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Development of a Structured Debriefing for Business Simulation Games and Its Effect on College Students' Business Knowledge and Entrepreneurship Competencies

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This study evaluates the effect of structured debriefing for a business simulation game for university students. The program provides an authentic learning experience of real-world business management by allowing learners to make decisions related to R&D, marketing, production, and finance through a business simulation game, and check the results in real time. In 2022, University A and B each ran a business simulation game-based program as an extra-curricular activity. University A conducted a traditional instructor-led debriefing where the instructor explained the summarized process and results, while University B implemented a structured debriefing which had been developed based on Gibbs' and 3D models. To assess the effect of the structured debriefing compared to the traditional instructor-led debriefing, business knowledge and entrepreneurship competencies were measured three times. Repeated measures ANOVA was used to test for the differences between the two groups and to examine interaction effects between group and time. The structured debriefing group achieved statistically significantly higher academic scores than the traditional instructor-led debriefing group at the post-test and in 2 weeks. There was no statistically significant difference between the groups in terms of entrepreneurship competencies. There was no interaction effect between group and time, both in academic achievement and in entrepreneurship competencies. In conclusion, the simulation game-based program integrated with the structured debriefing session is more likely to have a stronger impact on academic achievement and its retention.

Key words : business simulation game, structured debriefing, business knowledge, entrepreneurship competence

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Introduction

Technology-integrated learning environments overcome the time and space limitations of traditional classrooms, while enabling hands-on, experiential learning in an environment that closely resembles the real world where the learning transfer will be more likely to happen. The immersive and rich learning environment enhanced with technology is expected to increase learner engagement, achievement, and even transfer. The current society communicates an unprecedented higher expectation of the social roles of education in developing learners' competencies needed to solve complex and challenging problems in the real world, such as problem-solving skill, higher order thinking, and innovative attitudes. It is crucial to design learning environments in real-world contexts in order to meet these requirements. Simulation is a teaching and learning method that enables active learning experience in a context that closely resembles the real world, rather than being limited to indirect experience through instructor lectures or learning through decontextualized cases. Simulation has been widely used as an instructional method in various applied disciplines such as medicine, nursing, and engineering, which all emphasize the acquisition of practical knowledge and its application in real life. In the field of business education, computer-based simulation platforms have been actively developed since the emergence of mainframe computers in the 1950s.

Computer-based business simulation game platforms allow learners to run a fictitious company, make data-driven decisions, and directly and immediately experience the consequences of unpredictable market conditions caused by the interplay of decisions made by multiple actors. Moreover, computer-based online simulation learning environments can provide a realistic learning experience in a faster and more compressed way, but also allow learners to see the results of their decisions immediately. This is such a significant pedagogical advantage over traditional offline simulations.

Considering business is essentially an endeavor to achieve relative advantage in the

marketplace, competition is a core feature that cannot be removed from the learning environment design. Therefore, it is critical to include competition as a fundamental game element in business simulations since previous studies on gamification has reported that the integration of game elements (e.g., missions, competitions, items, rewards, levels, etc.) in educational programs can enhance learner engagement and learning (Deterding et al., 2011). Business simulation games are "experience-based educational tools that combine inter-team competition and game methods to learn management techniques and management knowledge while managing a virtual company and improve business management skills and problem-solving abilities" (Kim & Rim, 2016, p.282). Currently, CAPSIM, CAPSTONE, and Marketplace are representative platforms for business simulation games.

Previous studies have reported that business simulation games can enhance systemic understanding of business management activities and foster decision-making skills, collaboration, and communication skills (Kim, S. & Kim, Y., 2016) while learners are engaged in the learning situation thanks to the game features. However, in the process of combining education and games, there have been cases where the original purpose of education is overlooked due to an excessive focus on game design, or the game itself and education have been combined at a superficial level, missing both the benefits and educational effects of games (Kim, 2016). In addition, excessive immersion in the fun and competition of games may not lead to knowledge acquisition or meaningful learning experiences (Ahn et al., 2020). On the other hand, from the perspective of the input-process-output model of game-based learning proposed by Garris et al. (2002), these problems can be attributed to the absence of or inadequacy of debriefing in simulation game-based education. They emphasized that debriefing is essential to link the game experience to learning outcomes. Debriefing is the process of learners reflecting on their simulation experience, and providing and receiving feedback (Fraser & McLaughlin, 2019). There are various types of debriefing, depending on who leads the debriefing, when it takes place, the media used, the mode in which it takes place, and how it is

structured. However, to date, a significant number of business simulation game-based trainings either do not include a debriefing component at all or are not designed strategically and integrally within the context of the overall program (Ahn et al., 2020). This phenomenon can be attributed to a lack of empirical research on the effectiveness of debriefing in business simulation games and a lack of specific design guidelines on how debriefing should be designed within the context of the entire program. There is a strong need for research into how debriefing should be designed and operated in a business simulation game-based program in order to achieve the pre-defined educational objectives while maintaining the appeal of the game elements. In addition, empirical studies should be conducted on the effectiveness of debriefing sessions specific to business simulations on students' learning process and outcomes.

In summary, in order to utilize business simulation games for educational purposes, it is necessary to systematically design the educational experience, including debriefing as a critical component that can link the learning experience to learning outcomes, rather than simply using the platform developed by the vendor. Therefore, based on the need for such research, this study aimed to develop a structured debriefing in the context of an educational program using an online business simulation game platform called CAPSIM, to implement it in the context of an extra-curricular program at university, and to analyze how the developed debriefing affects learning outcomes in both cognitive and affective domains through quasi-experimental study.

Theoretical Background

Concepts and types of debriefing

Debriefing is a crucial element of educational simulation as it facilitates reflection

in the experiential learning cycle (Fanning & Gaba, 2007; Van Der Meij et al., 2013). Learners are encouraged to reflect on the simulation learning experience from different perspectives and to provide feedback during and after the simulation operation (Fraser & McLaughlin, 2019). Since its inception in the 1940s, debriefing has been used in a wide variety of settings, including healthcare, military, security, teamwork, aerospace, education, and other organizations.

