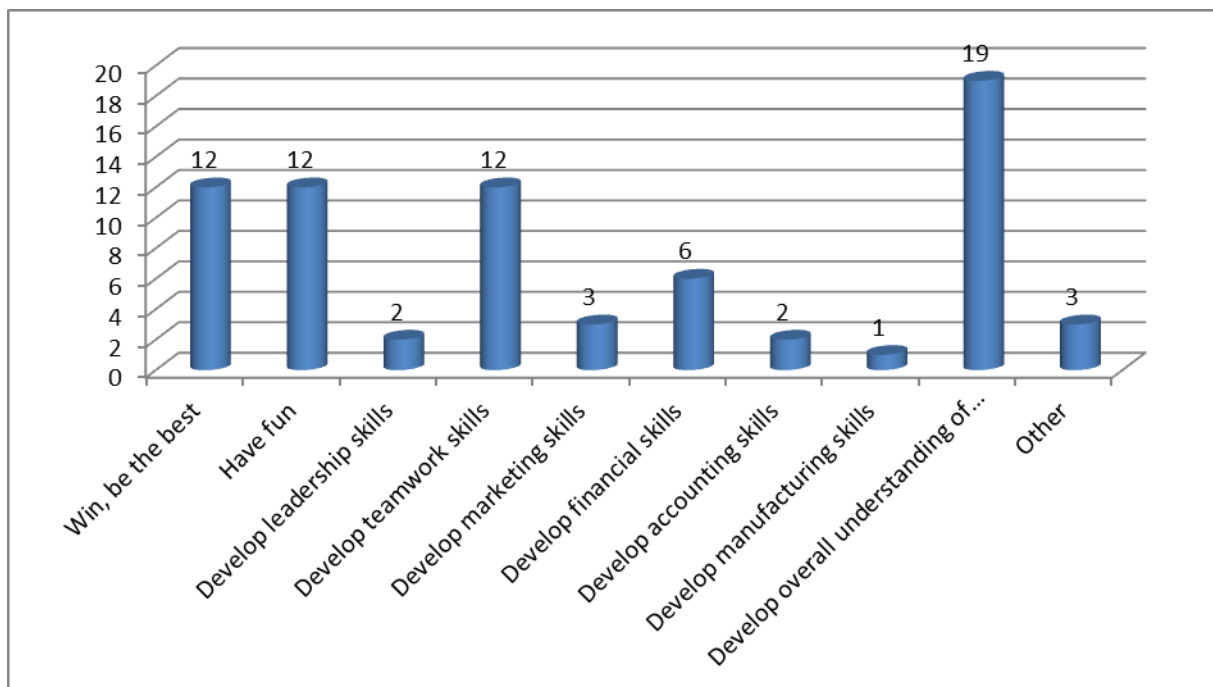
GRAPH 7
COMPARISON OF THE RESULTS OF THE STRATEGIC MANAGEMENT SIMULATION GAMES IN THE EXPERIMENT GROUP AND BENCHMARK GROUP.
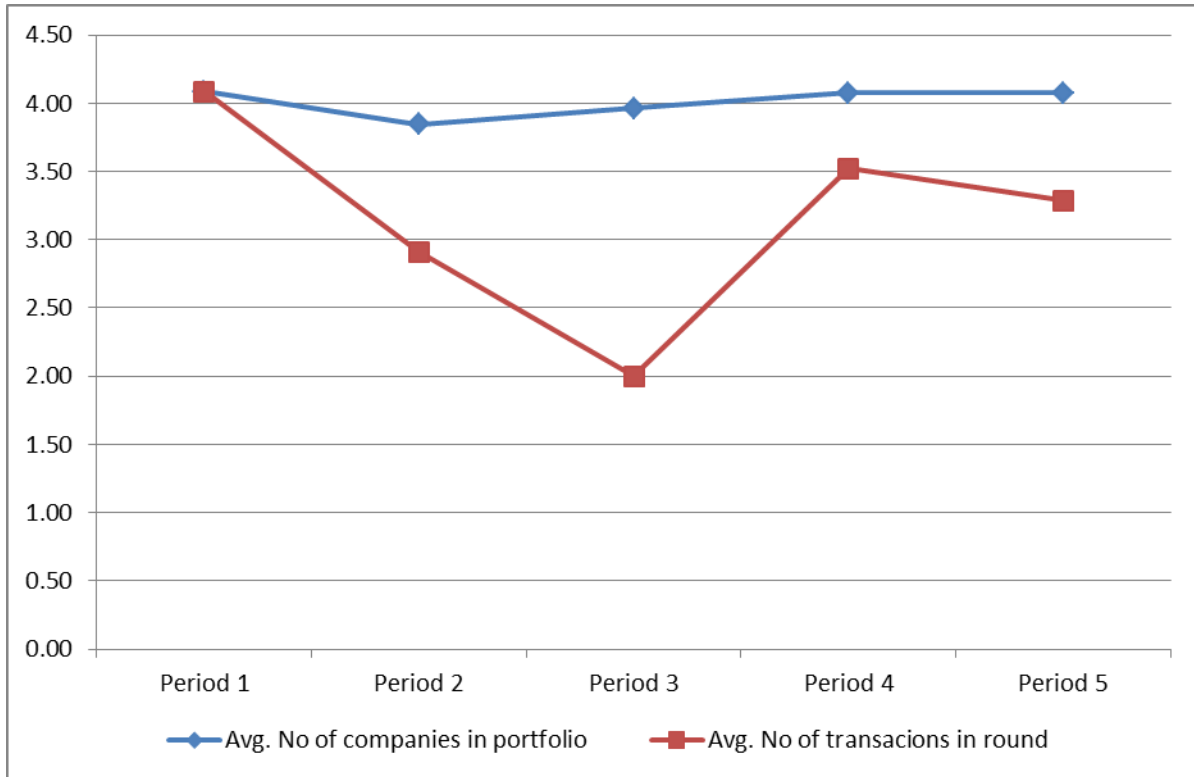
GRAPH 2
STUDENTS' SOURCES OF INFORMATION
