

Review Article

Business Simulation Games in Higher Education: A Systematic Review of Empirical Research

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Over the last few years, business simulation games (BSGs) in higher education have attracted attention. BSGs tend to actively engage students with course material, promoting higher engagement and motivation and enabling learning outcomes. Increasingly, researchers are trying to explore the full potential of these games with an upsurge of research in the BSG field in recent years. There is a need to understand the current state of research and future research opportunities; however, there is a lack of recent systematic literature reviews in BSG literature. This study addresses this gap by systematically compiling online empirical research from January 2015 to April 2022. We followed PRISMA guidelines to identify fifty-seven (57) papers reporting empirical evidence of the effectiveness of BSGs in teaching and learning. Findings showed that BSGs improve learning outcomes such as knowledge acquisition, cognitive and interactive skills, and behaviour. The review also summarises different issues concerning the integration of BSGs into the curriculum, learning theories used in the selected studies, and assessment methods used to evaluate student achievement in learning outcomes. The findings of this review summarise the current research activities and indicate existing deficiencies and potential research directions that can be used as the basis for future research into the use of BSGs in higher education.

1. Introduction

The simulation and virtual training market was valued at \$204.41 billion in 2019 and has been predicted to reach \$579.44 billion by the end of 2027 according to the Global Opportunity and Industry Forecast 2020-2027 report [1]. For many years, simulations employing mixed reality have been a sign of the future since they merge several linked disciplines of art and science to generate improved interactive experiences [2]. The cross-border combination of education and gaming has gotten a lot of interest from many parts of society, including education and technology. By providing a fun and engaging learning environment and encouraging students to learn via hands-on experience, simulation games have the potential to enhance students' advanced skills [3]. Business simulations were established in the 1950s, and the simulation industry has grown significantly since then, with a significant growth in usage by business schools in higher

education institutions. With the availability of off-the-shelf and customised business simulation games (BSGs), universities started integrating them into their courses in the mid-60s to provide an active learning experience to the students [4]. Since then, business simulations have been increasingly used to enhance students' learning. This development has resulted in an increase in research in this field. Academics have attempted to establish the advantages of these games via evidence-based research [5]. Research evidence is used to inform policymakers about the effectiveness of a specific educational approach. However, single studies present contextual and methodological limitations of research evidence as most empirical research are done within a confined context [6]. Therefore, there is a need to identify, evaluate, and synthesise research results from different empirical studies focusing on a single phenomenon to create a summary of current evidence. If done systematically, a literature review provides researchers and practitioners with a broad overview

of the research area, shows what work has been done, helps identify research gaps, and directs future research in that particular subject area [7].

Past reviews summarising the impact of using BSGs as part of pedagogical approaches to meet learning outcomes show ambiguous results and lack empirical evidence. Furthermore, the extensive effort and timescale involved in carrying out and then publishing literature reviews make them obsolete relatively quickly. By the time they are completed, many new studies have been done on the same phenomena with different or sometimes conflicting results [8]. Fu et al. [9] conducted the last literature review on the reported empirical evidence of the positive impact of BSGs on learning, summarising studies from 2005 to 2014. However, a significant expansion has been observed in BSG research, as shown in Figure 1.

Some of the newer games, teaching and evaluation techniques, and positive effects of these games on different learning and behavioural outcomes were examined and explored during this period. There is a value in systematically compiling these studies to provide a sound basis for further endeavours in this field. Therefore, this review is aimed at presenting a systematic literature review (SLR) of empirical studies on BSGs published between January 2015 and February 2022. The review addresses the research question: “What empirical evidence exists concerning the use of BSGs in promoting learning and effective teaching?” During the literature review, four distinct themes emerged that were then used to create four subquestions to analyse the fifty-seven selected papers for this systematic literature review. Figure 2 represents the themes.

- (i) Integration of BSGs in higher education: this theme addresses the integration of business simulation games to teach IT and business courses. This section also describes the instructors’ role in facilitating the learning process by using BSGs and the barriers to integrating these games
- (ii) Learning theories/models and BSGs: different learning theories and models are identified under this theme in BSG research, and links between these theories/models and simulation games are established
- (iii) Evaluation of BSGs: this theme discusses frameworks and guidelines to efficiently evaluate the simulation games’ learning outcomes
- (iv) Learning outcomes of BSGs: this theme addresses the different learning outcomes that can be achieved using simulation games as a learning tool. The learning outcomes are categorised into skills, knowledge, and behavioural effects

Overall, this SLR provides an overview of empirical research, what is currently being investigated, and possible future directions in BSGs research.

The structure of the rest of the paper is as follows. Section 2 presents the background of BSGs and discusses the past reviews on BSGs. Section 3 describes the research

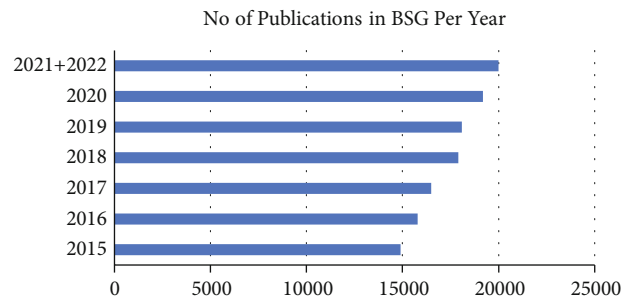


FIGURE 1: No. of publications in BSG literature from Jan 2015 to Feb 2022.

methodology. The results are shown in Section 4. Section 5 discusses the findings of the study. The limitations and future recommendations of the selected papers are discussed in Section 6, and Section 7 concludes the paper with a brief discussion of future research agendas.

2. Background

In this section, a brief introduction to BSGs, previous reviews, and their limitations are presented.

2.1. Business Simulation Games (BSGs). BSGs are experiential learning tools where students learn business processes by running a simulated firm in a risk-free, interactive, and realistic environment. Students make all strategic decisions and compete either individually or in teams. These active learning experiences improve student engagement and develop collaboration, decision-making, problem-solving, and critical thinking [4]. BSGs have been very popular in business education since their inception. With the technological developments in operations research, war games, computer technology, and education theory, educators started integrating these games into business courses in the late 1950s [10]. Games such as the Beer Distribution Game [11] and the Markstrat Simulation Game [12] were released in the following years and gained popularity among educators.

Technology developments such as interactive features, advanced graphics processing, artificial intelligence, and cloud computing have influenced business simulations [13, 14]). Furthermore, BSGs are sometimes used as incentives to make crowdsourcing (crowd-based online work) more valuable and attractive [15]. Global enterprises like Google, Microsoft, American Express, and Caterpillar are using these simulation games to train their employees and managers [16]. Currently, many business courses include one or more management simulations. They are more commonly used at the undergraduate level to provide an active learning experience to students [17]. In addition to encouraging higher engagement levels, simulations in the business context can improve soft skills such as teamwork, decision-making, leadership, and other technical skills used in strategic management, marketing, finance, and project management.

In contrast to passive learning experiences that can occur in traditional teaching techniques, such as lectures and tutorials, BSGs bridge the gap between academia and industry

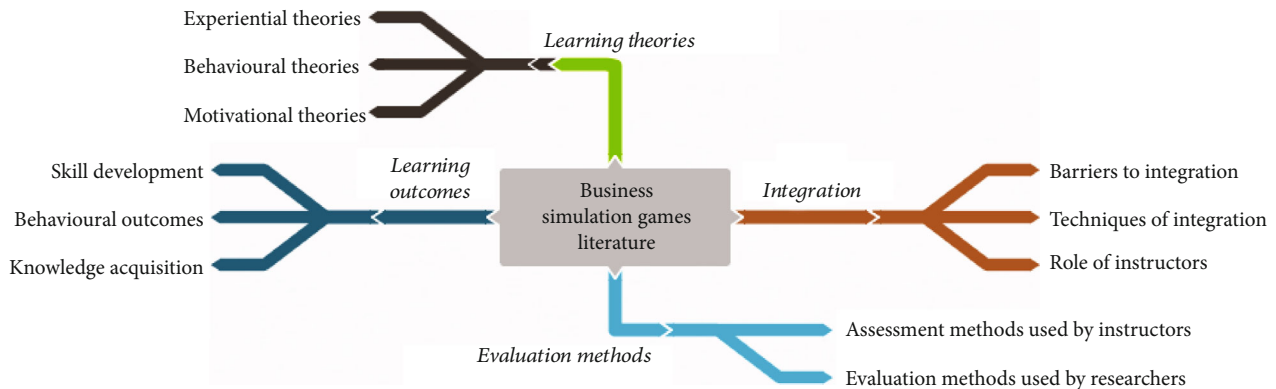


FIGURE 2: Themes in BSG literature.

through experiential learning techniques. In BSGs, students run a simulated company to learn business processes and strategies. They get the opportunity to integrate and experiment with what they have learned through simulations, solve complex problems, get involved in active decision-making, experience the consequences of their decisions, and learn from their mistakes [18]. BSGs are an effective teaching technique to help students develop managerial and generic skills in demand in the industry [19].