Yun and Son (2022) conducted a systematic literature review of nursing simulation education studies in Korea and abroad and summarized the types of debriefing used. Debriefing can be categorized into three types: instructor-led, self-debriefing, and peer-led debriefing, based on the operator. The time of debriefing can be during or after the simulation. The medium used for debriefing can be video, reflective journals, scripts, or worksheets. The mode of delivery can be virtual or face-to-face.

Notably, domestic research on debriefing, particularly in the field of nursing education, has been active and has contributed significantly to the understanding of the topic. Simulation in nursing education significantly improves learners' ability to experience clinical cases and develop contextualized nursing interventions. The common process includes a pre-briefing, simulation performance, and debriefing, which takes place immediately after the simulation. During the debriefing, the facilitator leads a discussion with the learners to gather their feedback on the learning process and performance. According to the Standardized Training Operations for Simulation in Nursing Education, effective debriefing requires a structured debriefing model, sufficient debriefing time, and a skilled debriefing facilitator (Decker et al., 2021).

Effective debriefing improves learner behavior, by structuring the learning experience through reflection, discussion, and feedback (Fanning & Gaba, 2007). It also facilitates the consolidation and transfer of learning into practice (Rudolph et al., 2008). It is important to note that inadequate debriefing can have a negative impact on learning outcomes, potentially demotivating learners and leaving them with feelings of helplessness or self-blame (Flanagan, 2008). To take full advantage of the

educational benefits of simulation, a well-structured debriefing should be conducted with the active participation of the learner and facilitated by a skilled operator (INACSL, 2016).

Previous studies have unequivocally demonstrated that structured debriefing significantly improves knowledge (Jansson et al., 2017a; Jeong & Choi, 2017), problem-solving skills (Eun & Bang, 2016; Oh et al., 2021), clinical judgment (Oh et al., 2021), and confidence (Jeong & Choi, 2017) compared to general debriefing. Therefore, it is imperative to adopt a structured debriefing model to guide the effective debriefing process. Representative debriefing models include the DAA model (Fanning & Gaba, 2007), the 3D model (Zigmont et al., 2011), the GAS model (O'Donnell et al., 2009), and Gibbs' (1988) reflection cycle-based debriefing model (Yun, 2020). These models follow a structured approach that involves multiple steps, such as description, analysis, application, defusing, discovering, deepening, gathering, analyzing, and summarizing.

The educational impact of debriefing

In a business simulation game, learners will understand the complexity of management by running a fictitious company and making decisions for all departments of the organization. In particular, learners will immediately experience how the results of decisions made through communication between team members lead to the success or failure of management. In this case, systematic reflection on the decision-making process and the results can be expected to enhance the educational effect.

Debriefing is considered to be the most important process in simulation as a component of the learning experience that facilitates learning through reflection on the process and outcomes (Lee et al., 2020). During the debriefing process, learners reconstruct knowledge based on patterns of reasoning and cognition in the simulation situation (Wotton et al., 2010). As learners are asked to articulate the

rationale for their performance, they are able to identify and correct their errors, thereby improving their knowledge and skills in the field (Lasater, 2007). Previous research in the context of business simulation games has also identified a number of variables that influence learning, including gender, cognitive style, complexity of the simulation, duration, prior experience, and how game performance is evaluated, with debriefing cited as an important influence (Ben-Zvi & Carton, 2008; Kriz, 2010; Peters & Vissers, 2004; Van Der Meij et al., 2013). Ben-Zvi and Carton (2008) emphasized the importance of debriefing as a critical mediator to facilitate learning according to Kolb's (1984) experiential learning cycle, in which experience in a simulation leads to knowledge acquisition and this knowledge leads to action. Garris and colleagues (2002) also argued that the debriefing process is essential to link the experience of the game to the learning outcomes.

Debriefing in modern simulation can be categorized into traditional instructor-led debriefing, learner self-debriefing, and peer debriefing, depending on who is actively leading the process (Ha & Song, 2015). Instructor-led debriefing, which is the most widely used, has the advantage of efficiently wrapping up the simulation experience in limited class time based on the instructor's expertise, but it does not provide sufficient opportunities for meaning-making and realization that active reflection can bring. Based on these limitations, self-debriefing and peer-led debriefing have been proposed as alternatives that provide learners with more active and proactive opportunities for reflection. In self-debriefing, learners think and find solutions on their own in a pre-designed debriefing process, such as completing a standardized questionnaire, without the help of an instructor (Lapum et al., 2019). In previous studies, students reported that self-debriefing allowed them to experience a relaxed and calm atmosphere, to engage in in-depth reflection at their own pace, and to develop future self-assessment skills (Boet et al., 2011). Peer debriefing or peer-led debriefing has also been shown to improve learning engagement and self-confidence by providing a sense of security during the reflection process (Song et al., 2021). Peer debriefing and self-debriefing have been reported to have positive effects on clinical

performance, clinical performance confidence, self-efficacy, problem-solving skills, and satisfaction (Lee et al., 2020; Song & Park, 2022). On the other hand, learner self-debriefing has the disadvantage that there are large differences in the depth and breadth of reflection depending on learner characteristics, making it difficult for instructors to control the quality of the learning experience through individual learner debriefing. Therefore, the development of a debriefing system that combines the advantages of learner self-debriefing with the advantages of instructor-led debriefing is expected to increase the effectiveness, efficiency, and attractiveness of the program.

Despite these findings, most training programs using simulation games have not included facilitative support elements, such as debriefing, to connect the game to learning and transform the game experience into learning (Ahn et al., 2020). While the literature on debriefing in other fields is relatively rich, no empirical studies have been identified that objectively evaluate the mediating role and impact of debriefing in the field of business games (Lacruz & Américo, 2018).

Previous studies on debriefing have been active but mostly in health-related fields such as nursing education and clinical education. In these fields, the design and development of debriefing has been emphasized for more effective simulation education. There have been various theoretical frameworks used for designing debriefings such as DML model (Debriefing for Meaningful Learning, e.g., Dreifuerst, 2012; Lee, 2022), Mezirow's transformative learning theory (Oh et al, 2021), DAA model (Description phase, Analysis phase, Application phase, e.g., Choi & Kim, 2023), and Clinical Judgment model (Son, 2022).

