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Learning Effect of Acquire Board Game in Engineering Economics Class

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Abstract: The application of game and gamified tools in engineering class has been used as an effective method which motivates the students and improves the learning outcomes. To validate the learning effect of Acquire board game in engineering economics class is the purpose of this paper. 28 studentsin engineering economics class played Acquire board game and answered survey which investigates the effectiveness of Acquire board game. A survey consisted of eight questionnaires on demographic characteristics of respondents, learning effects of the game and overall level of satisfaction on the game. The analysis results of the survey show that Acquire board game has the positive learning effects in various aspects of learning fields and the students recommend the use of Acquire board game in next semester class.

Key words: Acquire · Learning Effect · Engineering Education · Engineering Economics · Gamification

INTRODUCTION

One of the important factors in education environments is the motivation for students [1]. Kim & Ko shows that engineering students have various needs on fun and pleasure which could be provided in gamified class [2]. According to Papastergiou, to improve students' knowledge and to motivate the students in classroom, the gamified approach may be used in education environments [3]. Kim shows that regarding preferences on fun and pleasure, which are based on 20 factors of PLEX model, the engineering students prefer challenge, exploration, relaxation, completion and discovery to competition, eroticism, suffering, sadism and control [4]. Kim validates that the gamification can be used as a new tool which is more effective for motivating the learning desire, improving the level of communication and understanding and reducing the learning stress in engineering education [5].

Engineering students are usually uninteresting in studying economics because they lack in economic dynamics and social science knowledge. The purpose of this paper is to motivate the students to study engineering economics more interesting and actively engaged. As a tool of gamified motivation, this study use Acquire board game to educate the overall rule of economics including change of stock price, relation of investment risk and return and merge and acquisition. This study validates the learning effects of Acquire board game in engineering economics class using a statistical analysis.The following parts of this paper are organized in three parts. Firstly, the background and rule of Acquire board game are introduced shortly and the outline of the survey is summarized. Secondly, the learning effects and enjoyment that the students experienced are analyzed. Finally, the implication of this study and further research issues are summarized in the conclusion section.

Acquire Board Game in Engineering Class: The overall process of the study is shown in Figure 1. Firstly, six teams were organized using the egogram test. The egogram test is designed to investigate the ego-state of the students. Solomon mentioned that "each of our personalities is made up ofvarious parts: the Parent, the Adult and theChild ego states [6]." Solomon provides a readily understandable description of ego-state using the example of a childplaying in the sand. Solomon provides six differentcontents in the different ego-states as follows [6]:

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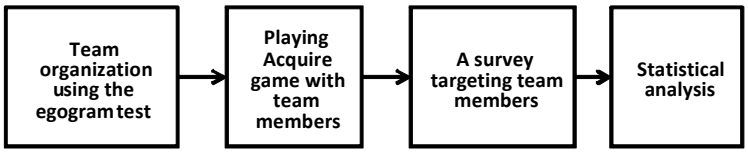

Fig. 1: Process of the survey

- Nurturing Parent: Go ahead, play and havefun!
- Critical Parent: Now, don't you DARE getyourself all messy!
- Adult: This sand looks really interesting. Ican make a castle.
- Free Child: WOW! Look how tall my castleis!!!!!
- Adapted Child: I better not get my clothesall dirty.
- Rebellious Child: I don't CARE if I do getdirty! (While dumping a bucket of sand onher head)

Secondly, six teams played Acquire board game. Single team has four or five members. Before playing the game, the lecturer introduced the background and rule of the game. There were no students who previously had played Acquire game. After playing the game in class, each team took a set of Acquire game and they had played the game several times till the next class. Thirdly, a survey targeting 28 students was conducted. Fourthly, the survey results were statistically analyzed using SPSS software.

Acquire Board Game: Acquire is a very well-known board game designed by Sid Sackson. 3M published the original version of this game in 1962. To earn the most money by developing and merging corporations is the goal of this game. When a large company acquires a small company that other players own stock, the founders of the acquired small company earn money and the stock value of the large company rises. At the end of the game, all players liquidate their securities andthe player who has the most money wins the game. The following components are included in the game.