2.2. Past Reviews on Simulation Games. Several studies summarised the literature on simulation games in the past ten years, but most reviews target a specific and limited feature of simulation games. Table 1 presents some of the reviews and meta-analyses published between 2009 and 2022 on game-based learning and their respective scopes:

Although the past reviews focused on the simulation games' effectiveness in building knowledge and skills, there are limitations in these studies. For example, the latest SLR by Ferreira et al. [20] only focused on researchers that used electroencephalogram (EEG) or eye tracking (ET) signals as data collection methods. Another limitation of this review is the limited amount of research linking ET and EEG devices to help study the BSG user experience which is a drawback of this work. These devices have employed marketing, human behaviour, and applied neuroscience research. However, they are integrated with other methodologies, comparing and contrasting findings. This paper lacks methodological integration, leading to skewed outcomes. In another review, Sitzmann [30] statistically summarised 52 studies on simulation games' effectiveness in enhancing industry-related knowledge and skills. The review focused on adult work competency requirements in organisational settings and did not discuss simulation games in educational settings. The study findings showed that technology could improve the learning experience and stressed the importance of multiple factors (integration, training, and debriefing) which can contribute to rich learning experiences through gamified learning. A review by Connolly et al. [28] addressed the impact of games on overall learning outcomes. That review had a broad scope, and instead of just focusing on simulation games, it considered all computer games (entertainment games, serious games, video games, simulation games, etc.).

It concluded that computer games positively impact students' cognitive, affective, behavioural, and motivational outcomes. The most significant gains were in knowledge acquisition and affective and motivational outcomes. In 2016, the same researchers [23] presented an updated version of their previous review, including entertainment and educational computer games. This review again demonstrated positive impact on learning outcomes but did not specifically focus on computer simulation games. Lopes et al. [26] summarised the effect of using simulation games as a means of meeting learning outcomes, but again, the review only covered leadership development through simulation games. Scholtz and Hughes [32] conducted a systematic literature review to explore the innovative and new pedagogical methods instructors use to integrate simulation games into business courses. The scope of that review was limited to exploring the educators' role in the learning process.

3. Research Methodology

A systematic literature review (SLR) helps to compile relevant research on a particular phenomenon of interest or topic [33]. In line with Keele [34] guidelines, this study used a systematic process to conduct a comprehensive literature review. This process involves developing protocols for the literature search, identifying and selecting relevant primary studies, extracting and synthesising data, and reporting results.

The broad objective of this SLR was to answer the following research question.

RQ: "What empirical evidence exists concerning using BSGs to promote learning and effective teaching?"

The subquestions that emerged from the coding of the literature were as follows:

- (i) What are the learning outcomes of BSGs?
- (ii) How are BSGs integrated into existing curricula to support learning outcomes?
- (iii) What were the learning theories used in BSG literature?

TABLE 1: Previous literature reviews on simulation games.

Year and author	Focus of review
Ferreira et al. [20]	SLR on research related to the learning process with (serious) business games using data collection techniques with electroencephalogram or eye tracking signals
Stanitsas et al. [21]	Simulation games facilitate sustainable education. The primary focus was on sustainability
Subhash and Cudney [22]	Categorisation of gamified and game-based learning
Subhash and Cudney [22]	Evaluation methods in computing education
Boyle et al. [23]	Reported empirical evidence of the positive impact of computer games on learning
Fu, Hainey and Baxter [9]	Reported empirical evidence of the effect of BSGs on learning outcomes
Giessen [24]	Serious games' role in improving learning outcomes
Hamari, Koivisto and Sarsa [25]	Reported empirical studies on the effect of gamification on learning
Lopes et al. [26]	Reported effect of business games on leadership development
Wouters [27]	Reported effect of business games on leadership development
Connolly [28]	Reported empirical evidence of the positive impact of computer games on learning
Tobias [29]	Reported empirical evidence of the use of serious games in learning
Sitzmann [30]	Industrial and organisational psychology and management
Jahangirian et al. [31]	Review simulation applications within manufacturing and business fields

- (iv) What assessment methods are used in BSG literature to evaluate learning outcomes and game performance?

Learning outcomes are classified into behavioural, knowledge, and skill outcomes [35].

3.1. Data Sources and Search Strings. Databases used to search for the relevant open access research papers were EBSCOhost, Emerald insight, IEEE, Informit, JSTOR, Oxford, Sage, ScienceDirect, Scopus, SpringerLink, Tylor & Francis, Web of Science, Wiley Online Library, and Google Scholar. These databases are the best and most supportive resources for computing game research.

Initially, we conducted Boolean searches using the “AND” operator between the keywords business simulation games, learning outcomes, and higher education. To avoid losing relevant data, researchers also used alternative words by conducting a Boolean search again, but they used “OR” as an operator this time. Table 2 shows the main key terms and alternative search terms for data search.

The snowballing method [36] was applied to exhaust the included papers' relevant sources to minimise any data loss. This process was considered complete when no pertinent new papers were found. The literature search was last updated on 28th February 2022.

3.2. Selection Process. This review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews (PRISMA) guidelines. Frequently, systematic reviews indicate a lack of comprehension of common principles that enable them to be replicable and scientifically competent. PRISMA is a common peer-reviewed methodology that utilises a checklist of guidelines, which was carefully adhered to in this work. It adds to the revision process's quality assurance and reproducibility. We created a protocol outlining the article selection criteria, search technique, data extraction, and data

TABLE 2: Terms used in the paper search.

Key search terms	Alternate search terms
Business simulation games	Serious games, computer games in business education, game-based learning in business
Learning outcomes	Learning outcomes, skills, behaviours, attitudes
Higher education	Business school, universities, vocational training

analysis methods. The researchers followed the Dybå and Dingsøyr [37] citation management process to sort out the relevant citations with the help of EndNote 20. The complete selection process is shown in Figure 3.

3.2.1. Inclusion Criteria. Papers that fulfil the following criteria were included:

- (i) Only peer-reviewed journal and conference papers were included
- (ii) Only empirical papers that reported on research using data collected from experiments or observation designs were included
- (iii) The participants should be studying in higher education institutes (graduate and postgraduate business courses)
- (iv) The review included only open access articles published between 2015 and 2022
- (v) The papers were available in English
- (vi) The papers explicitly report the learning outcomes of BSGs