Comparative studies of debriefing types include collaborative vs. individual reflective debriefing (Yun & Son, 2022) and structured debriefing vs. Verbal only debriefing (Jansson et al., 2017a). However, the results of structured debriefing studies have been inconsistent. For example, debriefing using a structured model has been shown to significantly improve knowledge, problem-solving skills, clinical judgment, and confidence compared to traditional debriefing (Yun & Son, 2022), but others have found no difference between groups in clinical judgment scores (Mariani

et al., 2013), reflection skills (Morse, 2015), nursing skills (Jansson et al., 2017a, b), and knowledge and performance (Kim & Kim, 2023). There have also been studies comparing learner self-debriefing and instructor-led debriefing (e.g., Verkuyl et al., 2018), but few studies have confirmed the effectiveness of debriefing that combines the benefits of self-debriefing, such as learner reflection, with the benefits of instructor-led debriefing, such as instructor modeling.

Therefore, based on the results and suggestions of previous studies, this study aims to design and develop a debriefing suitable for simulation games in business education by reflecting the elements and principles of effective debriefing, such as creating a debriefing environment where learners can actively reflect, including elements that allow learners to model experts, and testing its effectiveness in an authentic context. Simulation education is expected to improve academic performance and change attitudes and beliefs by providing a realistic learning environment. In this context, this study aims to examine the differences in students' business knowledge and entrepreneurship competencies between a group of students who experienced a self-debriefing and expert modeling structured to promote active and systematic reflection and a group who received a traditional instructor-led debriefing. We will also test whether these differences persist two weeks after the end of the program. The research hypotheses are:

Hypothesis 1. There will be no significant difference in the amount of change in business knowledge scores between the structured debriefing group and the instructor-led debriefing group.

Hypothesis 2. There will be no significant difference in the amount of change in entrepreneurship competency scores between the structured debriefing group and the instructor-led debriefing group.

Research Methods

Study design

This study aims to examine the effect of structured debriefing on students' business knowledge and entrepreneurship competence in business simulation education, and the research design is as follows Table 1.

Table 1
Study design

	pre-test	treatment		post-test	test in 2 weeks
EG (N=19)	Business knowledge Entrepreneurship competencies	Simulation Games (7 total)	Structured debriefing	Business knowledge Entrepreneurship competencies	Business knowledge Entrepreneurship competencies
CG (N=24)			Instructor-led debriefing		

Note: EG = Experimental Group; CG = Comparative Group

Participants

This study focused on students who participated in a business simulation learning program using CAPSIM, a digital business simulation game platform, conducted as part of an entrepreneurship camp in November 2022 at university A and B in metropolitan city G, respectively. The programs were open to anyone interested in starting a business. After explaining the purpose of the study, the anonymity of the data analysis, and the possibility to withdraw from the study, the students voluntarily agreed to participate in the study. The recommended sample size was calculated using the G*Power 3.17 program. The size of effect (d) was calculated as .50, the significance level (α) as .05, and the power 1-β for repeated measures one-way ANOVA of two groups as .95. The minimum sample size for each group required for the study was 12 participants per group, for a total of 24 participants. The experimental group consisted of 19 participants from University A who experienced

a structured debriefing, while the comparative group consisted of 24 participants from University B with traditional instructor-led debriefing. The number of participants for each group met the minimum number required for ANOVA. The participants' demographic information is presented in Table 2 below. The distribution of participants with previous experience in simulation games seemed to be very similar between the two groups.

Table 2
Participants information

Demographic variables	Categories	EG (N=19)	CG (N=24)
		N (%)	N (%)
Majors	Engineering	11 (57.9)	5 (20.8)
	Humanities & Social Sciences	6 (31.6)	15 (62.5)
	Art & PE	0 (0.0)	2(8.3)
	Medicine	0 (0.0)	1(4.2)
	Nature Science	2(10.5)	1(4.2)
Grade Level	1	6 (31.6)	7 (29.2)
	2	8 (42.1)	8 (33.3)
	3	0 (0.0)	3 (12.5)
	4	1(5.3)	6 (25.0)
	Graduate School	4(30)	0 (0.0)
Simulation game experiences	Yes	1(5.3)	3 (12.5)
	No	18 (94.7)	21(87.5)

Study tools

Business Knowledge Assessment Tool

Business knowledge was measured using 11 multiple-choice questions about the knowledge of business that can be learned through the business simulation game. One doctoral student in educational technology who developed the items is an expert in business management simulation education with one year of relevant program

training and two years of teaching experience and participated in both the structured debriefing and instructor-led debriefing groups in this study.

The draft questions were reviewed by a simulation facilitator and two PhDs in educational technology to discuss whether learning through simulation training is possible, whether it measures the achievement of educational goals, whether the difficulty level is appropriate, and the appropriateness of wrong answers, and to ensure content validity. In the end, a total of 11 questions were developed, including 3 questions each in R&D, marketing, and production, and 2 questions in finance. Except for one question with 3 options, the rest were all multiple-choice quiz questions with 1 correct answer out of 4 options. Business knowledge was measured before the program, at the end of the program, and again two weeks later to measure retention.

Table 3.
Business knowledge assessment tool

Categories	Items
R&D	▫ When developing a product and brand, what are the first things you should do?
	▫ What is the impact of product performance/size/age?
	▫ What is the impact of the product's launch date?
Marketing	▫ What are the pricing implications of the product?
	▫ The primary job of a marketing team is to manage public relations/sales. Which of the following statements is true?
	▫ How does a marketing research study that predicts how many units will be sold affect the company?
Production	▫ What is the best thing the production team can do to reduce the manufacturing cost per unit of product?
	▫ How would increasing the factory's production capacity benefit the company?
	▫ What tasks should the production team prepare in advance when a new product is developed?
Finance	▫ What can the finance team do when the company is short on funds?
	▫ What are the criteria to determine if a company's financial structure is sound?

