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ANALYSIS OF THE EFFECT OF INTEGRATING DIGITAL GAME-BASED DECISION-MAKING INTO THE APPROPRIATE TEACHING OF BUSINESS ETHICS

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ABSTRACT

As the increasing emphasis of game-based learning on teaching strategies, many researchers in dictated that implanting game-based learning strategies, which include the enjoyment and tasks for student to pass, in the digital learning system can guide students to enhance their learning motive to win game. Many teaching strategies were developed to improve programming skills instead of traditional business ethical class lecture. Among them, game-based learning are applied to enhance students learning. Nonetheless, they fail to engage students in deep thinking and reflections. To cope with this issue, a two-tier test-based learning system is proposed to enhance students' learning performances and the flow experience in business ethical courses in this study.

Keywords: *game-based learning, flow experience, commercial ethic education*

1. INTRODUCTION

M Case analysis is a commonly used teaching method in business ethics education. In case analysis, a learner explores ethical factors and management methods through a case. Combining adaptive teaching strategies and tools in the classroom can contribute to improving the management skills and increasing the ethical awareness of students. However, in a traditional classroom, although confirmation with ethical theories is combined in case-based ethics education, classroom teaching with one teacher for numerous students limits the opportunities for learners to profoundly examine the experiences and feelings of the person making ethical decisions in the case, and this arrangement also prevents a teacher from providing individualized instruction based on the specific backgrounds of individual learners.

The present study aimed to replace the lecture method of teaching for traditional business ethics courses with innovative business ethics education that integrates game-based decision-making; students experienced a dilemmatic decision-making process in a game and aimed to "progress to the next level," thereby learning the core concept of business ethics education. The researcher combined ethical theories with interactive learning activities and used the tool of the mind, CmapTools, to conduct relevant knowledge capture and construction, thereby developing a knowledge table that was appropriate for developing a game-based learning mode for case analysis that uses a two-tier test. The content of subject knowledge was built into a game-based learning mode for case analysis using a two-tier test comprising the "knowledge" and "application" categories, and the effect of the method on students' learning motivation and flow experience was examined. Through teaching practice, a case-based teaching mode and strategy that incorporates ethical theories, the structure of case analysis, and the learner's reflection on a case decision maker's feelings and experience were developed. The results of the present study may serve as references for college teachers in implementing case-based ethics education, enhancing learners' ethical literacy, and promoting changes in learners' ethical behavior. The research problems of this study are as follows:

1. What are the differences in the learning motivation of students who learn using the game-based learning mode for ethical case analysis with a two-tier test-based guidance mechanism and those who learn using the game-based learning mode for ethical case analysis?
2. Does the flow experience of students who learn using the game-based learning mode for ethical case analysis with a two-tier test-based guidance mechanism differ from that of those who learn using game-based learning mode for ethical case analysis?
3. Does the technology acceptance (cognitive usefulness and ease of use) of students who learn using the game-based learning mode for ethical case analysis with a two-tier test-based guidance mechanism differ from that of students who learn using game-based learning mode for ethical case analysis?

2. BRIEF LITERATURE REVIEW

The one-tier test does not allow for confirmation on whether correct responses of students were based on correct comprehension or speculation; this prevents students from assessing their learning difficulties and prevents a teacher from reflecting on the blind spots in a teaching activity. Although concept maps and interviews allow for in-depth exploration of specific themes or subjects, a thorough evaluation is unlikely to be conducted due to constraints relating to objective factors such as time and budget. Haslam and Treagust (1987) and Treagust (1988) [1] [2] proposed the two-tier test, a tool that combines the advantages of interviews and conventional multiple-choice items to diagnose the learner's misconception and learning difficulties. The test proposed is a tool based on a paper-and-pencil multiple-choice test. The first tier comprises yes-no/multiple choice questions to assess a learner's knowledge. The second tier comprises a number of narrative options; students are requested to select a reason statement that corresponds to their ideas. The goal is to examine whether a learner's concept is correct; if his or her concept is incorrect, it is regarded as an alternative concept.

The two-tier test was proposed to address the disadvantage of traditional assessment that prevents the determination of whether a learner really understands what is learned or is only making speculations. In addition, when the time provided is limited, large-scale tests and feedback for examinees are difficult to implement. The proposed two-tier test combines the advantages of interviews and traditional multiple-choice items to diagnose learners' misconception and learning difficulties. In addition, the two-tier test can positively contribute to learning motivation, technology acceptance, and flow experience (Chu et al., 2017).[3]

Meanwhile, Odom, and Barrow (1995)[4] used a two-tier diagnostic tool to collect and analyze students' alternative conceptions and suggested that the terms and scenario in a question and an option might affect students' actual understanding, leading to varying learning outcome. Treagust (1995) [5]proposed a two-tier test comprising choice questions, which are more representative than the options proposed by experts; the information obtained through a two-tier test can be used in comparative research and as a reference regarding students' error types or learning disabilities.