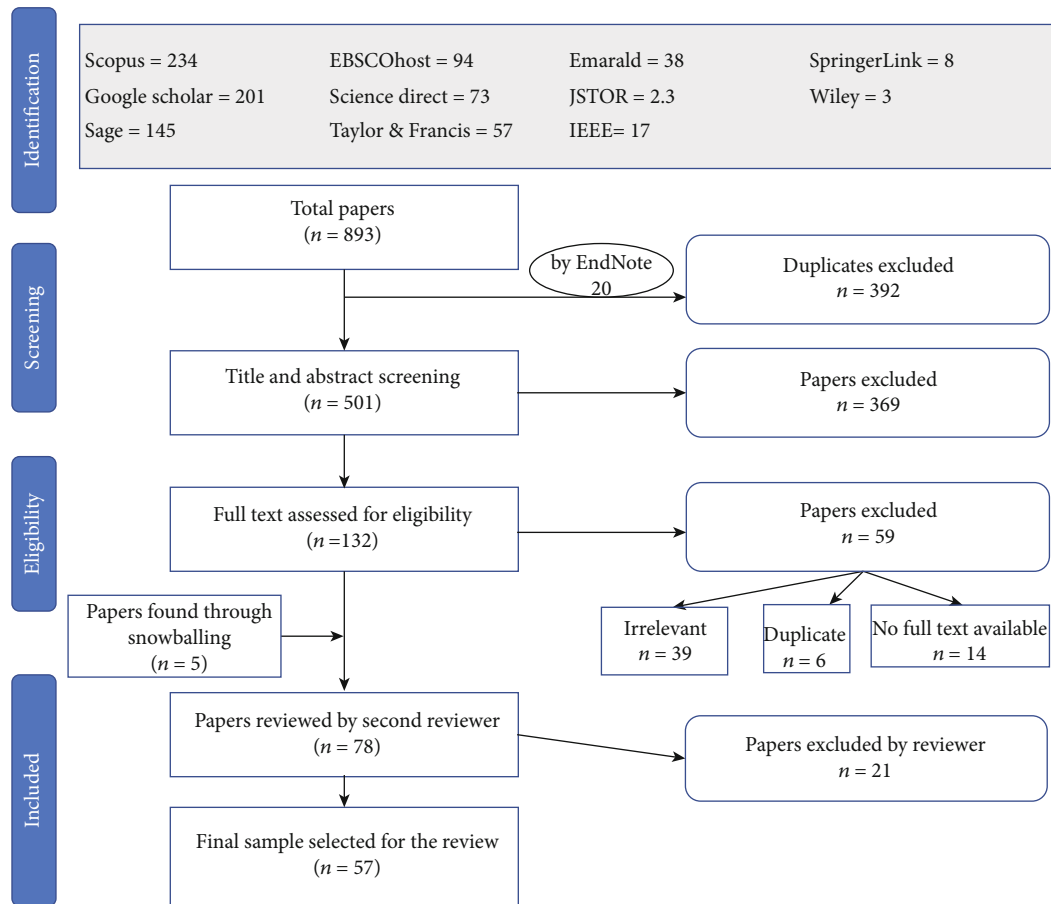


FIGURE 3: Paper selection process.

3.2.2. Exclusion Criteria

- (i) Nonempirical studies are not included in this review
- (ii) Studies conducted with participants younger than 18 are not included as the focus is on higher education institutions
- (iii) Studies on nondigital and entertainment games are not included in this review
- (iv) Book chapters are not included as they are difficult to search on databases and hard to access as full texts. The peer-review process for journal and conference papers does not always apply to books. Other sources were also excluded for the same reason. For example, dissertations, theses, editorials, book reviews, and reports are also excluded for similar reasons
- (v) Papers that are not open access are not included
- (vi) Papers that do not adhere to the research objectives are not included
- (vii) Papers published before January 2015 are also excluded

Coauthors of this SLR reviewed the selected papers to ensure they met the inclusion criteria. In cases of doubt, all four reviewers discussed and determined the inclusion or exclusion decision on the paper.

3.3. Quality Assessment. In the third stage, a quality assessment of the included papers was conducted. Extra discussions among researchers were undertaken to ensure the objectivity and quality of the selected papers. The quality assessment criteria gave each of the 57 selected papers on a five-dimensional scale inspired by Connolly et al. [28]. Five dimensions were scored from 1 to 3 across each dimension, where 3 represented high, 2 medium, and 1 low quality of the paper. In this paper, we adopted the following five dimensions in Table 3.

The total quality weight of each paper was determined by adding scores for all five dimensions ranging from 5 to 15. The mean rating was 8.9, and the mode rating was 9. 37 papers reaching 9 or above scores on the five dimensions scale were considered methodologically more critical papers, providing strong evidence of the impact of BSGs on learning

TABLE 3: Quality assessment criteria.

Quality assessment criteria	Indicators (1-3)
Is the research focusing on BSGs?	Low-medium-high
Is the research design suitable to address the objectives of this SLR?	Low-medium-high
Is the focus of the study relevant to the objective of this SLR?	Low-medium-high
Is the methodology of the study well defined and well structured?	Low-medium-high
Are the findings of the study answering the research questions?	Low-medium-high

outcomes. These papers are shown in Table 3 with their respective methodological designs.

3.4. Data Analysis and Synthesis. The 57 selected papers were analysed using a qualitative content analysis, which involved coding for the emergence of themes. The researchers examined the papers from a range of viewpoints. Firstly, they conducted a bibliographic overview which included demographics, research design, year of publication, database of publications, and citation counts of the selected papers. Secondly, the papers were examined to determine the learning outcomes, learning theory, integration techniques, and assessment methods that were discussed in BSG research. The categorisation is aimed at helping instructors select the most highly ranked games according to the required learning outcomes, the evaluation methods used to assess these outcomes, integration of the games into the curriculum, and the role of instructors in facilitating the learning.

4. Results

This section presents results from the selected papers ($n = 57$).

4.1. Bibliographic Overview of the Papers. The included papers are journal publications except two [38, 39]. The included papers presented multiple study designs, with most papers falling into survey design. Most papers are retrieved from the SCOPUS database, followed by ScienceDirect. The number of papers per year and per data base is shown in Figures 4 and 5, respectively. The papers have an average citation count of 10 ± 20 (till February 2022).

Due to cultural settings and available resources, demographic differences can cause varying attitudes and expectations toward learning [40]. The number of papers published in the region also shows its willingness to adapt and experiment with innovative knowledge and teaching methods and tools. Most of the studies on simulation games (Figure 6) were conducted in Europe ($n = 33$) followed by North America ($n = 10$). Asia ($n = 8$) comes after them, followed by Australia, Africa, and the Middle East.

4.2. Methodologies of Selected Studies. There are different types of constructs and variables used in the selected papers. Most empirical studies on BSGs evaluated how playing the game might assist students in meeting learning outcomes. Entrepreneurial skills and attitudes are other

commonly used constructs in the BSG literature. A range of study designs (quantitative, qualitative, and mixed methods) was used in the selected papers depending on the research objectives. Figure 7 presents an overview of the study design.

Most of the papers used postgame surveys (questionnaires) to collect data (28 papers), and the participants were students in the selected studies except three papers. Mainly, informal methods were used to develop these questionnaires without defining a measurement model or theoretical construct. 13 studies used tests to assess the students' learning outcomes and skills acquisition, typically in experimental studies and by applying them before and after playing the game. However, a few studies conducted surveys just after the game session (8 studies). Five studies reported the use of challenge or exercise for data collection. Interviews with students on how playing the BSGs helped them to achieve learning outcomes were also used, typically in qualitative design or mixed-method approaches. These interviews were done most of the time after playing the game. Only 3 studies included interviews with instructors. In five studies, researchers conducted focus group meetings to collect opinions on the effectiveness of BSGs in enhancing students' learning experiences. Figure 8 shows the number of papers as per the data collection method used in the study.

BSGs are usually played in teams, and most studies conducted on BSGs collected data over large samples (100-500), usually in postgame surveys or game results. Three selected studies used extensive samples, with one analysing 3681 messages posted by students on an online discussion forum [41], one analysing 3129 game results [39], and one longitudinal study surveying more than 12000 students over three years [42]. The number of papers as per sample size range is shown in Figure 9.

Quantitative data were mostly analysed through statistical analysis using different software. Regression analysis, t -test, and one-way ANOVA are the most commonly employed tests on the quantitative data sets in selected studies. A comprehensive bibliographic review of the selected papers is given in Tables 4 and 5.

4.3. Results of the Quality Assessment. The researchers selected the papers based on quality ratings. The minimum acceptable number was 9, and the maximum number given on the paper was 15. The average quality rating of the selected papers is 11. A standard deviation of 1.7 was found in the quality ratings for the total mean score. As shown in Figure 10, there has been a steady increase in the quality of empirical papers on BSGs over time.

