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Innovative Technologies and Learning

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Sections

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This book constitutes the refereed proceedings of the 5th International Conference on Innovative Technologies and Learning, ICITL 2022, held in Porto, Portugal, in August 2022. The 53 full papers presented together with 3 short papers were carefully reviewed and selected from 123 submissions. ICITL focuses on artificial intelligence in education, VR/AR/MR/XR in education, design and framework of learning systems, pedagogies to innovative technologies and learning, application and design of innovative learning.

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Keywords

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computer vision **curricula** **e-learning**

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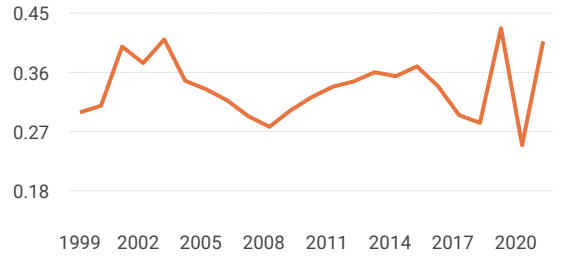

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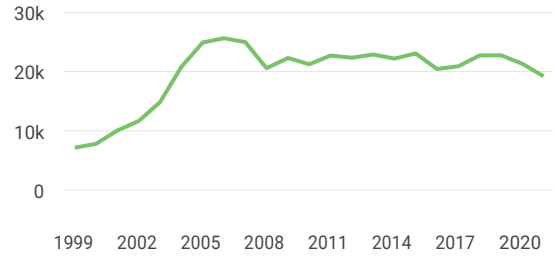

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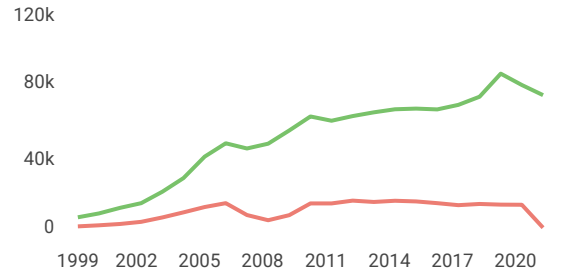

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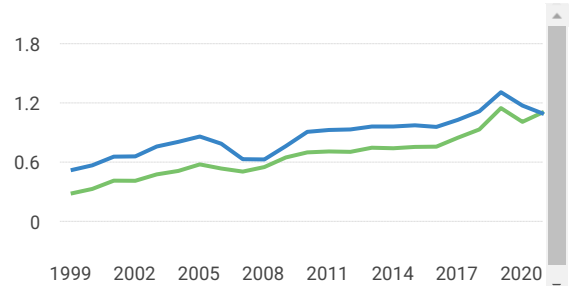

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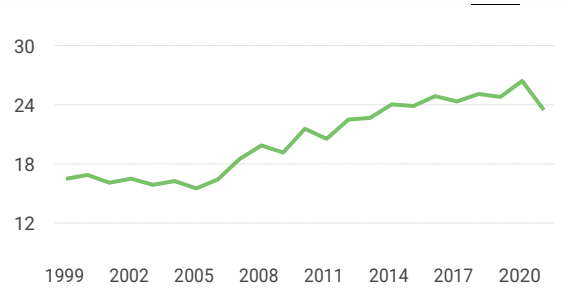

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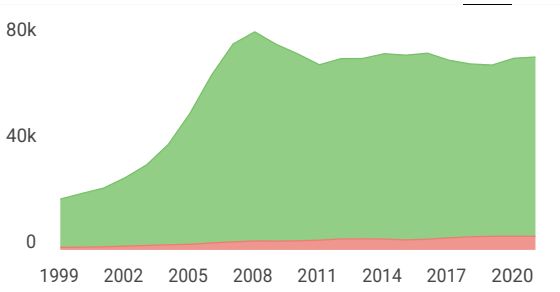