3. RESEARCH DESIGN

Participants

The participants of this study were 48 second-year students (24 men and 24 women) who were taking a business ethics elective course (2 course credits); these students were enrolled in a four-year technical program (day school) of a school of business and management of a

university of science and technology. The students were randomly and voluntarily divided into three experimental groups comprising 23 participants and three control groups comprising 25 participants; each group comprised 7–8 participants. For course content design, the Taiwan Semiconductor Manufacturing Company (TSMC) Materiality Matrix, a sub-unit of the course Identification and Analysis of Business Ethical Issues, was adopted as the content of the thematic unit; discussions and interactions were conducted through cooperative learning.

Research Procedure

The present study used CmapTools to capture the concepts required for learning the content of the unit. The researcher used the RPG Maker MV software to develop a digital game for ethical case analysis-based learning that incorporated a two-tier test-based guidance mechanism for extracting the steps of materiality matrix-based decision-making analysis, which were made into a concept map.

Course Design

Two-Tier Test-Based Digital Game

The experimental groups in the present study learned using the proposed game-based learning mode for ethical case analysis with a two-tier test-based guidance mechanism, whereas the control groups learned using a general digital game for ethical case analysis. When learning the content of the unit, both groups used identical learning materials (i.e., those of the ethical case), read the case history and theory of stakeholder issue identification and analysis, and performed the same game scenario; the learners played the role of TSMC's ethics director Esker, who is faced with a sudden economic downturn. For the learning steps, a materiality matrix of TSMC's business ethics issues was first created to reporting the best coping strategy for ethical issues to the president. The students in the control group started the game without first taking the two-tier test. Figure 1 presents the opening scene of the game; once a participant was in the game, the opening scene provides a bird's-eye view of the company. Inside the walls was a simulated enterprise site, which included the corporate headquarters, factory buildings, and other facilities; outside the walls were a jungle and multiple stakeholders who served as metaphors for the corporate jungle and an environment of competitors.

Game background description: Esker first accepted the challenge of the board of directors and was informed of the decision-making mode. He visited each level to overcome challenges; whenever he succeeded in overcoming a given challenge, he was awarded with equipment that enhanced his attack skills, allowing him to ultimately challenge the demon king.

Figure 1 Game Interface

No second tier questions were directed at a participant who has started the game; the participant could self-evaluate to determine whether he or she had accumulated sufficient experience and adequate equipment to challenge the demon king.

In the two-tier test-based digital game for ethical case analysis, after the questions of the first tier were answered, the questions of the second tier were asked. The second-tier questions comprised questions of the first tier and options involving other alternative conceptions. The students could self-evaluate the correctness of their concept through the game; those who answer correctly could obtain better equipment and increase their ability to achieve a breakthrough. Teaching materials were used as reminders when the wrong answers were given.

Experiment Flow

In the present study, students following the elective course on ethics were divided into two groups to conduct a case analysis of the sub-unit theme TSMC materiality matrix in a course on business ethics course. With respect to the scheduling of the experiments, the two experiments were conducted after the participants' midterm exams. In the first week, the lecturer taught about the TSMC case background and then administered a pretest and prequestionnaire. The questions in the pretest were multiple-choice questions that focused on the stakeholder theory, analysis of the materiality matrix in TSMC's 2018 corporate social responsibility (CSR) report, stakeholders' concerns, level of concern and influence of each stakeholder, background of case company, and analysis of factors that affect decision-making. The goal of the learning motivation questionnaire that was administered before learning was to analyze learner's learning motivation regarding the theme of the unit. A pretest was conducted to evaluate the learner's familiarity with the theme and content of the unit after the unit was taught. Enhancements were made when the learners' familiarity was inadequate. Because the game content already implied related items, no posttest questionnaire was administered after learning.

Learning Activity Design

During the teaching process of the present study, a teacher gave thematic instruction to students in class; the focus was on the case set for the materiality matrix analysis in the frame of the

sub-unit of the business ethics case analysis. In this students-centered process, the teacher used relevant teaching materials to guide the students to learn about the role of "Esker," who is the social responsibility director in the case analysis, with the expectation of achieving his or her teaching goal. During the teaching process, the students could experience the company's implementation of its CSR and improve their motivation to engage in the course through the digital game. Figure 6 presents the instructional process.

The course in the following week was designed per the procedure for digital game-based learning; the students were divided into the experimental and control groups to conduct different digital game-based learning modes. The activities were completed in 50 min. After learning was completed, a posttest questionnaire was implemented to analyze the effect of the learning modes on learning motivation, flow experience, and technology acceptance. Subsequently, the researcher summarized and proposed suggestions.