5. Discussion and Findings

In this literature review on the use of BSGs for teaching and learning, we found that the research on BSGs in teaching and learning has grown in the last five years. The quality rating of the selected papers is also increasing, as shown in Figure 10. Most empirical studies explored the learning outcomes of incorporating these games in coursework. Using the key terms, the initial literature search retrieved 523

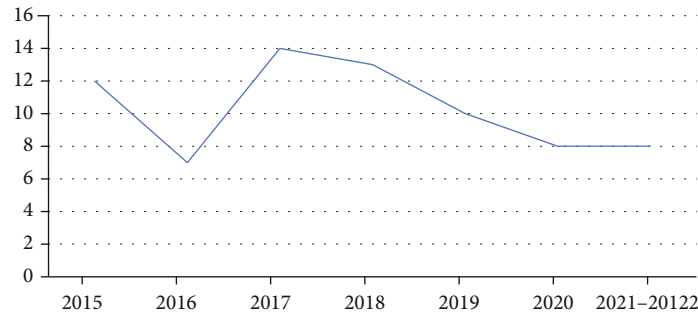


FIGURE 4: Number of selected papers per year.

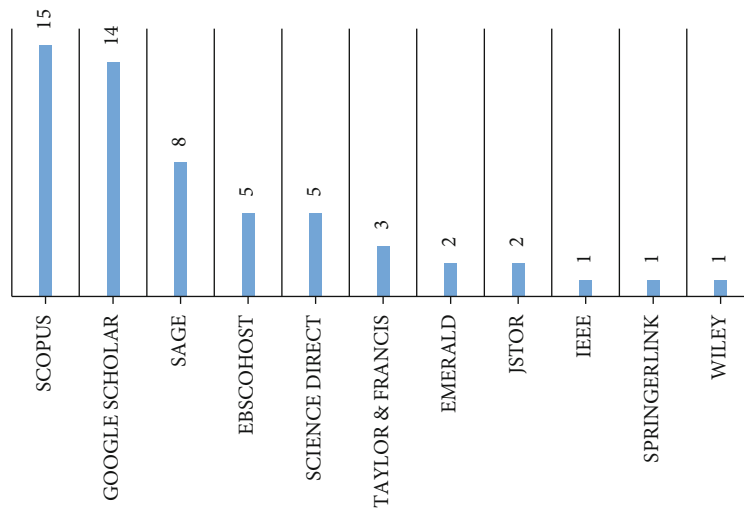


FIGURE 5: Number of selected papers per database.

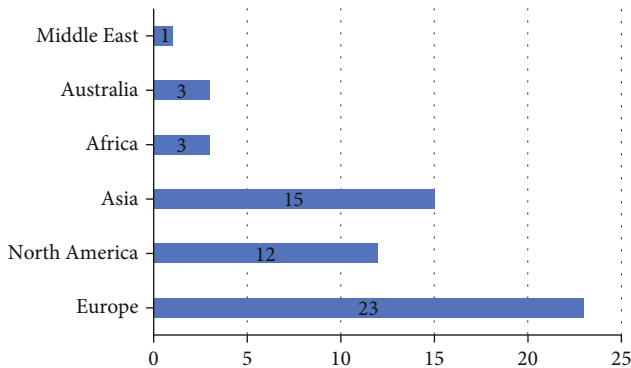


FIGURE 6: Number of papers as per region.

relevant papers, which were later reduced to the final sample of high-quality forty-nine open access empirical studies. The factor analysis of the selected studies provided a framework for organising the diverse research on BSGs and summarising trends in literature. This section presents the selected papers’ findings, limitations, and future recommendations of the selected papers. Four distinctive trends emerged from the literature review, which was used to analyse the selected studies:

- (1) Integration of BSGs in teaching and learning processes

- (2) Learning outcomes achieved by using BSGs as a learning tool
- (3) Learning theories used in BSG literature
- (4) Evaluation methods used to assess the learning outcomes of BSGs and the game performance

5.1. Integration of BSGs in Teaching and Learning. The way simulation games are integrated into teaching and learning makes a difference in the success of achieving desired learning outcomes [95]. In a literature review, Oliveira et al. [96] addressed seven emerging technologies utilised in education, one of which is simulations. According to the research, simulations have been shown to improve students’ learning experiences, particularly in terms of problem-solving and creative thinking. An important enabling component for the successful use of simulation games in education is the role of the instructor/facilitator. Seven studies discussed the instructor’s part in achieving desired learning outcomes using BSGs.

BSGs are often a supplementary tool to assist educators on regular courses. They are mainly conducted after lectures and tutorials, usually at the end of the semester as a final test or integrational activity. They are also taught as separate courses in a degree program to complement the other courses [97]. In most selected studies, off-the-shelf BSGs

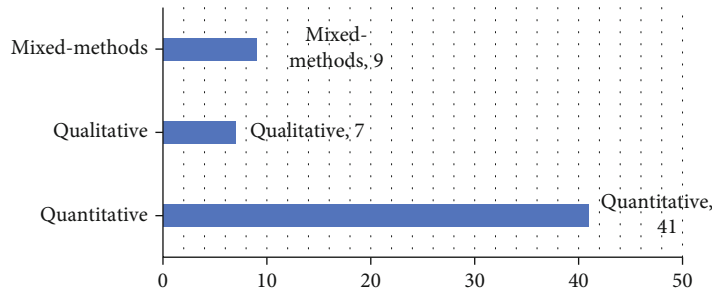


FIGURE 7: No. of papers per study design.

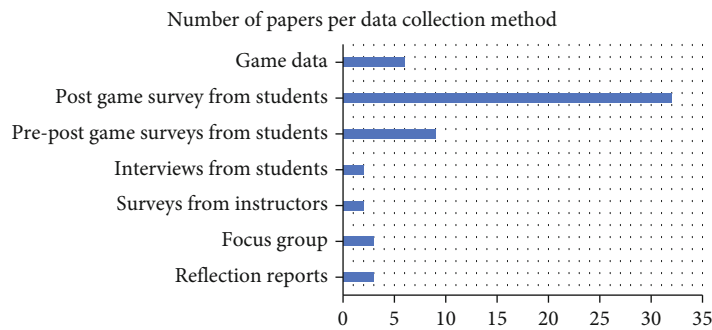


FIGURE 8: No. of papers as per data collection method.

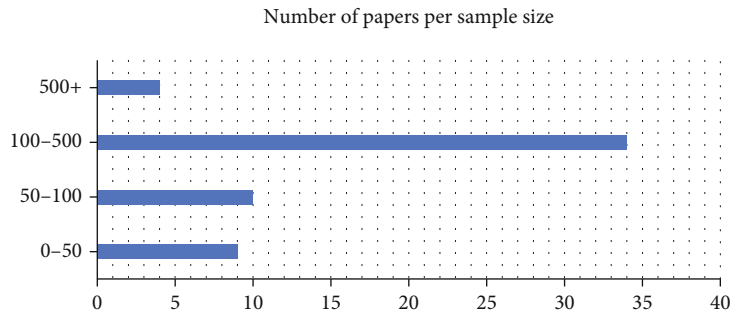


FIGURE 9: No. of papers as per sample size.

are incorporated as an add-on or run as a test activity. Research on BSGs has proven that these games can help instructors facilitate students’ engagement, learning, and employability if they are appropriately integrated [4]. Since a BSG consists of many decision-making elements (e.g., finance, marketing, human resources, distribution, and logistics), it is essential for instructors first to identify the learning outcomes they want to achieve and then use BSGs as a mean to achieve those outcomes [98].

Vos [43] explained the three important roles instructors have to play in integrating and supporting these learning activities: instructors have to plan appropriate learning and teaching strategies, support students during the whole process, and then design appropriate assessment tasks to assess whether the game is achieving the required learning outcomes. Ellahi et al. [65] reinforced the instructors’ role in incorporating BSGs into courses. The study used instructor support as a moderating factor to examine the relationship

between simulation games and learning outcomes. The study’s findings showed that although the role of the instructor is essential in the learning process using computer simulations, the research argued that students should mainly take control of their learning. On the contrary, Hernández-Lara and Serradell-López [41] suggested that instructors should play an active role at the pregame stage and then throughout the game while determining the complexity levels and other conditions of the game that include the economic environment, market conditions, production facilities, employee engagement and motivation, and other conditions. Loon et al. [81] conducted a mixed-methods study on the role of instructional design and the context of the study in strategic decision-making. He suggested that a lack of support during the simulation activity might result in demotivating the students from taking part in the activity. Even if they participate, the absence of instructor support can negate any possibility of learning from the process. He suggested three

TABLE 4: Bibliographical overview of the selected papers.