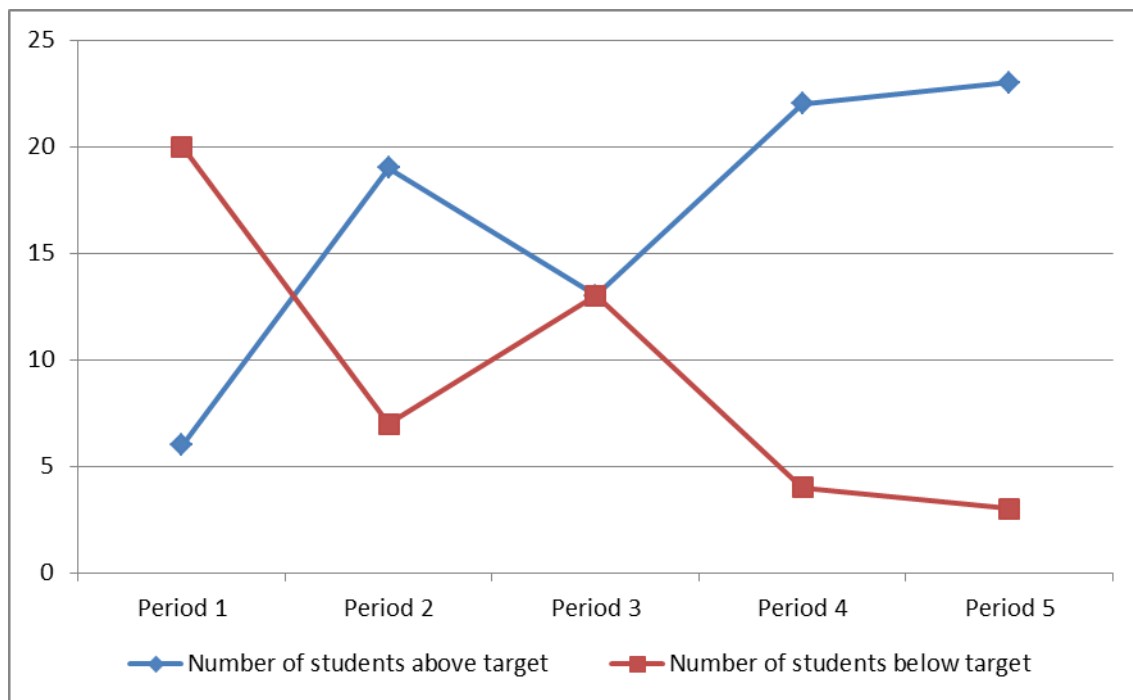**FOR MAKING DECISIONS IN THE INVESTMENT GAME.**
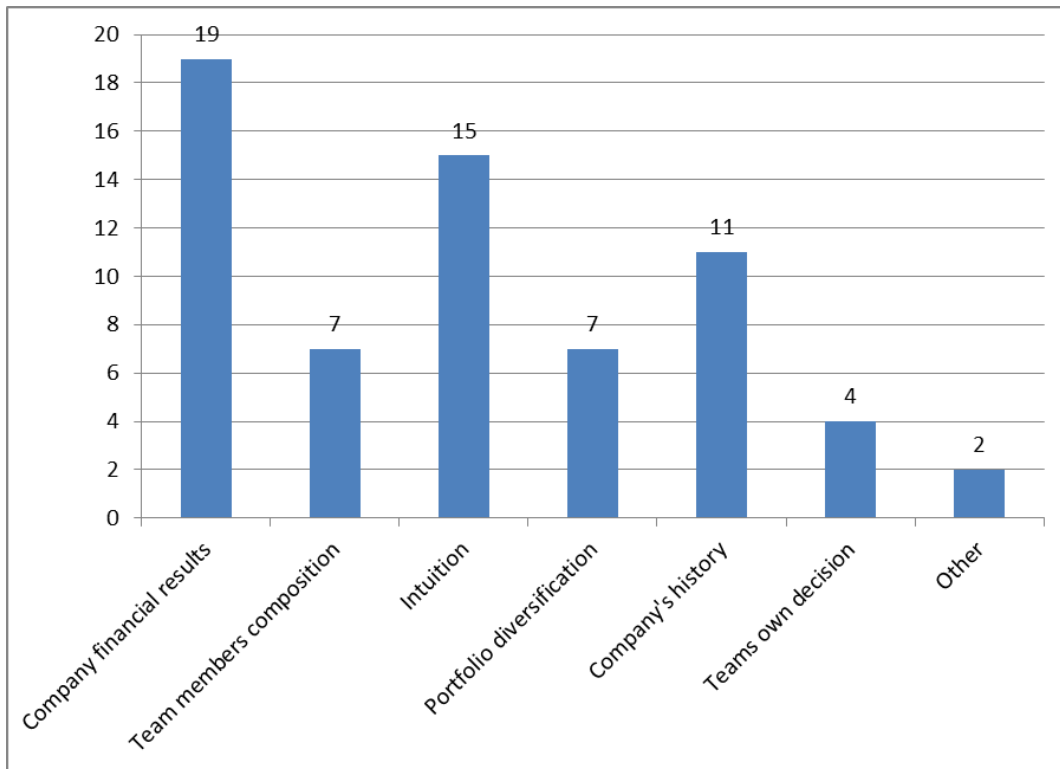
GRAPH 1
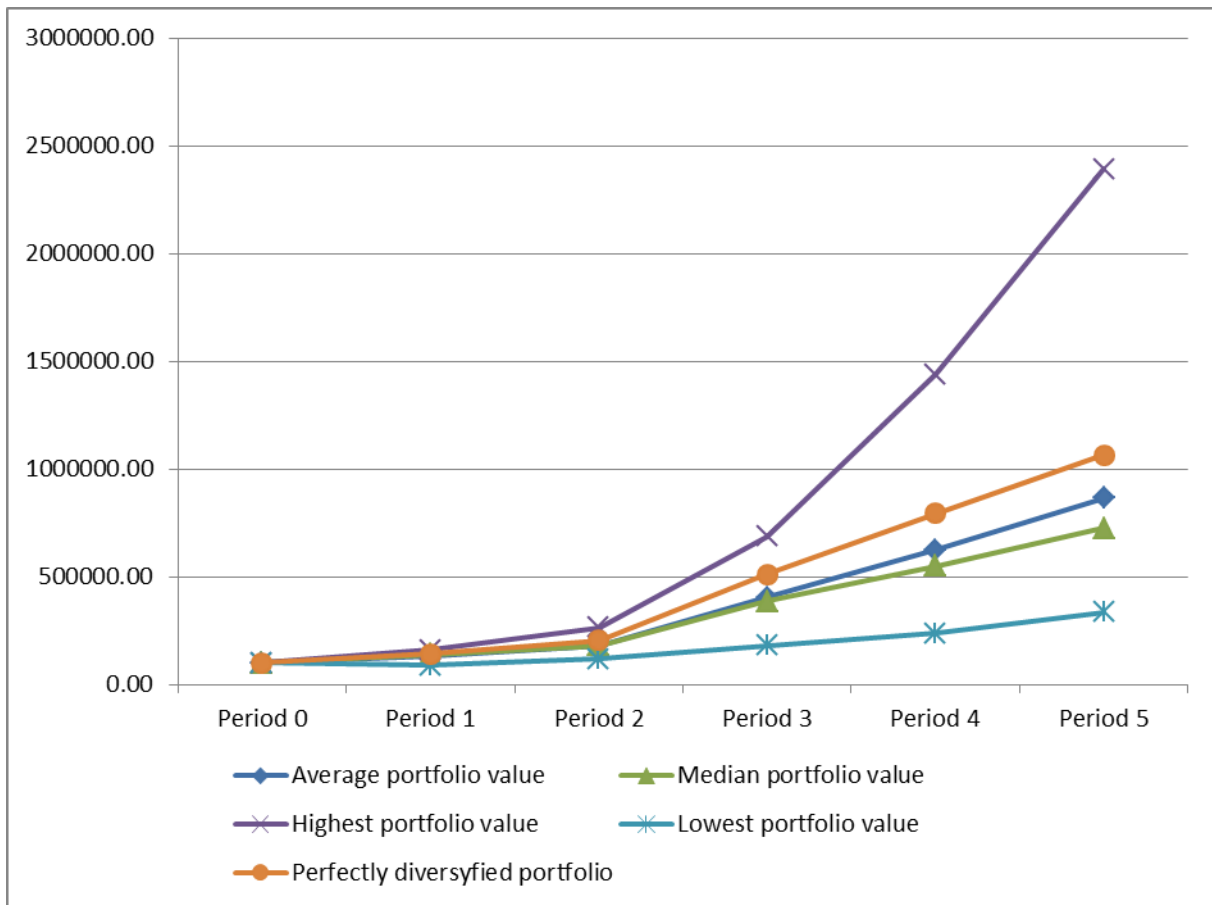**STUDENTS' PERSONAL GOALS IN THE EXPERIMENT GROUP.**