Entrepreneurship Competency Measurement Tool

Entrepreneurship competencies are the ability to realize self and contribute to society through entrepreneurial practices, which is an intrinsic lifelong competitiveness and pursuit of existential value for all members of society (Bacigalupo et al, 2016). To measure entrepreneurship competencies, the Entrepreneurship Competency Diagnostic Tool of Bian et al. (2021), which was derived by reviewing several previous studies such as Bacigalupo et al. (2016) and Tovar et al. (2020), was modified and supplemented with a total of 14 questions to fit the context of this study. The revised and supplemented items were reviewed by two PhDs in educational technology, an expert in business simulation education, and a PhD candidate in educational technology. The diagnostic questions consisted of opportunity and value creation competencies, self-development competencies, technology use competencies, resource acquisition competencies, and strategy, networking, and experience competencies, such as 'I can prioritize and establish strategies when setting goals' and 'I can create value by discovering hidden customer needs. A 5-point Likert scale was used, and the reliability analysis of the items showed that the Cronbach's α value was over .7, which ensured the reliability of the tool. Entrepreneurship competencies were measured three times: before participation in the program, after participation, and two weeks later.

Apply structured debriefing design and business simulation game

The purpose of this study is to systematically design and verify the educational effectiveness of debriefing, which has not received much attention in business simulation games, with the aim of designing a holistic experience for simulation game-based education. To this end, we reviewed several previous studies (e.g., Debriefing with good judgement model, GAS model, DAA model) to design a debriefing to be applied to a business simulation education program and finally designed a structured debriefing session based on Gibbs' (1988) reflection cycle,

which is based on Zigmont et al.'s (2011) 3D model (Defusing, Discovering, Deepening). The research team determined that this model was the most appropriate for debriefing because it would allow them to see the connections between the simulation game context (managing a business in a fictional situation) and the learning context, helping to ensure that in-game achievements lead to learning outcomes. The 3D model was developed based on adult learning theory (Sheckley et al., 2008), Kolb's (1984) experiential learning theory, and Zigmont's Learning Outcome model (2010) as a strategy to facilitate the application of learning in the real world, taking into account the characteristics of adult learners. Gibbs' (1988) reflection cycle was proposed to guide systematic reflection in six stages: description, emotion, evaluation, analysis, conclusion, and action plan.

Considering the limited operating time of the program under study, we designed Gibbs' (1988) six stages of reflection in two phases, and developed questions to facilitate learners' reflection in each phase. The questions were developed using Google sheet, which allows for real-time responses and sharing. To compensate for the shortcomings of learner-led self-debriefing, we designed an opportunity for expert modeling based on the instructor's expertise in the final stage. The final design of the structured debriefing was discussed and agreed upon by two PhDs in educational technology and one expert in business management simulation to ensure content validity and feasibility. In addition, we discussed and reviewed the appropriateness of the program in terms of content and time with one of the program facilitators. Through this process, the debriefing content was supplemented so that students could easily understand the reflection prompts and reflect within the allotted time. The detailed phases and corresponding activities of the structured debriefing designed in this study are presented in Table 4.

The procedure of the business simulation game program for the experimental and comparative groups with debriefing is shown in Figure 1. The pre-briefing and simulation game were identical in time and method, with the experimental group having a structured debriefing and the comparative group having only an instructor-led course summary and team debriefing.

Table 4
Structured debriefing phases and activities

Debriefing Phases			Debriefing Activities
Phase 1. Learner Self-debriefing	Description & Emotion		▫ Select the report of the round* that impressed you the most ▫ Describe what happened in the round
			▫ Describe your feelings during the round and after the round ended
	Evaluation & Analysis		▫ Evaluate and analyze what you did well and what you didn't do well in that round
	Conclusion & Action Plan		▫ Analyze team decision-making that significantly impacted the outcome of the round
			▫ Create an alternative action plan that may yield better results in the round
Phase 2. Instructor-led debriefing	Deepening & Expanding	Expert Modelling	▫ Identify differences in decision-making among the 5 teams and learn the standard decision-making scheme
			▫ Analyze overall team results and consequences of their decisions
			▫ Ask individuals what a better decision would be

* A round refers to one game of a year-long business simulation.
** Report refers to a one-year corporate management performance report for each company operated in the simulation game.

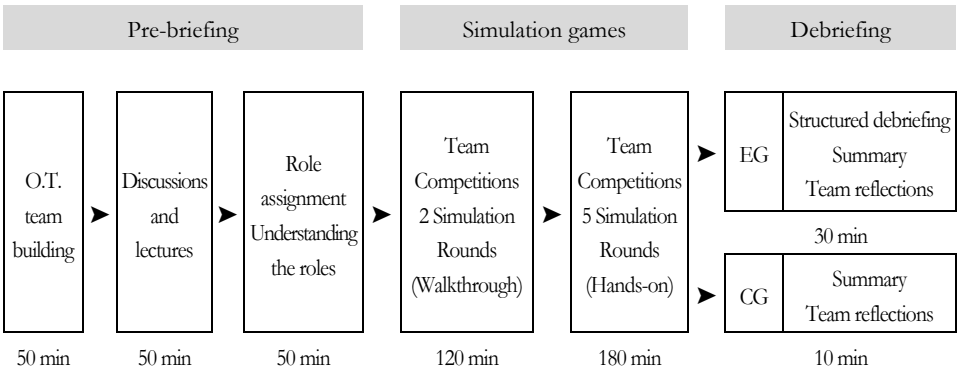


Figure 1. Flow of business simulation game program

Study Procedures

The research team was mainly concerned with what we had observed about the risks or failures of the game-based learning programs that were not closely linked to educational objectives. It is inevitable to deny that the learner's flow or engagement in simulation games does not guarantee learning. For this study, the structured debriefing was designed based upon an extensive literature review of debriefing related studies in the various fields such as nursing, business, safety, and health. To design the structured debriefing for this study context, we first defined the purpose of simulation education and the educational roles of debriefing in simulation education. Through an extensive literature review, the relevant models and theoretical background were collected and evaluated by the research team. The draft design of the structured debriefing was reviewed and revised by the CAPSIM experts and two doctoral students in educational technology. The prototype of the structured debriefing was developed and applied to the experimental group.