Paper	Database	Citation	Publication type	Study design	Study focus/contribution
Vos [43]	EBSCOhost	87	Journal paper	Exploratory	Authentic assessment strategy
Chen, Keys and Gaber [44]	EBSCOhost	15	Journal paper	Confirmatory	Effect of enjoyment and cognitive appraisal on learning outcomes
Burdon, Munro [45]	EBSCOhost	19	Journal paper	Case study	Experiences of design, development, and implementation of simulation
Eder, Antonucci and Monk [46]	EBSCOhost		Journal paper		Examine the association of learning outcomes with student engagement and team dynamics
Bitrián, Buil and Catalán [47]	EBSCOhost	3	Journal paper	Quasiexperimental	Effect of flow on learning outcomes
Ghani, Mohammad [48]	EBSCOhost	1	Journal paper	Confirmatory	Aimed to find the integration of the logic model that contributes to effective entrepreneurial learning
Thanasi-Boçe [49]	Emerald		Journal paper	Exploratory	Effect on entrepreneurial mindset
Tawil et al. [39]	Google Scholar	11	Conference paper		Entrepreneur skills in decision-making
Öun, Mägi and Noppel [50]	Google Scholar	1	Journal paper	Comparative analysis	Effects of personality and cultural difference on learning outcomes using BSG
Lovelace, Eggers and Dyck [51]	Google Scholar	67	Journal paper	Exploratory	Development of critical thinking through simulation and its relationship with game performance
Almeida [52]	Google Scholar	13	Journal paper	Longitudinal study	Entrepreneurship learning through business simulations
Costin, O'Brien and Hynes [19]	Google Scholar	25	Journal paper	Case study	Development of entrepreneurial skills
Mohsen, Abdollahi and Omar [53]	Google Scholar	11	Journal paper		Educational values generated from a SG
Urquidi-Martín, Tamarit-Aznar and Sánchez-García [54]	Google Scholar	7	Journal paper	Confirmatory	Develop critical thinking focused on sustainability
Almeida and Buzady [55]	Google Scholar	2	Journal paper	Exploratory	Development of entrepreneurship competencies
Buzady and Almeida [56]	Google Scholar	7	Conference paper	Exploratory	Development of management, leadership, and entrepreneurship skills
Bach, Zoroja and Fašnik [17]	Google Scholar	2	Conference paper	Confirmatory	Investigate the level of usage of simulation games at faculties of economics as compared to other types of teaching
Zulfiqar et al. [57]	Google Scholar	14	Journal paper	Longitudinal study	Compared the impact of traditional teaching and teaching through online management simulation games on student learning performance and further leads to entrepreneurial intention
Yusof [58]	Google Scholar	0	Journal paper	Confirmatory	Seeks to link the effectiveness of business simulation with entrepreneurship interest of the students
Lovin et al. [59]	Google Scholar	7	Journal paper	Confirmatory	Examined the roles of graduates' engagement in business simulations, working environment culture, and acquired knowledge on business simulations in knowledge transfer

TABLE 4: Continued.

Paper	Database	Citation	Publication type	Study design	Study focus/contribution
Dharmastuti et al. [60]	Google Scholar	1	Journal paper	Confirmatory	Examine how a business simulation class student's experience impacts student business competency and learning outcomes in learning business simulation
Faisal et al. [61]	Google Scholar	3	Conference papers	Exploratory	Explored the effects of ERPsim game on the work readiness of IS graduates
Beranič and Heričko [62]	Google Scholar	2	Journal paper	Confirmatory	Investigating impact of business simulation on knowledge acquisition and future student engagement
Hishiyama and Nakajima [63]	IEEE		Conference proceeding	Case study	Management flow functions
Tao, Yeh and Hung [64]	JSTOR	15	Journal paper	Experimental	Perceived learning-cycle effects caused by playing multiple BSGs with different complexity
Ellahi, Zaka and Sultan [65]	JSTOR	12	Journal paper	Experimental	Analysing success of supplementary components for the existing teaching strategies
Williams [66]	Sage	10	Journal paper	Action	Development of entrepreneurial capabilities through simulation
Beuk [67]	Sage	12	Journal paper	Cross-sectional	Comparing three teaching methods (lectures, case studies, and simulation) in terms of learning outcomes
Kriz, Auchter [42]	Sage	38	Journal paper	Longitudinal study	Increase in entrepreneurial competencies a result of startup simulation courses and cup competitions
Zulfiqar [68]	Sage	31	Journal paper	Confirmatory	Influence of simulation on attitude and intentions of the students toward entrepreneurial activities
Rogmans and Abaza [69]	Sage	6	Journal paper	Comparative analysis	Analysing students' engagement levels in two different teaching methods, simulation, and case study
Wang et al. [70]	Sage	1	Journal paper		Investigated the factors that influence students' BSG usage intention
Kiss and Schmuck [71]	Sage	3	Journal paper	Longitudinal	Investigated the influence of games on managerial skills
Kuang, Adler and Pandey [72]	Sage	2	Journal paper	Quasiexperimental	Positive effect on higher order thinking skills
Goi [4]	SpringerLink	26	Journal paper	Sequential explanatory	Role of authentic team based learning in enhancing the learning outcomes and satisfaction
Levant, Coulmont and Sandu [73]	Taylor & Francis	47	Journal paper		Development of soft skills under the impact of cultural background
Hernández-Lara and Serradell-López [41]	Taylor & Francis	11	Journal paper	Exploratory	Educational effectiveness of business simulation games based on the students' opinions
Humpherys, Bakir and Babb [74]	Taylor & Francis	4	Journal paper	Confirmatory	Investigated simulation as an experiential learning tool
Obi, Eze and Chibuzo [75]	Taylor & Francis	2	Journal paper	Confirmatory	Determining the experiential learning activities required of business education students for the development of various 21st century competencies
Buil, Catalán and Martínez [76]	Wiley	4	Journal paper	Confirmatory	Facilitate students' learning and engagement

TABLE 4: Continued.

Paper	Database	Citation	Publication type	Study design	Study focus/contribution
Olive et al. [77]	ScienceDirect	1	Journal paper		
Carenys, Moya and Perramon [78]	ScienceDirect	33	Journal paper	Experimental	Effectiveness of videogames in comparison to simulations
Leal-Rodriguez and Albort-Morant [79]	ScienceDirect	38	Journal paper		Impact on academic performance
Ştefan et al. [80]	ScienceDirect	0	Journal paper		Examine the effect of simulation on collaborative decision-making skills
Severengiz [38]	ScienceDirect	1	Conference paper		Effect of simulation on factory planning knowledge
Loon, Evans and Kerridge [81]	Scopus	65	Journal paper	Multimethod	Role of instructional design and the context of the study in strategic decision-making
Bell and Loon [82]	Scopus	67	Journal paper	Quasiexperimental	Determine whether learning through business simulations is affected by students' critical thinking disposition
Lee, Long and Visinescu [83]	Scopus	4	Journal paper	Quasiexperimental	Development of business intelligence through BSG
Pando-Garcia, Periañez-Cañadillas and Charterina [84]	Scopus	62	Journal paper	Quasiexperimental	Constructs of ease of use and perceived usefulness and their effects on attitude to use and intention to use between two groups of students using different modes
Lin, Yen and Wang [85]	Scopus	19	Journal paper	Experimental	Effect of learning method and motivation on learning performance in BSGs
Hwang, Cruthirds [86]	Scopus	13	Journal paper	Experimental	Comparison of online and traditional teaching methods using BSGs on ERP, SAP, and business process knowledge
Urquidi Martín and Tamarit Aznar [87]	Scopus	6	Journal paper	Quasiexperimental	Empirical evidence on the effectiveness of business simulations in university teaching
Mustata, et al. [88]	Scopus	16	Journal paper	Case study	Development of management-related competencies
Newbery, et al. [89]	Scopus	47	Journal paper	Quasiexperimental	Impact of the initial entrepreneurial experience on identity formation using BSG
Torres and Augusto [90]	Scopus	29	Journal paper		Impact of BSG on students' self-perception of their improvement on strategic competencies
Farashahi and Tajeddin [91]	Scopus	54	Journal paper	Comparative analysis	Comparison of learning outcomes of lectures, case study, and simulation
Alas et al. [92]	Scopus		Journal paper	Quasiexperimental	The relationship between the results obtained by different teams in business game Dynama and their teams' characteristics
Calabor, Mora and Moya [93]	Scopus	20	Journal paper	Delphi	Accounting academic perceptions of the usefulness and the potential barriers to implementing BSGs
Zulfiqar et al. [57]	Scopus	10	Journal paper	Confirmatory	Compared the impact of traditional teaching and teaching through online management simulation games on student learning performance and entrepreneurial intention

TABLE 4: Continued.