Research Tools

Cmap Rating Scale

The learning motivation questionnaire in the present study was revised on the basis of the motivation theory, which in turn was based on the ARCS (Attention, Relevance, Confidence, Satisfaction) model proposed by Keller (1987). A 6-point Likert scale was used to measure the students' learning motivation with respect to the content of the teaching materials, thereby clarifying whether the unit learning activities could arouse the students' interest and curiosity, meet their personal needs and goals, and help them build confidence and obtain internal and external encouragement and rewards for their achievements; six items were examined, and their Cronbach's alpha was 0.86.

The flow experience questionnaire was an appropriation of the five-item scale proposed by Pearce et al. (2005). The assessment of flow was conducted using a 6-point Likert scale, and its Cronbach's alpha was 0.87. The technology acceptance questionnaire was a revised version of the questionnaire developed by Hwang et al. (2013). This questionnaire survey consisted of six cognitive usefulness items (Cronbach's alpha = 0.91) and seven cognitive ease-of-use items (Cronbach's alpha = 0.88).

To assess the learning motivation of the experimental and control groups before and after adopting various modes of learning, an analysis based on a paired sample t-test was conducted using a learning motivation questionnaire, with the aim of clarifying whether the digital game-based mode with a two-tier test (designed in the present study) improved learning motivation. The cognitive usefulness and cognitive ease of use of the digital game-based learning mode developed in the present study were examined using the one-way analysis of variance (ANOVA).

4. RESULTS AND ANALYSIS

Table 1 Analysis of Differences in Learning Motivation Using Paired Sample T-Tests

α (0.05)		M	n	SD	t	p
Experiment Groups	Before Learning	4.0430	23	0.27704	-4.952	0.000
	After Learning	4.3117	23	0.22174		
Control Groups	Before Learning	4.0724	25	0.28304	-0.054	0.958
	After Learning	4.0732	25	0.25431		

For the implementation of the digital game-based learning mode for business ethical case analysis based on a two-tier test and the general digital game-based mode, this study divided the students into experimental and control groups and applied various teaching methods. The course content was a sub-unit on materiality matrix analysis, which was part of an ethical case analysis that was conducted for a course on business ethics. To obtain the experimental results, questionnaires were used for analyzing differences in terms of learning motivation, technology acceptance, and flow experience.

Analysis of Differences in Learning Motivation

To examine the experimental and control groups before and after using the implementation of various learning modes, a learning motivation questionnaire and paired sample t-tests were used to determine whether the digital game mode based on a two-tier test that was designed in the present study improved learning motivation. The experimental results revealed that the experimental groups' average learning motivation score before playing the game was 4.04, and their learning motivation score after playing the game was 4.31; the difference in learning motivation before and after playing the game was statistically significant ($p < 0.025$). In other words, after the implementation of the digital game-based learning mode for business ethical case analysis based on a two-tier test, the learning motivation of the students in the experimental groups increased significantly. For the control groups, the results of the questionnaire survey revealed that the average learning motivation score of the control group before undergoing general game-based learning was 4.07, and their average learning motivation after undergoing general game-based learning was 4.07; therefore, the difference in the control groups' learning motivation before and after the game was not statistically significant ($p = 0.958$). These results indicated that the control groups' learning motivation did not increase after they played the general digital game. Table 1 presents the analysis of the differences in learning motivation.

According to the aforementioned findings, for the game-based ethical case analysis that was conducted as part of the unit examined in the present study, the learners who learned through the digital game-based learning mode for ethical case analysis with a two-tier test (designed in the present study) exhibited improved learning motivation compared with those who played the general digital game.

Analysis of Differences in Technology Acceptance

A questionnaire was used to obtain statistics of the students' behavioral intention to use the digital game-based learning mode. ANOVA was performed to examine the cognitive usefulness and cognitive ease of use of the students in the experimental and control groups after learning through the digital game-based learning mode designed in the present study. The questionnaire results were subjected to a one-way test of homogeneity of variance, which revealed that the Levene's test value of cognitive usefulness was 0.115 (p = 0.737), and that the Levene's test value of cognitive ease of use was 0.942 (p = 0.337); the two items did not achieve statistical significance, indicating that the questionnaire results pertaining to the tested students' cognitive usefulness and ease of use passed the test for homogeneity, and that the subsequent analysis of one-way variance could be performed.