One of the researchers recruited students who would voluntarily participate in the business simulation game using CAPSIM at University A and B in G metropolitan city. University A was chosen as the comparative group with a traditional explanation-based debriefing by the instructor, while University B was chosen as the experimental group with the structured debriefing session.

The goal of the business simulation program for this study, which was part of the university's extracurricular entrepreneurship program, is for students to gain a practical sense of business management by running a fictitious company through an online simulation game, making decisions related to R&D, marketing, production, and finance, and seeing the results in real time. To accomplish this, students from each university were randomly assigned to teams of three to four students. Both schools followed the same flow of pre-briefing-simulation game-debriefing for 8 hours a day (9:00-18:00) while the only difference was in the type of debriefing.

In the pre-briefing phase, all participants were asked to complete a Google Forms

assessment of their business knowledge and entrepreneurship competencies. The program was then introduced through orientation, team building, lectures on business management theories and learning about roles and responsibilities within the team.

The simulation game phase consisted of a total of seven simulation games, two practice games and five actual games, in a competitive format between teams using the online CAPSIM program. A simulation session is called a round in CAPSIM and corresponds to one year of a company. In each round, teams were asked to manage a single company for one year by making various decisions based on an analysis of the market and their own company. Immediately after each round, the students were able to view the results and scores of each company's five key performance indicators (KPIs) - sales, profit, stock price, contribution margin, and emergency loan - through the information provided on the CAPSIM platform dashboard and the generated management results report. Based on these results, the team analyzes the status of the company and makes decisions to build a healthy and profitable company in the face of competition from other teams. Throughout the process, the instructor and a facilitator with more than two years of operational experience, who had received expert training on the program, provided continuous feedback on the students' questions and facilitated the activity process. Rather than providing answers to questions, the feedback was designed to help the teams better analyze their business landscape more accurately and guide them on factors to consider and directions to take in the decision-making process.

During the debriefing phase, the experimental group engaged in a 30-minute structured debriefing process consisting of learner self-debriefing and instructor expert modelling. The self-debriefing was conducted using a shared Google sheet, with structured reflection based on the questions posed (see Figure 4), followed by expert modelling. Students in the experimental group were given a report of their team's simulation results and the decisions they had made along the way and were

asked to reflect and respond to the questions posed. The rationale for using written rather than verbal group debriefing was that it allowed more time for individual reflection in a limited amount of time, and that individual students' experiences could be more organized and specific in writing. The instructor monitored the students' participation in real time during this process and facilitated debriefing activities. She then shared her impressions with the team based on the reflections expressed in the shared Google sheet. The site photos and screen capture of online CAPSIM program are presented (see Figure 2, 3). The screen for round includes scale bar, perceptual map, and customer needs sections. At the scale bar (top left), learners can determine specifications such as performance, size, durability of products to be researched within the company, and also determine the specifications of the company's products according to consumer needs and competitive products. In the perceptual Map (top right), learners can check the positioning of the formed market and products (high-tech, low-tech market), place the position according to product performance and size. In the customer needs (bottom), participants can customers' different needs for performance, size, durability, price, etc. and design products accordingly.

The round report (see Figure 3) provides all the information generated from the previous round, and learners can check the management performance of the entire team by round. They can evaluate KPI and star acquisition based on management performance compared to last year by company. Specifically they can check profit, return on sales, return on equity, return on assets, market share, stock price, asset turnover, and market cap by company.

After individual reflection, the instructor presented the results of the game in terms of overall rankings and rankings by areas such as profit and revenue. The debriefing was then designed as a thought-deepening phase, with expert modeling to explain the differences in decision-making between teams 1-5 based on specific team reports, follow-up questions about what decisions could have been made for better results, and suggestions for alternatives as an expert in business simulation.

Figure 2. Site photos

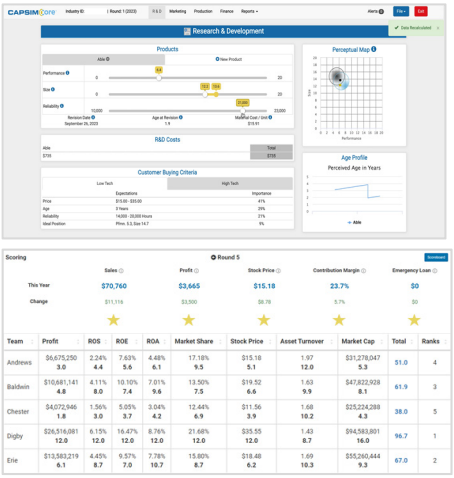
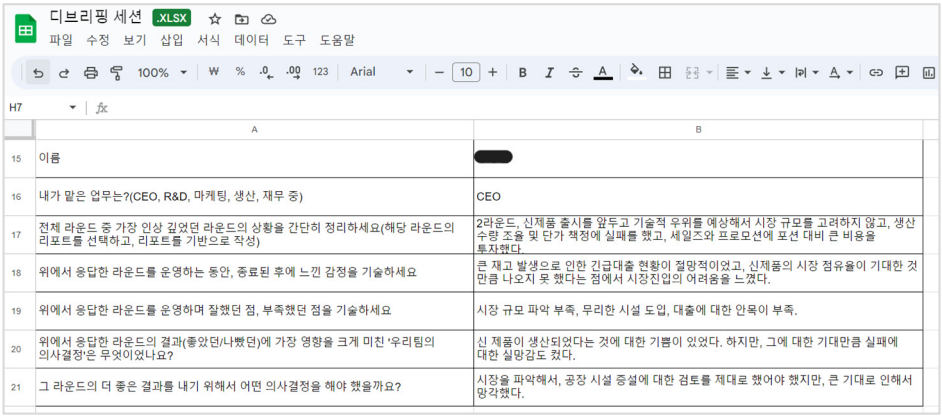