Paper	Database	Citation	Publication type	Study design	Study focus/contribution
Beranič and Heričko [62]	Scopus	0	Journal paper	Confirmatory	Investigating simulation impact on significant knowledge gain and students' future course engagement
Samaras, Adkins and White [94]	Scopus	2	Journal paper	Confirmatory	Compared case studies and simulations to provide insights into how each may contribute to the development and demonstration of students' critical thinking skills

types of support for students during the activity: interpretative support (background information and relevant input knowledge, including elaborative and explanatory feedback), experimental support (in developing perspectives and propositions), and reflective support (inquiry process and knowledge gained from the simulation).

Another important factor concerning the instructors' role in the successful integration of BSGs was discussed by Kriz and Auchter [42] in an empirical study where they explored the effect of simulation games on entrepreneurial competencies by conducting more than 12000 surveys with students who have played different BSGs. One factor that influenced students' acceptance of the simulation activity was the role of the instructors. According to the students, instructors' skill levels, enthusiasm, and teaching quality impacted how students perceived and adopted these simulations. Pando-Garcia et al. [84] explored the effect of perceived usefulness and ease of use of simulation on the attitude and intention to use simulation by students using the Technology Acceptance Model (TAM) (Urquidi-Martín, Tamarit-Aznar, & Sánchez-García) model. TAM is a theory of information systems that describes how people learn to accept and use technology. The study's results showed a strong relationship between positive attitudes towards using simulation games and their perceived ease of use. This leads the authors to conclude that the instructors can influence students' attitudes toward using simulation because they can help students understand the game's technical aspects, which may make the game experience easier for students. Overall, the selected studies which explored instructors' role in using BSGs established the instructor's significant role in the integration or running phases of the BSGs.

Kriz and Auchter [42] explored the barriers to integrating BSGs in existing courses as part of their longitudinal study with multiple business schools all over Europe using BSGs. They identified the three most common barriers to adopting BSGs: the perceived risk of adopting new teaching techniques, the suitability of the available simulations, and lack of resources (financial and infrastructural). These three barriers are interlinked [99] and should be examined together. The risk perceptions of individual instructors vary and play an essential part in explaining the instructors' attitude toward adopting the simulation. From an instructor's perspective, as the simulation is a student-centred learning activity, there is the possibility that they may lose control over student learning.

Rogmans and Abaza [69] conducted a comparative analysis of the effectiveness of two teaching methods in management education. The results of students' surveys showed that the average engagement levels of students were higher in the traditional case study compared to simulation games. The findings showed that the main reason for students' preference for selecting the case study over simulation is the complexity level of the simulation. The results showed that complexity was crucial in determining students' acceptance of simulation-based learning. Calabor et al. [93] used Delphi techniques to explore instructors' perceptions concerning barriers to incorporating BSGs in classrooms. In the panellists' view, the most significant obstacle to implementing BSGs in existing courses was the lack of information on the suitability of the game for a particular course, the lack of infrastructure and financial resources, and the lack of knowledge regarding expected learning outcomes from the use of a specific BSG. They proposed to train instructors for new technologies and teaching methods so that they can facilitate their students' learning performance. The researchers concluded that there is a general reluctance to adopt new teaching techniques and a need to create an awareness of the benefits for students and instructors of adopting simulation systems.

The selected studies demonstrated the benefits of blended learning and incorporating BSGs into existing courses and traditional teaching methods (lectures and tutorials). For example, in one of the selected papers, Loon et al. [81] suggested the adoption of the guidelines provided by [100] and Salas et al. [101] in the selection and implementation of simulation games. The integrative aspect of blended learning was found to be effective as simulation games are not sufficient on their own to promote learning. They must be supported and supplemented by effective instructional designs and teaching approaches that involve regular intervention and instructor support through coaching and playing the role of a facilitator.

5.2. Learning Theories/Models and BSGs. Drawing on learning theory can assist educators in making well-informed decisions in selecting, integrating, and delivering specific simulation games. From the BSGs researchers' point of view, learning theories were used to explain why certain aspects of simulations are successful or problematic and to develop a clear understanding of the research problems. Therefore, these researchers argued that BSGs provide a learning environment for students to bridge theoretical and conceptual

TABLE 5: Quality ratings and methodologies of selected papers.

Paper	Quality rating	Data collection	Sample and instruments	Data analysis	Constructs used in the study
Vos [43]	11	Mixed methods	Postgame 35 surveys and 8 interviews from students	Qualitative	
Chen, Keys, and Gaber [44]	12	Quantitative	Postgame surveys from 164 students	SPSS partial least squares (pls)	Behavioural intentions, enjoyment, cognitive appraisal, perceived learning outcomes
Burdon and Munro[45]	13	Qualitative	Qualitative surveys from students	Thematic analysis	
Eder, Antonucci, and Monk [46]	12	Quantitative	Postgame surveys from 118 students	Statistical analysis	Engagement, team dynamics, learning outcomes
Bitrián, Buil, and Catalán [47]	9	Quantitative	Pre-postgame surveys from 430 students	SPSS two cluster analysis	Students' perceived learning, skills, and satisfaction, boredom, flow, anxiety, apathy
Ghani and Mohammad [48]	13	Quantitative	Pre-postgame surveys from 272 students	Confirmatory factor analysis	Student characteristics, lecturer characteristics, simulation characteristics, business plan learning effectiveness
Thanasi-Boçe [49]		Qualitative	Postgame 16 open-ended surveys from students	Thematic analysis	
Tawil et al. [39]	9	Quantitative	3129 students game results		
Õun, Mägi, and Noppel [50]	9	Quantitative	Postgame survey from 118 students from four countries		
Lovelace, Eggers, and Dyck [51]	13	Quantitative	Pre-postgame surveys from 98 students	SPSS paired sample <i>t</i> -test and descriptive analysis	Critical thinking, problem-solving, game performance
Almeida [52]	12	Quantitative	Postgame surveys from 83 students	Stata software v13.0 descriptive analysis	Technical competencies, management skills, personal entrepreneurship
Costin, O'Brien, and Hynes [19]	14	Qualitative	Reflective essays	Thematic analysis	Decision-making, problem-solving, communication and teamwork, risk management
Mohsen, Abdollahi, and Omar [53]	14	Mixed methods	Postgame surveys and reflection reports of 120 students	SPSS exploratory factor analysis and reliability analysis, thematic analysis	Students' experience generation, conceptual understanding, skills development, and affective evaluation, respectively
Urquidi-Martín, Tamarit-Aznar, and Sánchez-García [54]	13	Quantitative	Postgame surveys from 326 students	Analysis of the causal relationships	Game realism, game structure, perceived usefulness, motivation, critical thinking

TABLE 5: Continued.