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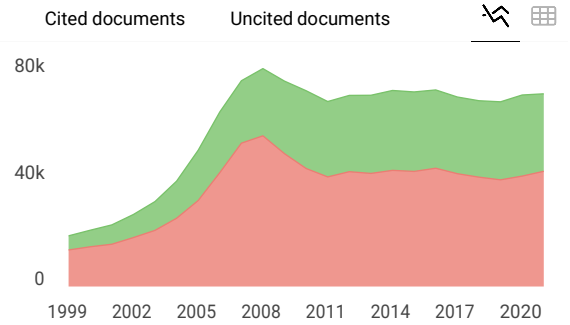

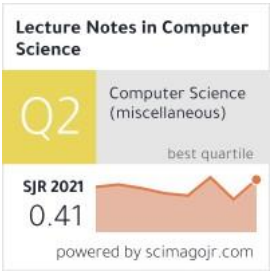

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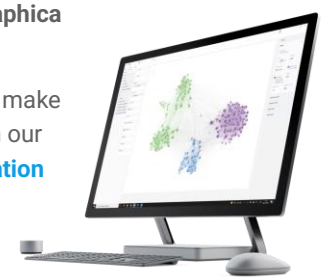

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BSG - A Serious Game Tool to Improve Student's Self-efficacy, Motivation, and Engagement in Entrepreneurship

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Abstract. Entrepreneurship education has grown tremendously, as has been extensively documented. Entrepreneurship education has expanded in scope, significantly extending across fields in universities and penetrating all levels of educational systems. Moreover, the notion and measurement of engagement have become increasingly important to academics and practitioners. Some researchers have discovered that an approach for increasing engagement in a beneficial way has been established from games. The study adopts a business simulation game (BSG) as a serious game in the Entrepreneurship course to develop students' self-efficacy, motivation, and engagement. The quasi-experiment was applied to 48 university students. The findings indicate that BSG, based on real challenges in a business environment, allows students to develop their self-efficacy, motivation, and engagement. BSG provides significant opportunities and new alternatives for developing management, leadership, and entrepreneurial skills.

Keywords: Serious game · Simulation · Entrepreneurship education · Classroom teaching

1 Introduction

Entrepreneurship is a critical economic activity in the twenty-first century. Entrepreneurship empowers today's youth to establish their businesses and acquire soft critical skills that will serve them well across their professional careers [1]. Universities are commonly regarded as incubators of entrepreneurial spirit and culture, with the expectation that they will play a critical role in discovering and developing students' entrepreneurial talents and tendencies and enabling them to start their ventures [2]. Numerous researchers and educators define entrepreneurship education's objective as increasing and enhancing students' knowledge of entrepreneurship as a process and prospective vocation and their understanding of how multiple management disciplines interact. Moreover, simulation-based learning, which manipulates learning information frequently and observes the

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manipulation outcomes in order to help students better grasp real-world experience and practice, is one of the most popular ways of entrepreneurship education today [2–4].

A serious game is characterized as one that has an educational purpose but also incorporates three essential components: enjoyment, experience, and multimedia [5]. Serious games are created with a definite educational goal, not only for enjoyment. Serious games are a relatively recent addition to entrepreneurship classrooms. According to [4] games combine trial-and-error learning, immediacy, complexity, and point-scoring features.

Several studies have just started investigating the feasibility of employing game-based learning to boost students' self-efficacy in various topic areas [6]. Self-efficacy is a term that relates to an individual's perceived capacity for gaining knowledge or completing tasks at a specified level [7]. Furthermore, Self-efficacy is a critical cognitive factor affecting motivation and engagement [8]. Self-efficacy affects one's motivation and the resilience required to complete a challenging work [7, 9].

However, the application BSGs, as serious games to the study of engagement are a relatively recent area of research [10]. BSG should be designed in such a way that groups of students collaborate, hence increasing engagement. They asserted that participation in the game and enjoyment are the two most significant aspects affecting the success of a BSG [11]. Moreover, [12] stated that students' motivations affect their level of engagement throughout games. The nature and design of gaming activities significantly impact a learner's motivation, engagement, and problem-solving performance.