Figure 3. CAPSIM screen



	A	B
15	이름	[redacted]
16	내가 맡은 업무는?(CEO, R&D, 마케팅, 생산, 재무 중)	CEO
17	전체 라운드 중 가장 인상 깊었던 라운드의 상황을 간단히 정리하세요(해당 라운드의 리포트를 선택하고, 리포트를 기반으로 작성)	2라운드, 신제품 출시를 앞두고 기술적 우위를 예상해서 시장 규모를 고려하지 않고, 생산 수량 조율 및 단가 책정에 실패를 했고, 세일즈와 프로모션에 포션 대비 큰 비용을 투자했다.
18	위에서 응답한 라운드를 운영하는 동안, 종료된 후에 느낀 감정을 기술하세요	큰 재고 발생으로 인한 긴급대출 현황이 절망적이었고, 신제품의 시장 점유율이 기대한 것만큼 나오지 못 했다는 점에서 시장진입의 어려움을 느꼈다.
19	위에서 응답한 라운드를 운영하며 잘했던 점, 부족했던 점을 기술하세요	시장 규모 파악 부족, 무리한 시설 도입, 대출에 대한 안목이 부족.
20	위에서 응답한 라운드의 결과(좋았던/나빴던)에 가장 영향을 크게 미친 '우리팀의 의사결정'은 무엇이었나요?	신 제품이 생산되었다는 것에 대한 기쁨이 있었다. 하지만, 그에 대한 기대만큼 실패에 대한 실망감도 컸다.
21	그 라운드의 더 좋은 결과를 내기 위해서 어떤 의사결정을 해야 했을까요?	시장을 파악해서, 공장 시설 증설에 대한 검토를 제대로 했어야 했지만, 큰 기대로 인해서 망각했다.

Figure 4. Self-debriefing screen on google sheet

In the comparative group, the instructor announced the results of the game in terms of overall ranking and ranking by areas such as profit and sales immediately after the 7th round of the simulation, followed by an activity in which the teams presented their impressions of the learning experience. This was followed by a post-test to assess their knowledge of business management and entrepreneurship competencies. Two weeks after the end of each program, the final survey was conducted again to see if the students' level of business knowledge and

entrepreneurship competencies would persist. We chose to end the survey after two weeks because, first, we wanted to see if the effects of the business simulation persisted after the program ended and, second, we felt that this was a reasonable amount of time to allow participants to answer questions about the program from a reasonably accurate recollection. The specific research procedure is as follows Table 5.

Table 5
Study Procedure

Procedure	Targets		Details		Method
Define your research question	Generate research hypotheses		Analyze need and purpose, generate hypotheses		Literature Review
▼ ▼					
Designing structured debriefings	Simulation		Identify the definition and purpose of simulation game		Literature Review & Expert Review
	Debriefing		Identify debriefing objectives and utilization model		
	Reflections		Identify ways to promote systematic reflection		
	Tool Selection	Entrepreneurship competencies	Check definitions and components, revise and supplement questions		
		Business knowledge	Development of business management knowledge measurement questions		
▼ ▼					
Running a business simulation with structured debriefing	Pre-briefing		O.T. and team building		Observation
			Discussions and lectures		
			Role assignment, understanding the role		
	Simulation		Team competition simulations (2 practices, 5 games)		
	Debriefing		Experimental group	Comparative group	
			Learner self-reflection Expert modelling Team reflections	Summary Team reflections	
▼ ▼					
Analyze effectiveness	Entrepreneurship competencies		Measured before, after, and two weeks after operations		Surveys
	Business knowledge				

Data Analysis Methods

The collected data were analyzed using the SPSS 27.0 program. The characteristics of the two groups were tested for homogeneity using independent samples t-test. The reliability of the instruments used was analyzed using Cronbach's alpha coefficient. The business knowledge and entrepreneurship competencies of the two groups were analyzed using one-way repeated measures ANOVA. The significance level for hypothesis testing was set at .05.

Results

Validation of the homogeneity of the two groups

In order to determine whether the experimental group that applied structured debriefing with learner self-debriefing and expert modelling, and the comparative group that applied instructor-led debriefing were homogeneous, an independent samples t-test was conducted on the pre-test scores of business knowledge and entrepreneurship competencies, which are the dependent variables of this study. As shown in Table 6, there was no statistically significant difference between the two groups. In other words, the two groups can be considered homogeneous in terms of the level of business knowledge and entrepreneurship competencies.

Table 6
Homogeneity validation of experimental and comparative groups

	EG (N=19)		CG (N=24)		*t*
	M	*SD*	*M*	*SD*	
Business knowledge	5.94	1.54	5.41	1.86	-.999
Entrepreneurship competencies	3.99	.57	3.78	.74	-1.000

Hypothesis testing

A. Effect of structured debriefing on business knowledge

To verify the educational effectiveness of the structured debriefing developed by the research team, a repeated measures analysis of variance was conducted to determine the differences between the pre-, post-, and in 2 weeks periods and between the groups in terms of cognitive business knowledge. The descriptive statistics of the business knowledge of the experimental and comparative groups at each time point are as follows Table 7.

Table 7
Business knowledge of two groups by time point

	Pre-test		Post-test		Test in 2 weeks	
	M	*SD*	*M*	*SD*	*M*	*SD*
EG(N=19)	5.94	1.54	8.05	1.84	7.73	1.75
CG(N=24)	5.41	1.86	5.95	2.42	6.50	2.35

The mean of the business knowledge score of the experimental group tended to increase over time from pre (*m=5*.94) to post (*m=8*.05) and then decreased slightly after two weeks (*m=7*.73). However, it was still higher than the pre-test after two weeks. The comparative group continued to increase slightly from pre (*m=5*.41) to post (*m=5*.95) to two weeks (*m=6*.50). The results of the difference test between the experimental and comparative groups are shown in Table 8.

The mean of the business knowledge score of the experimental group tended to increase over time from pre (*m=5*.94) to post (*m=8*.05) and then decreased slightly after two weeks (*m=7*.73). However, it was still higher than the pre-test after two weeks. The comparative group continued to increase slightly from pre (*m=5*.41) to post (*m=5*.95) to two weeks (*m=6*.50). The results of the difference test between the experimental and comparative groups are shown in Table 8.