Paper	Quality rating	Data collection	Sample and instruments	Data analysis	Constructs used in the study
Almeida and Buzady [55]		Mixed methods	Postgame focus group discussion and game results	Descriptive and thematic	Game performance and 29 management and leadership skills
Buzady and Almeida [56]	13	Mixed methods	Postgame surveys and interviews from 52 students	Descriptive and thematic	Individual attitudes, 29 MAP dimensions
Bach, Zoroja, and Fašnik [17]	13	Quantitative	Postgame surveys	Descriptive analysis and chi square test	Advantages of different types of teaching methods
Zulfiqar et al. [57]	14	Quantitative	Postgame survey from 277 students	Structural equation model (SEM)	Perceived ease of use and perceived usefulness, knowledge application and knowledge sharing, learnability, self-efficacy and perceived enjoyment, technology adoption and learning performance, entrepreneurial intentions
Yusof [58]	13	Quantitative	Postgame survey from 160 students	Multiple regression analysis	Learning, benefit, satisfaction, and perception of business simulation
Lovin et al. [59]	14	Quantitative	Postgame survey from 120 graduates	Multiple regression analysis	Knowledge transfer, engagement, working environment culture, acquired knowledge from business simulation
Dharmastuti et al. [60]	13	Quantitative	Postgame survey from 83 students	Descriptive analysis	Perceived usefulness, perceived ease, perceived enjoyment, student business competency, perceived learning outcomes
Faisal et al. [61]	14	Qualitative	Interviews from 15 instructors	Thematic analysis	Learning outcomes, behavioural changes, work readiness
Beranič and Heričko [62]	10	Quantitative	Pre-postgame survey	Descriptive analysis	Business processes knowledge, technical knowledge of SAP, ERP transaction knowledge, intent for future course engagement
Hishiyama and Nakajima [63]	10	Mixed method	138 students and 180 instructors	Descriptive, ANVOVA	
Tao, Yeh, and Hung [64]	13	Quantitative	Postgame surveys from 43 students	Statistical analysis, descriptive, ANVOVA, paired sample <i>t</i> -test	Complexity level, skills, declarative knowledge, procedural knowledge, strategic knowledge, matching the competition
Ellahi, Zaka, and Sultan [65]	13	Quantitative	Pre-postsurvey from 87 students	SPSS, independent sample <i>t</i> -test	Learning satisfaction, learning performance, learner's interest

TABLE 5: Continued.

Paper	Quality rating	Data collection	Sample and instruments	Data analysis	Constructs used in the study
Williams [66]	14	Mixed methods	Pre-postgame survey from 32 students +reflection reports and game logs	Independent sample t -test and thematic analysis	Entrepreneurial skills, entrepreneurial attitudes, business skills
Beuk [67]	13	Quantitative	Postgame surveys from 137 students, 248 instructors	Repeated measures one-way ANVOVA, regression analysis	Perceived usefulness, level of fun, instructors perceived learning outcomes
Kriz and Auchter [42]	12	Quantitative	Postgame surveys from 12521 students	Descriptive	Organisation and facilitation of the simulation game, personal and social skills, competition and teamwork, business knowledge and entrepreneurship skills, overall satisfaction
Zulfiqar et al. [68]	13	Quantitative	Postgame 360 students survey	Structural equation modelling (Garris et al.) using AMOS 24	Perceived business value, subjective norms, perceived behavioural controls, attitude toward entrepreneurship and entrepreneurial intentions
Rogmans and Abaza [69]	11	Quantitative	Postgame 200 students survey	Descriptive	Motivation and engagement Performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, and price value, behavioural intentions to use business simulation games
Wang et al. [70]	14	Quantitative	Postgame surveys from 141 students	Partial least square approach SmartPLS software	Strategy formulation, planning, decision-making, and teamwork; mathematical financial skills, managerial skills
Kiss and Schmuck [71]	13	Quantitative	Postgame survey from 329 students	Frequency tables, univariate ANCOVA, t -tests and cross-tabulation	Teamwork, learning outcomes, satisfaction
Goi [4]	14	Mixed method	Postgame 365 students' surveys and 14 students focus group	Exploratory factor analysis (SPSS) and confirmatory factor analysis (AMOS) for quantitative and thematic analysis for qualitative	Employability skills, soft skills
Levant, Coulmont, and Sandu [73]	13	Mixed methods	Pre-postsurveys from 392 students, mi- of Likert scale and open-ended questions		
Hernández-Lara and Serradell-López [41]	14	Qualitative	3681 messages posted in discussion forum	In vivo data analysis	
Humpherys, Bakir, and Babb [74]	10	Quantitative	Comparison of project grades of students	Descriptive analysis	

TABLE 5: Continued.

Paper	Quality rating	Data collection	Sample and instruments	Data analysis	Constructs used in the study
Obi, Eze, and Chibuzo [75]	12	Quantitative	Postgame survey from 210 students	Cronbach's alpha reliability	Communication and collaboration competencies, critical thinking competencies, academic instruction
Buil, Catalán, and Martínez [76]	13	Quantitative	Postgame surveys from 360 students	Statistical analysis	Competence, autonomy, relatedness, self-efficacy, cognitive engagement, emotional engagement, behavioural engagement, skill development, and perceived learning
Olive et al. [77]	10	Mixed methods	114 students pre-post achievement tests, feedback surveys and analysis of trace files	Statistical analysis	
Carenys, Moya, and Perramon [78]	12	Quantitative	Postgame surveys from 132 students	Exploratory factor analysis and Cronbach's alpha test of reliability	Attributes, motivation, and cognitive learning outcomes
Leal-Rodriguez and Alborn-Morant [79]	13	Quantitative	80 students end of semester grades and game results	Pearson correlation and structural equations modelling	Students performance and students learning
Ştefan et al. [80]	9	Qualitative	Not mentioned	Not mentioned	
Severengiz, Seliger, and Krüger [38]	13		Postgame surveys from 31 students	Descriptive study	
Loon, Evans, and Kerridge [81]	14	Mixed methods	Postgame surveys 155 and 36 semistructured interviews from students	Pearson correlation and multiple regression analysis SPSS	
Bell and Loon [82]	14	Quantitative	Postgame surveys from 173 students	Principal component analysis, correlation and regression analysis	Engagement, cognitive maturity, innovativeness, intended learning outcomes
Lee, Long, and Visinescu [83]	13	Quantitative	Postgame surveys from 93 students	Partial least square approach	Active learning, meaningful learning, collaboration, subject integration
Pando-Garcia, Periañez-Cañadillas, and Charterina [84]	11	Quantitative	Postgame surveys from two groups, 131 online, 83 onsite students	Confirmatory factor analysis	Perceived usefulness, perceived ease of use (PEOU), attitude to the business game technology, intention to use a business game technology
Lin, Yen, and Wang [85]	10	Quantitative	Experimental scenarios, an achievement test and a motivation scale, 49 response from individual and 47 response from groups of students	Descriptive analysis, two-way ANOVA on SPSS	Learning methods (collaborative and individual), learning motivation, learning performance
Hwang and Cruthirds [86]	12	Quantitative	Pre-postgame surveys from 52 from students	Descriptive analysis	SAP ease of use, business process knowledge, enterprise system knowledge, sap transaction knowledge

TABLE 5: Continued.

Paper	Quality rating	Data collection	Sample and instruments	Data analysis	Constructs used in the study
Urquidi Martín, and Tamarit Aznar [87]	10	Quantitative	Postgame survey from 58 students	Descriptive analysis	Evaluation of the experience, learning, and development of critical thinking
Mustata et al. [88]	10	Qualitative	Postgame qualitative surveys from 88 students	Thematic analysis	Group level micro identity, individual level micro identity, and interpersonal micro identity, observed entrepreneurial behaviour, experienced entrepreneurial behaviours
Newbery et al. [89]	10	Quantitative	Pre-postgame surveys from 236 students divided in treatment and control groups	<i>t</i> -test and regression	Strategy formulation, strategy implementation, critical analysis
Torres and Augusto [90]	12	Quantitative	Postgame surveys from 22 MBA executive students	ANOVA	Problem-solving skills, interpersonal skills, and self-awareness
Farashahi and Tajeddin [91]	14	Quantitative	Postgame surveys from 194 undergraduate and MBA students	Descriptive analysis	GPA, expenditure of market information, point for homework, normalized profits
Alas et al. [92]	9	Quantitative	28 game data	On SPSS, correlation analyses, regression analyses, and <i>t</i> -tests	Technical aspects of game, learning values of games, general view of game
Calabor, Mora, and Moya [93]	14	Quantitative	12 academics Delphi	Descriptive analysis	Knowledge sharing, knowledge application, learnability, perceived pleasure, and self-efficacy
Zulfiqar et al. [57]	12	Quantitative	Time-lagged surveys from 277 students	Structural equation modelling	Business process knowledge, technical SAP knowledge, ERP transaction knowledge, intent for future course engagement
Beranič and Heričko [62]	12	Quantitative	Pre-postgame survey from 32 students involved in ERPsim introductory simulation	Descriptive analysis	Critical thinking process and simulation participation
Samaras, Adkins, and White [94]	13	Quantitative	Postsurvey from 119 students	Paired-sample <i>t</i> -tests	