GRAPH 3
AVERAGE NUMBER OF COMPANIES HELD BY PORTFOLIO AND
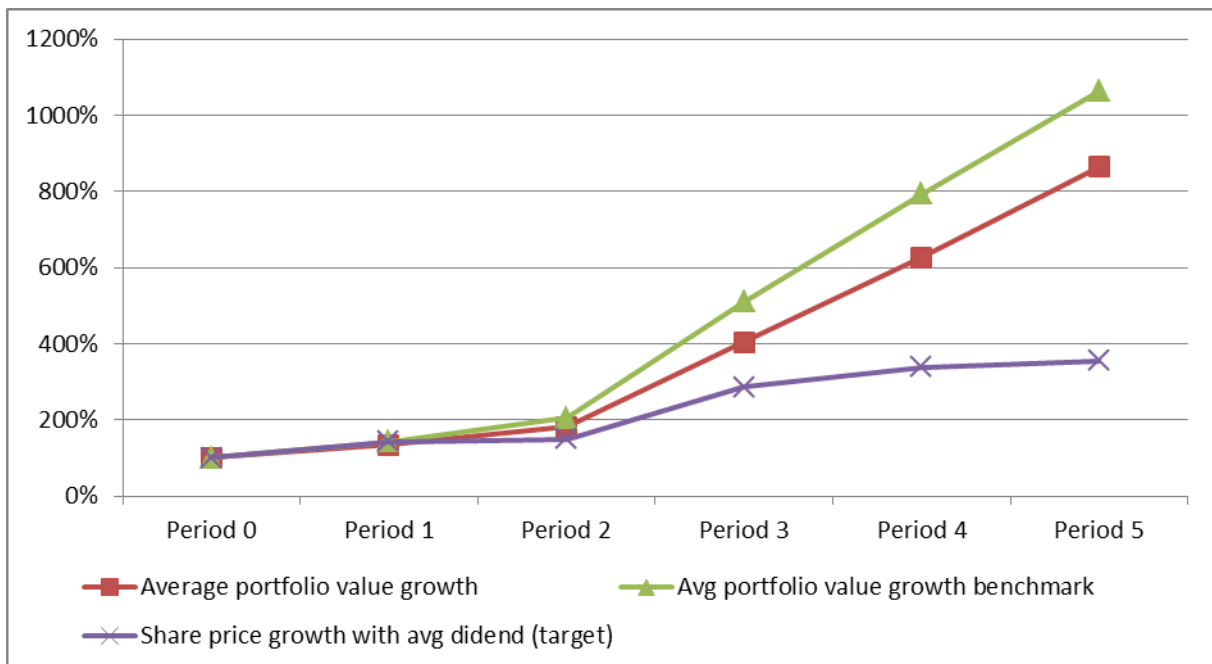**AVERAGE NUMBER OF INVESTMENT DECISIONS (BUY AND SELL) IN THE ROUND.**

GRAPH 4
STUDENTS' DISTRIBUTION FROM THE TARGET MEETING PERSPECTIVE.

GRAPH 5
INVESTMENT PORTFOLIO VALUES IN THE EXPERIMENT GROUP.

GRAPH 6
GROWTH RATIOS COMPARISON IN EXPERIMENT GAMES.

GRAPH 7
COMPARISON OF THE RESULTS OF THE STRATEGIC MANAGEMENT
SIMULATION GAMES IN THE EXPERIMENT GROUP AND BENCHMARK GROUP.