Table 8.
Business knowledge differences between groups and across time points

	Source	*SS*	*df*	*MS*	*F*	
Between Group	Group	52.719	1	52.719	6.683*	
	error	323.436	41	7.889		
Within Group	Time	54.120	2	27.060	12.401**	
	Group*Time	13.004	2	6.502	2.980	
	error	178.934	82	2.182		
Group		Pre-test	Post-test	in 2 weeks	*F*	*Bonferroni*
EG (N=19)	M	5.94[a]	8.05[b]	7.73[c]	9.57**	a<b, a<c
	SD	1.54	1.84	1.75		
CG (N=24)	M	5.41[a]	5.95[b]	6.50[c]	3.26*	a<c
	SD	1.86	2.42	2.35		

**p <.001 *p <.05

Table 8.
Business knowledge differences between groups and across time points

	Source	*SS*	*df*	*MS*	*F*	
Between Group	Group	52.719	1	52.719	6.683*	
	error	323.436	41	7.889		
Within Group	Time	54.120	2	27.060	12.401**	
	Group*Time	13.004	2	6.502	2.980	
	error	178.934	82	2.182		
Group		Pre-test	Post-test	in 2 weeks	*F*	*Bonferroni*
EG (N=19)	M	5.94[a]	8.05[b]	7.73[c]	9.57**	a<b, a<c
	SD	1.54	1.84	1.75		
CG (N=24)	M	5.41[a]	5.95[b]	6.50[c]	3.26*	a<c
	SD	1.86	2.42	2.35		

**p <.001 *p <.05

Table 8 shows the results of the repeated measures analysis of variance for business knowledge of the experimental and comparative groups. The Mauchly's sphericity test met the assumption of sphericity (W=.976, $\chi^2(2)$=.963, p >.05), and the Box test

met the assumption of equality (p =.497). The analysis showed a significant difference in business knowledge between the experimental and comparative groups (F=*6*.683, p <.05), and a statistically significant difference in business knowledge within the experimental and comparative groups over time (F=*12*.401, p <.05). The interaction effect of group and time was not significant, but it was found to be statistically significant at the .10 level of significance (F=*2*.980, p < .10). As a result, Hypothesis 1. There is no significant difference in the amount of change in entrepreneurial knowledge scores between the experimental group that received structured debriefing and the group that received instructor-led debriefing was rejected.

Effect of Structured Debriefing on Entrepreneurship Competencies

A repeated measures analysis of variance was conducted to determine the difference in entrepreneurship competencies by debriefing type. The descriptive statistics of the entrepreneurship competencies at each time point for the experimental and comparative groups are as follows Table 9.

Table 9
Entrepreneurship Competencies by Time Point

	Pre-test		Post-test		Test in 2 weeks	
	M	*SD*	*M*	*SD*	*M*	*SD*
EG(N=19)	3.99	.57	4.21	.59	4.09	.68
CG(N=24)	3.78	.74	4.31	.56	4.16	.53

The mean of entrepreneurship competencies of the experimental and comparative groups tended to increase over time from pre (m=*3*.99) to post (m=*4*.21) and then slightly decrease after two weeks (m=*4*.09), and similarly, the comparative group tended to increase over time from pre (m=*3*.78) to post (m=*4*.31) and then slightly decrease after two weeks (m=*4*.16). Table 10 below shows the results of the repeated measures analysis of variance for the entrepreneurship competencies of the experimental and comparative groups.

Table 10
Differences in entrepreneurship competencies between groups at time points

	Source	*SS*	*df*	*MS*	*F*	
Between Group	Group	.006	1	.006	.009	
	error	28.903	41	.705		
Within Group	Time	3.037	1.715	1.771	6.691*	
	Group*Time	.600	1.715	.350	1.321	
	error	18.609	70.321	.265		
Group		Pre-test	Post-test	In 2 Wks	*F*	*Bonferroni*
EG (N=19)	M	3.99	4.21	4.09	1.268	a, b, c
	SD	.57	.59	.68		
CG (N=24)	M	3.78	4.31	4.16	7.182	a<b
	SD	.74	.56	.53		

**p <.01

For the analysis results, the Mauchly test did not meet the sphericity assumption (W=.834, x^2(2)=7.265, p=.026), so the Greenhouse-Geissor based analysis (p=.858) satisfied the sphericity assumption, and the Box test failed to meet the equality assumption(p=.037), so we used the corrected degrees of freedom.

According to the repeated measures analysis of variance, the difference in entrepreneurship competence between the experimental and comparison groups was not significant (p=.926). However, there was a statistically significant difference in entrepreneurship competencies between the experimental and comparison groups over time (F=6.691, p<.05), and there was no interaction effect of group and time (F=1.321, p=.271). Therefore, Hypothesis 2 was accepted, which states that there is no significant difference in the amount of change in entrepreneurship competency scores based on the type of debriefing. The changes in business knowledge and entrepreneurship competencies of the two groups over time are shown in Figure 5 and Figure 6.