[2] stated that studies on the influence of simulation games and game-based learning in entrepreneurship education are limited; therefore, this study examines how BSG as a serious game might boost entrepreneurship motivation, self-efficacy, and engagement. The study's objectives were to address the following:

1. Does employing a BSG enhance students' self-efficacy compared to a traditional classroom?
2. Does employing a BSG enhance students' motivation compared to a traditional classroom?
3. Does employing a BSG enhance student engagement compared to a traditional classroom?

2 Introduction

2.1 Serious Game and Business Simulation Game

Mainly, serious games are created with the primary purpose of attaining a fun experience and engaging players. Furthermore, a BSG, as a serious game, can be utilized to boost entrepreneurial motivation and competencies [1]. A simulation game has been found to improve students' comprehension of specific courses by simulating real-world circumstances through frequent manipulations of learning content and examinations of the outcomes of those manipulations [13, 14]. Fun, play, rules, targets, engagement, outcomes or feedback, winning states, competition, and problem-solving are all characteristics of simulations [3]. Moreover, business simulations are most frequently used

in management, commerce, financial, budgeting, marketing, project management, and entrepreneurship [4, 15].

Serious games provide educators with more realistic and engaging learning experiences. The entrepreneur's educational method, based on serious games, enables the integration of amusing elements and detailed information, encouraging the learning process and assisting students in feeling more prepared for starting a new firm [1].

2.2 Self-efficacy in Entrepreneurship

A greater sense of self-efficacy has benefited learning, performance, self-regulation, and motivational goals such as activity selection, concentration, resilience, and enthusiasm [7, 16]. Students who are self-efficacious are enthusiastic and engaged in their studies, which enhances their capacity as learners [17].

[7] characterized perceived self-efficacy as "beliefs in one's skills to arrange and carry out the objectives – to achieve certain goals." Furthermore, a significant aspect of this concept is that self-efficacy affects motivation and the level of perseverance required to complete a challenging activity [9]. This is critical for educators since students are expected to develop into motivated and persistent managers. Self-efficacy has been shown to affect behavior significantly and results in various topics, such as human resources, information management, business, and entrepreneurship.

Entrepreneurial self-efficacy is characterized as an individual's confidence in their capacity to fulfill entrepreneurial roles and responsibilities successfully. The study found a significant correlation between entrepreneurial self-efficacy and students' desire to begin their own company [2, 18].

2.3 Motivation

Intrinsic and extrinsic motivation can be classified according to the various reasons or objectives that motivate action. Intrinsic motivation is defined as motivation that originates within an individual rather than from external rewards, whereas extrinsic motivation is defined as motivation produced by tangible rewards or penalties associated with success or failure in a task [2, 19]. In this study, learning motivation is defined as students' intrinsic motivation to learn. Additionally, it refers to students' motivation to continually dedicate themselves to acquiring knowledge and competencies [20].

Previous studies examined a range of applications within the context of game-based learning and the effect of games on learning motivation. For instance, [21] devised a science-learning experiment to determine whether increasing students' engagement and motivation inside an online game-based learning environment may improve their learning accomplishment. According to Kuo's studies, game-based learning can effectively motivate students to engage in science exploration and the learning process [21].

2.4 Engagement

Engagement is characterized as the degree to which students participate in activities, such as active learning, enhancing learning programs, seeking help from faculty, or

cooperating with other students [4, 22]. Engagement entails classroom instruction and can relate to both academic and non-academic areas of university education [23, 24]. Moreover, Engagement indicators are internal components of the idea of engagement, and the primary indicators of engagement are commonly acknowledged as cognitive, emotional, and behavioral indicators [10, 11].

In game-based learning research, engagement has been a fundamental concept. However, there are remarkably few researches that analyze psychological engagement in game-based learning [25]. In a game-based learning environment, [26] discovered a correlation between these three engagement characteristics (cognitive, emotional, and behavioral).