Table 2 Analysis of Differences in Technology Acceptance

α (0.05)		n	M	SD	t	p
Cognitive Usefulness	Experimental Groups	4.0430	23	0.27704	-4.952	0.000
	Control Groups	4.3117	23	0.22174		
Cognitive Ease-of-Use	Experimental Groups	4.0724	25	0.28304	-0.054	0.958
	Control Groups	4.0732	25	0.25431		

Table 2 presents the analysis results. The average score for cognitive usefulness for the experimental groups was 4.79, and that of the control groups was 4.79; no significant difference in cognitive usefulness was observed between the experimental and control groups (F = 0.001, p > 0.05). For the cognitive ease of use, the analysis results revealed that the average score of the experimental groups was 4.76, and that of the control groups was 4.81. For cognitive usefulness, the questionnaire results of the experimental and control groups did not achieve statistical significance (F = 0.437, p = 0.512 [>0.05]). In other words, for the participants in both the experimental and control groups, no significant difference was observed for perceived ease of use and usefulness of the system between those who played the digital game for ethical case analysis based on a two-tier test and those who played the general digital game for ethical case analysis. In both the experimental and control groups, the average score was higher than 4, indicating that learners exhibited positive attitudes toward both digital games and believed that game-based learning contributed to their learning and was easy to use.

Analysis of Differences in Flow Experience

The present study used a flow experience questionnaire to assess students' engagement in learning activities and immersion in the action game-based learning mode during the learning process, with the aim of understanding the learner's learning status with respect to the case scenario and game structure designed in the present study.

The questionnaire was a reverse-scored 6-point Likert questionnaire; 1 point indicated "strongly disagree" and a high-level flow experience, whereas 6 points indicated "strongly agree." For the questionnaire survey results relating to the participants' flow experience, the value of Levene's test of equal variances was 0.663 (p = 0.42); equal variance was adopted for an analysis involving an independent samples t-test (Table 3).

Table 3 Analysis of Flow Experience Using Independent T-Test

α (0.05)	n	M	SD	t	p
Experimental Groups	23	2.9782609	0.31121	-0.6802724	0.5
Control Groups	25	3.0372	0.28909		

The average questionnaire score for flow experience of the experimental groups was 2.98 with a standard deviation of 0.31, whereas that of the control groups was 3.03 with a standard deviation of 0.29. The flow experience of the two groups did not reach statistical significance ($t = -0.68$, $p = 0.5$ [> 0.05]), indicating that the experimental and control groups shared a similar flow experience and feelings during game-based learning.

5. CONCLUSIONS AND SUGGESTIONS

The present study proposed a multiple evaluation method (as a replacement for traditional single evaluation methods) for business ethics courses. The objective of the present study is to attain the following four teaching goals pertaining to business ethics:

(1) Students should understand the basic principles of business ethics (cognition);
(2) Students should cultivate their ability to apply business ethics theories in decision-making (skills);
(3) Students should cultivate an appropriate attitude that aligns with business ethics (emotion);
(4) Students should build their experience in conducting case analysis of business ethics.

A teacher guided the students to correctly understand concepts of business ethics, and during the course, the teacher cultivated their motivation for learning and reflection. In accordance with the teaching goals of this course, the researcher evaluated the students' learning motivation and outcomes; learning outcomes were assessed through game-based learning activities and questionnaires. The two-tier test was revealed to be more effective in diagnosing students' misconceptions; the test could also be combined with relevant learning activities to improve learning outcomes.

The present study revealed that the combined implementation of a thematic course unit with a diversified range of learning activities (including teaching methods and activities such as in-class lectures, cyber university-assisted homework and games, and group discussions) effectively enhanced the playfulness dimension for students during the learning process. The diagnosis of students' learning misconceptions and integration of case business stakeholders in teaching content can enhance students' experience with respect to business practices and ethical literacy.

The implementation of a decision-making mind map and role-playing game in the course increased the students' perception of ethical awareness relating to the logic of decision making. The game allowed the students to assume the role in a case and experience ethical decision

making. For business ethics, the educational goals were to help students to understand both basic theories and business management practices. Regarding the business stakeholders in the unit that was taught, for business management practices, stakeholders are involved whether a company substantially fulfills its CSR or not. In other words, even if a micro-business in the start-up phase cannot fully address stakeholders' concerns, its business activities can still substantially affect all stakeholders. The business stakeholder theory and its significance in practice can not only serve as topics for simple theoretical discussion activities in class but also be used to train students' ethical awareness and logical decision-making skills. The goal of teaching the course was to cultivate students' case analysis skills; the two-tier role-playing game provided the students with an accessible decision-making concept map that help them to achieve the goals of learning.

In future studies, the game content for teaching courses can be elaborated on because such courses are designed to cultivate students' case analysis skills. Through these courses, students can learn theoretical knowledge, attain self-fulfillment, and rediscover the theory and practice of knowledge (including practical tasks pertaining to CSR practices such as CSR report writing), thereby allowing them to review all CSR policies by developing a complete understanding of business functions.

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