- Game board with 108 spaces with 12 by 9 array
- 108 square tiles corresponding to the 108 spaces
- 7 markers which stand for 7 companies
- Certificates of stock for 7companies
- Play money of $100, $500, $1000 and $5000
- 6 charts which lists the prices of securities

There are lettered rows of A through I and numbered columns of 1 through 12 on the array of the game board. The 108 square tiles are matched with each of the 108 spaces of array. Figure 2 shows the overall components and setting of Acquire game.

Introduction to the Survey: The survey, which explores the learning effects of Acquire board game, consists of eight questionnaires. Questionnaires are categorized into two questionnaires on the characteristics of respondent, four questionnaires on the learning effect and two questionnaires on the overall satisfaction and fun. Questionnaires on the characteristics of respondents survey the grade (Q1) andgender(Q2).

With playing Acquire board game, the lecturer was willing to educate four basic rules of economics that a technology entrepreneur should know. Four basic rules are that a founder of start-up company who lack in funds is advantageous to sell a business to a large company to raise funds for new business; a large company is advantageous to take over a start-up company that has a new technology or business model and raise a business with their own capital strength, distribution network and marketing capability; a private investor who prefers high-risk and high-return investment should invest in the early start-up companies; a private investor who prefers low-risk and low-return investment should invest in the large companies that have their market dominating power [7]. Questionnaires on the learning effect are as follows:

Q3 -Selling a business to a large company: Do you think that Acquire board game has a rule that a founder of start-up company who lack in funds is advantageous to sell a business to a large company to raise funds for new business?
Q4 - Taking over a start-up company: Do you think that Acquire board game has a rule that a large company is advantageous to take over a start-up company that has a new technology or business model and raise a business with their own capital strength, distribution network and marketing capability?
Q5 - High risk, high return: Do you think that Acquire board game has a rule that a private investor who prefers high-risk and high-return investment should invest in the early start-up companies?

Fig. 2: Acquire board game

Q6 - Low risk, low return: Do you think that Acquire board game has a rule that a private investor who prefers low-risk and low-return investment should invest in the large companies that have their market dominating power?

Questionnaires on the overall satisfaction and fun are as follows:

Q7 - Fun of learning: Does Acquire board game make you fun and motivate you for learning?
Q8 - Recommendation to others: Would you like to recommend the use of Acquire board game to next semester class?

The respondents of this survey are undergraduate students at engineering school of K university. There were 28 students in that class, 19 male students and 9 female students. All the students had been participated in that class as team leaders or team members. 28 students in that class were served as survey respondents. The questionnaires each, excepting two questionnaires on the characteristics of respondent, were surveyed using a five-point Likert item which consists of strongly disagree (point 1), disagree (point 2), neither agree nor disagree (point 3), agree (point 4) and strongly agree (point 5).

Analysis of the Learning Effect and Fun: Table 1 summarizes the one-sample statistics results for students' response on Acquire board game using SPSS software.

Table 2 summarizes the one- sample test results for students' response on Acquire board game using SPSS software. The test value for one-sample test is 3 which means neither agree nor disagree as defined by Likert scale. The test value stands for that there are no meaningful effects of Acquire board game.

Based on the statistical analysis results provided in Table 1 and Table 2, the effects of Acquire board game are summarized.

Selling a Business to a Large Company: The t-value of Q3 is 4.533, so it can be believed that the students learned that a founder of start-up company who lack in funds is advantageous to sell a business to a large company to raise funds for new business through playing Acquire board game. The students who sold their start-ups to others in early stage earned more money. With this money, they founded other companies or invested in rapidly growing start-ups. The founders excepting the minority who made a big company earned less money than the others who sold their start-ups to others in early stage.

Taking over a Start-up Company: The t-value of Q4 is 5.791, so it can be believed that the students learned that a large company is advantageous to take over a start-up company that has a new technology or business model and raise a business with their own capital strength, distribution network and marketing capability through playing Acquire board game. At the interview after playing Acquire board game, the students told that it was more convenient and safe to acquire and merge a competitive start-up to grow their company.