3 Methods

3.1 Data Collection and Participants

The quasi-experimental study was conducted at the agribusiness faculty of one state-owned university in Indonesia. A total of 48 students from second and third-year students were enrolled in two classes of the entrepreneurship course. Both classes were taught by the same instructor, using identical course materials but with different instructional strategies. The control group used the conventional learning approach, whereas the experimental group participated in a serious game. Data were collected through a self-administrated questionnaire at the end of the experimental activity. The participants' identities and confidentiality were assured.

3.2 Procedure

This study employed a serious business simulation game developed by United Sates simulation developer Marketplace Simulation. Figure 1 illustrates the experimental procedure used in this study. During the first meeting, the students were informed about the course's aims and objectives and the game's operations exclusively to the experimental group participants. After becoming familiar with the serious game, students were divided into teams of six members. Each team was tasked with managing a company to compete against companies operated by other students. All students in both groups completed the pretest questionnaires that assessed their self-efficacy, motivation, and engagement in the first meeting.

The experimental group of students has hands-on experience in starting a new business and competing in a simulated market. The game featured six decision rounds (meeting 2–7) that created interconnected learning. They are challenged to manufacture and sell carbon fiber bicycles in various market segments. Students were required to formulate business strategies, analyze the market data, plan production, and engage in R&D to gain a competitive edge to serve the customers through interrelated tactical decisions. The control group students learned through the conventional learning approach of PowerPoint lectures, direct instructions, and discussion to start a business. All students completed the posttest questionnaires on self-efficacy, motivation, and engagement in the eight meetings.

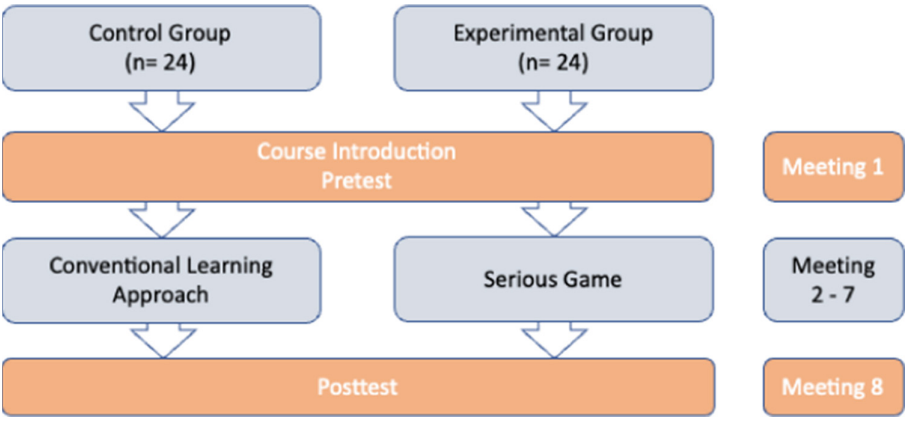

Fig. 1. The experimental procedure

3.3 Procedure

The variable was measured using a well-established questionnaire from prior literature. Student self-efficacy and motivation were assessed using the Motivated Strategies for Learning Questionnaire, developed by [27]. The self-efficacy questionnaire has eight items that assess participants' confidence in their abilities to execute the task—student motivation comprised of 14 items representing various motivational factors. The students' engagement was measured by [28] engagement scale, consisting of 17 items indicating various reasons for engaging in the classroom activity. All items were adapted for this study and served as the pretest and posttest. The items were assessed on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree)—Cronbach's α coefficients for the pretest and post-test of all variables were shown in Table 1.

Table 1. The reliability of the measurement

Variable	Items	Cronbach's alpha α	
		Pretest	Posttest
Self-efficacy	8	0.916	0.818
Motivation	14	0.990	0.898
Engagement	17	0.779	0.936

3.4 Data Analysis

The differential analysis between experimental and control groups was conducted using a one-way analysis of covariances (ANCOVA) to see significant differences in student self-efficacy, motivation, and engagement between the two groups. The pretest scores

served as a covariate, whereas the posttest scores served as the dependent variable. Levene's test was employed to determine the homogeneity of the participants, and the findings confirm that both sets of groups were statistically homogenous.