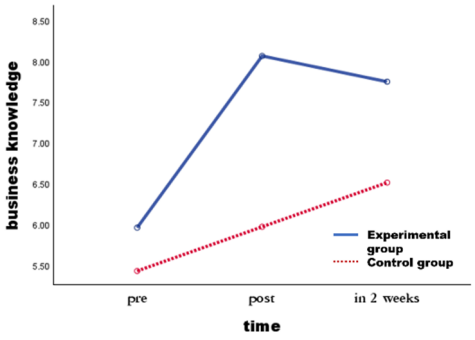


Figure 5. Changes in business knowledge over time by group

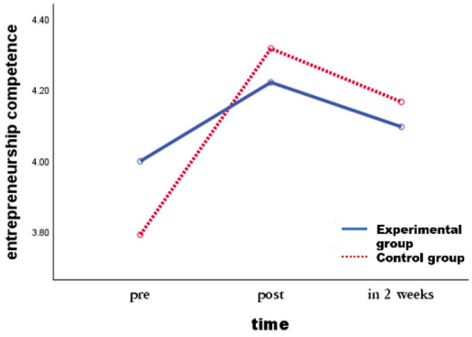


Figure 6. Changes in entrepreneurship competencies over time by group

Conclusion and Discussion

In the context of business simulation games, this study focused on the debriefing elements that are essential to link the game experience to meaningful learning outcomes. It sought to design a systematic and structured debriefing session for a holistic learning experience. After applying the developed debriefing session based on the design principles and model derived from the literature review to the actual program operation, we tested whether there are differences in business knowledge and entrepreneurship competencies at different points in time depending on the type of debriefing. The structured debriefing designed by integrating learner reflection and expert modelling by instructor was based on the reflection cycle proposed by Gibbs (1988) and the 3D model to promote systematic reflection by having students recall the simulation situation and emotions, analyze and evaluate what they did well and poorly in their own and their team's decision-making, and explore alternatives. Expert modelling was then provided to extend learners' metacognitive thinking. This debriefing process ensured that students' immersive experience in the simulation game led to deep learning and transfer of learning to real-world situations. Key findings and discussions from this study include the following.

First, the post-test business knowledge score of the experimental group with structured debriefing was statistically significantly higher than that of the comparative group, and there was a statistically significant difference between the pre- and post-test business knowledge scores of the experimental group. These results suggest that structured debriefing has a positive effect on knowledge retention. This result is consistent with the findings of Lacruz and Américo (2018), who provided a structured debriefing based on Kolb's (1984) experiential learning theory in a business simulation game, which found that debriefing with systematic and structured questions promotes learners' thinking and learning, identifies gaps between the simulation experience and students' knowledge, and helps them connect knowledge and practice (Lasater, 2011). It is also consistent with previous studies (Jansson et al., 2017a; Jeong & Choi, 2017) that report that structured debriefing has a significant effect on knowledge improvement compared to general debriefing. The step-by-step questions developed to facilitate students' self-debriefing may have contributed to the improvement of learners' academic performance by encouraging active and higher-order reflection, which is consistent with the findings that debriefing that promotes active reflection and incorporates expert modeling is an essential and important process to help learners see the connections between the game context and learning, leading to in-game achievements leading to learning outcomes (Moreno-Ger et al., 2008). These findings have important implications for previous studies that have shown that simulation games alone do not lead to meaningful learning outcomes. Although the simulation program was effective in helping students acquire business knowledge, the structured debriefing had a more significant positive effect, which means that learners revised their existing cognitive structures through reflection and internalized the new knowledge. This reflection-based systematic debriefing process seems to have had a positive impact on the increase in academic performance and its maintenance at some level after two weeks. Boet et al. (2011) found that the majority of students who experienced virtual reality simulations reported that self-debriefing provided a relaxed and safe environment for

debriefing and was a good opportunity to engage in in-depth reflection at their own pace. Kim et al. (2017) found that most students perceived it as an effective method to guide them to discover their mistakes rather than having the instructor clarify them directly. In other words, the improvements in academic performance found in the study suggest that the systematic debriefing process based on learner reflection designed in this study leads to learner learning outcomes and positively affects learning retention and transfer, thereby enhancing the educational effectiveness of the simulation.

Second, there was no significant difference between the experimental and comparative groups in terms of entrepreneurship competencies. However, there was an increase in entrepreneurship competencies over time for both the experimental and comparative groups. The type of debriefing had no effect as there was no significant difference in entrepreneurship between the two groups, meaning that the structured debriefing designed for this study may not be effective in fostering entrepreneurship in learners. While there was no difference by time in the experimental group, there was a statistically significant difference in the comparison group, which means that the business simulation game experience itself could affect the attitudes of the comparison group learners. These findings differ from those of Boet et al. (2013), who found that debriefing had a positive impact on definitional aspects such as leadership and teamwork. In the debriefing developed in this study, the cognitive part of the debriefing consisted of recalling the situation and emotions at the time based on specific key performance indicators (KPIs: i.e., sales, profit, stock price, contribution margin, and emergency loan results), analyzing and evaluating the causes and consequences of the company's situation, and finding alternatives to more appropriate decisions to improve sales, profit, and stock price. However, the entrepreneurship competencies measured in this study include not only knowledge but also attitudes, using questions such as "I am open to other people's value-creating activities" and "I can understand social trends and solve problems". Competencies are the internal characteristics of an individual that form the basis for

effective and superior behavior in a particular situation or task, and include motivation, personality traits, self-concept, knowledge, and skills (Spencer, L. M. & Spencer, S. M., 1993). Therefore, if the goal of education is to encompass both cognitive and definitional change, debriefing should reflect the principles and elements of reflection for definitional change. Furthermore, empirical research on the impact of such debriefing on the justice domain needs to be conducted.

The aim of this study was to verify the effectiveness of a debriefing process developed through an experimental study, which is rarely studied in business simulation game programs. We found that the debriefing process developed and supplemented in this study leads to learning outcomes and has a positive impact on retention, thus increasing the educational effectiveness of simulation games. The developed debriefing can be used universally in different types of training programs for business simulation. The reflection questions for each stage can be adapted to the goals, content, and keywords of the training program according to the instructor's judgment.

The limitations of this study are as follows. First, the debriefing process applied to the experimental group took approximately 20 minutes longer than the comparative group due to the time required for students to complete the reflection sheet. Although this is not a significant difference compared to the total program time, it is difficult to completely exclude the possibility that it may have some impact as an extraneous variable. Therefore, it is necessary to strictly control the debriefing time in subsequent studies to study the impact on academic performance and entrepreneurship competencies. Secondly, as the participants were recruited voluntarily and the study was a quasi-experimental study, the participants' variables were not strictly controlled. Readers should be cautious in generalizing the results of the study to other subjects.

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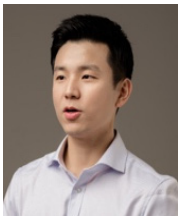

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