Table 1: One-sample statistics of Acquire board game

	N	Mean	Std. Deviation	Std. Error Mean
Selling a Business to a Large Company	28	3.79	.917	.173
Taking Over a Start-up Company	28	3.9643	.88117	.16652
High Risk, High Return	28	4.1429	.80343	.15183
Low Risk, Low Return	28	3.9286	.85758	.16207
Fun of learning	28	3.8214	.72283	.13660
Recommendation to Others	28	4.8214	.39002	.07371

Table 2: One-sample test of Acquire board game

	Test Value = 3					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Selling a Business to a Large Company	4.533	27	.000	.786	.43	1.14
Taking Over a Start-up Company	5.791	27	.000	.96429	.6226	1.3060
High Risk, High Return	7.527	27	.000	1.14286	.8313	1.4544
Low Risk, Low Return	5.730	27	.000	.92857	.5960	1.2611
Fun of learning	6.013	27	.000	.82143	.5411	1.1017
Recommendation to Others	24.712	27	.000	1.82143	1.6702	1.9727

High Risk, High Return: The t-value of Q5 is 7.527, so it can be believed that the students learned that a private investor who prefers high-risk and high-return investment should invest in the early start-up companies through playing Acquire board game. As mentioned above, the students who sold their start-ups to others in early stage earned more money but some students who failed to sell their company and did not grow their company earned less money. At the interview after playing Acquire board game, the students told that the investment in start-up companies provides an opportunity of high return but it bears high risk.

Low Risk, Low Return: The t-value of Q6 is 5.730, so it can be believed that the students learned that a private investor who prefers low-risk and low-return investment should invest in the large companies that have their market dominating power through playing Acquire board game. At the interview after playing Acquire board game, the students told that the investment in a large company is very safe but they cannot expect to earn more money with it.

Fun of Learning: The t-value of Q7 is 6.013, so it can be believed that the students had fun with playing Acquire board game and were more motivated to study engineering economics. At the interview after playing Acquire board game, the students told that they experienced some kinds of fun such as challenge, competition, completion and control among 20 fun factors of PLEX model [8]. It is not sure what kinds of fun they felt most with playing Acquire board game because fun factors that the students experienced were not studied quantitatively.

Recommendation to Others: The t-value of Q8 is 24.712, so it can be believed that the students were satisfied with Acquire board game and preferred to recommend the use of Acquire board game to next semester class. Engineering economics class in K university has been being opened annually. The students who played Acquire board game in the class judged that it will be helpful to play Acquire in engineering economics class in next year again.

CONCLUSION

This paper shows the learning effects of Acquire board game using statistical analysis. The implications of this paper are summarized as follows:

- Acquire board game is very effective tool to educate four basic rules of economics that a founder of start-up company who lack in funds is advantageous to sell a business to a large company to raise funds for new business; a large company is advantageous to take over a start-up company that has a new technology or business model and raise a business with their own capital strength, distribution network and marketing capability; a private investor who

prefers high-risk and high-return investment should invest in the early start-up companies; a private investor who prefers low-risk and low-return investment should invest in the large companies that have their market dominating power [7].

- Playing Acquire board game in class makes the students fun by providing challenge, competition, completion and control among 20 fun factors of PLEX model [8].
- Students' enjoyment by playing Acquire board game motivates them to study engineering economics more actively.
- As a result, Acquire board game could be used as an effective tool which educates basic rules of economics with fun and motivation.

Limitation and further research issues are summarized as follows:

- It is not studied quantitatively what kinds of fun the studentsexperienced most with playing Acquire board game among 20 factors of PLEX model including captivation, challenge, competition, completion, control, discovery, eroticism, exploration, expression, fantasy, fellowship, nurture, relaxation, sadism, sensation, simulation, subversion, suffering, sympathy and thrill [8].
- A relative comparison with other kinds of board game on economics should be studied to find more effective tool and explore what characteristics of those games are more effective.

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