4 Results

4.1 Self-efficacy

The ANCOVA result in Table 3 shows a significant difference in self-efficacy between control and experimental groups ($F = 24.802$, $p < 0.05$, $\eta 2 = 0.305$). Further analysis of the average scores of the two groups in the self-efficacy posttest (Table 2) shows that compared with the control group ($M = 3.8854$, $SD = 0.48471$), the experimental group had stronger self-efficacy ($M = 4.4531$, $SD = 0.4775$). This implies that a serious game can boost students' self-efficacy more than a conventional learning approach.

Table 2. The descriptive results of student's self-efficacy, motivation, and engagement

Variable	Group	Pretest		Posttest	
		Mean	SD	Mean	SD
Self-efficacy	Control group	4.0573	0.64688	3.8854	0.48471
	Experimental group	3.8073	0.58744	4.4531	0.4775
Motivation	Control group	3.3512	0.59647	3.6696	0.4056
	Experimental group	3.5417	0.97823	4.3958	0.34287
Engagement	Control group	3.5368	0.42642	3.4926	0.4536
	Experimental group	3.424	0.4709	4.6054	0.38922

Table 3. The ANCOVA results of student's self-efficacy, motivation, and engagement

Variable	Mean square	F	p	$\eta 2$
Self-efficacy	4.847	24.802	0.000*	0.305
Motivation	6.220	43.153	0.000*	0.49
Engagement	15.585	96.608	0.000*	0.682

*$p < 0.05$

4.2 Motivation

According to the results of ANCOVA test, there was a significant difference in students' motivation between the two groups ($F = 43.153$, $p < 0.05$, $\eta 2 = 0.49$), as seen in Table 3. The comparison of the motivation posttest indicates that the students in the experimental group feel more motivated ($M = 4.3958$, $SD = 0.34287$) than control group ($M = 3.6696$, $SD = 0.4056$) (Table 2).

4.3 Engagement

Table 3 shows that there is a significant difference between control and experimental groups ($F = 96.608$, $p < 0.05$, $\eta 2 = 0.682$). The comparison of the engagement posttest scores (Table 2) indicates that compared with control group ($M = 3.4926$, $SD = 0.4536$), the experimental group showed more engagement in the learning activity ($M = 4.6054$, $SD = 0.38922$).

5 Discussion

A BSG was used as a serious game in this study to increase students' self-efficacy, motivation, and engagement.

5.1 Effects on Students' Self-efficacy

The findings of this study indicate that using a BSG has a significant and beneficial effect on students' self-efficacy in entrepreneurship. Hence, students who actively participate in the simulation develop a strong belief that they are capable of successfully running their own business. When students in the experimental group participated in BSG activities, they demonstrated a considerably more significant improvement in self-efficacy than students in the control group. Furthermore, students' capacity to engage in various marketing activities in the simulation game may be self-monitored and evaluated to develop and enhance their sense of entrepreneurial self-efficacy.

5.2 Effects on Students' Motivation

This study shows that the use of a BSG had a significant and positive impact on the students' motivation. The game's components, including badges, points, levels, and trophies, promoted student participation. Additionally, the game encouraged student engagement due to its user-friendly and interactive Web application. Earning bonus points and badges as an incentive for simulation accomplishments increased student motivation and satisfaction.

5.3 Effects on Students' Engagement

The BSG increased student participation in general. The simulation's interactions increased student involvement. All simulation game work incorporates debate and critical thinking about market, sales, production, and finance issues. As a result, the experimental group's average level of involvement was higher than that of the control group.

6 Conclusion

The BSG activities required students to quickly overcome barriers and tasks, which enhanced their self-efficacy throughout gameplay. As a result, the results suggested that higher self-efficacy resulted in a higher student engagement, with students focusing on future motivation and commitment to completing the BSG's challenge problems. It is determined that one of the most crucial aspects of game design is sustaining student motivation throughout gameplay. Given that students are inquisitive individuals that enjoy novelty and problem solving, one strategy for addressing the issue of sustainability is to give students with new and demanding game scenarios as they progress through their gameplay assignments. It will keep students engaged and motivated.

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