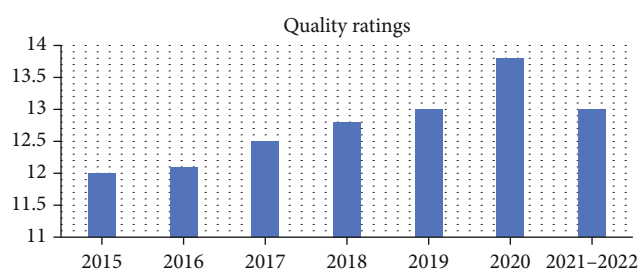


FIGURE 10: Mean quality rating per year.

knowledge taught in classrooms with authentic, real-world experiences [102].

Several theories/models have been proposed in the selected studies for understanding the role of BSGs in enhancing learning and teaching processes. Fourteen studies used learning theory to develop a well-defined research model out of forty-nine chosen papers. Kolb's [103] experiential learning theory is the most commonly used approach, followed by the Technology Acceptance Model [104]. The list of these fourteen papers, learning theories/models, and the constructs used is presented in Table 6.

TABLE 6: Learning theories and the variable used in selected papers.

Author	Theories	Constructs used in study	
		Independent	Dependent
Chen, Keys, and Gaber [44]	Theory of planned behaviour [105]	Behavioural intentions, enjoyment, cognitive appraisal	Perceived learning outcomes
Bitrián, Buil, and Catalán [47]	Flow theory [106]	Boredom, flow, anxiety, apathy	Students' perceived learning, skills, and satisfaction
Newbery et al. [89]	The models of entrepreneurial intent [107]	Personal attitudes, perceived behavioural control, perceived social norms	Entrepreneurial intent
Tao, Yeh, and Hung [64]	Problem-based gaming model [108], input-process-outcome game model [109]	Student-perceived complexity level of BSGs, BSG competition outcomes	Declarative knowledge, procedural knowledge, strategic knowledge
Ellahi, Zaka, and Sultan [65]	Activity theory [110]	Learners' interest, instructor role	Satisfaction and performance
Williams [66]	Experiential learning theory [103]	Game cycle	Entrepreneurial skills, entrepreneurial attitudes
Zulfiqar et al. [68]	Technology Acceptance Model [104] and theory of planned behaviour [105]	Perceived business value, subjective norms, perceived behavioural controls, attitude	Entrepreneurship and entrepreneurial intentions
Buil, Catalán, and Martínez [76]	Self-system model of motivational development [111]	Competence, autonomy, relatedness, self-efficacy	Cognitive, emotional, and behavioural engagement, skill development, perceived learning
Leal-Rodríguez and Albort-Morant [79]	Experiential learning theory [103]	Students' experiential learning involvement (project grade)	Performance in the final exam (exams grade)
Lee, Long, and Visinescu [83]	Expectancy-value theory of motivation [112]	Active learning Meaningful learning Collaboration, subject integration	Business intelligence motivational beliefs
Pando-García, Periañez-Cañadillas, and Charterina [84]	Technology Acceptance Model [104]	Perceived usefulness, perceived ease of use	Attitude to using BSG, intention to use a BSG
Newbery et al. [89]	Identity conflict theory [113]	Group-level micro identity, individual micro identity, interpersonal micro identity	Observed entrepreneurial identity, entrepreneurial behaviour
Torres and Augusto [90]	Experiential learning theory [103]	Decision styles (analytical, conceptual, directive, behavioural)	Strategic competencies (strategic formulation, strategic implementation, critical analysis)
Urquidi-Martín, Tamarit-Aznar, and Sánchez-García [54]	Experiential learning theory [103]	Game realism, game structure, perceived usefulness	Motivation and critical thinking
Wang et al. [70]	Unified Theory of Acceptance and Use of Technology (UTAUT) [114]	Performance and effort expectancy, social influence, facilitating conditions, hedonic motivation, price value and habit	Behavioural intention
Zulfiqar et al. [57]	Technology Acceptance Model [104]	Perceived usefulness, perceived ease of use, technology adoption	Entrepreneurial intention and learning performance

The BSG literature uses the learning paradigms of humanism, constructivism, cognitivism, and behaviourism to varying degrees. The fundamental theories that play a significant role in understanding learning during simulations are game-based, problem-based, and experiential learning.

Many studies combined multiple theories. For example, Tao et al. [64] conducted an experimental study where he combined the problem-based gaming model [108] and the input-process-outcome game model [109] to examine the perceived learning-cycle effects caused by playing multiple BSGs with different complexity levels to develop the research model of the study. He used the problem-based gaming model to create constructs related to complexity and the

input-process-outcome game model to develop constructs of knowledge gain (declarative, procedural, and strategic). The study's findings showed that a significant number of students perceived that the complexity level of the BSG affected their knowledge levels. Zulfiqar et al. [68] combined the theory of planned behaviour [105] and the Technology Acceptance Model [104] to explore how the use of simulation games influenced and developed entrepreneurial attitudes in students. The variables measuring perceived business value came from the TAM, and subjective norms, perceived behavioural controls, and attitudes were taken from the theory of planned behaviour. The results showed a significant increase in the perceived behavioural controls

and attitude toward entrepreneurial activities after using BSGs. However, subjective norms did not have a substantial effect on entrepreneurial attitudes.

5.3. Learning Outcomes of Using BSGs. A significant part of empirical studies on BSGs focused on measuring learning outcomes. Identifying learning outcomes enables instructors and researchers to determine how much progress students have made in meeting learning outcomes while completing a course. These outcomes consist of students' knowledge and skills to acquire for effective learning. Many studies discussed the methodologies and benefits of integrating simulation games in different business courses. For the effective integration of simulation games in education, the specificity of the selected game regarding the desired learning outcomes to be considered. We observed that most chosen papers explained clearly defined learning objectives using a specific simulation game. Faisal et al. [61], for example, conducted qualitative research to investigate teachers' perceptions of utilising ERPsim games in a supply chain training. The ERPsim game is an innovative learning method which provides students a real-time, risk-free environment to improve their knowledge of business processes and ERP systems [115]. ERPsim game runs on SAP HANA, the latest version of SAP as it provides an in-memory database which facilitates rapid processing and analysis of big data in real time [13]. This in-memory database provides students instant results of the decisions they have made [116]. This business simulation game has been used in more than 250 universities worldwide and a few universities in Australia including University of Melbourne, RMIT University, Victoria University, and Federation University, to teach enterprise system concepts.

Figure 11 illustrates the scope of the manufacturing simulation game. Shaded rectangles represent SAP transactions automated by ERPsim, while students must perform other transactions to manage their company.

These games were also designed to provide a rich and economically representative simulation of a medium-sized organisation. The most measured skills in the selected studies are communication, decision-making, entrepreneurial skills, analytical thinking, and problem-solving skills. The most common knowledge outcome is business process knowledge discussed in 9 studies, followed by ICT and functional knowledge (5 studies) and supply chain knowledge (3 studies). The most common behavioural outcomes are engagement (12 studies), followed by motivation (7 studies) and self-efficacy (4 studies). Table 7 shows the commonly measured learning outcomes and the respective studies they are discussed in.

From the selected studies, the learning outcomes can be classified into three main categories: knowledge acquisition, skill development, and behavioural outcomes.

5.3.1. Knowledge Gains from Using BSGs. Many reviewed papers discussed the impact of simulation games on knowledge acquisition. Almost all the selected papers reported the beneficial implications of the use of simulation games on knowledge acquisition and conceptual understanding. Specific simulation games were used in different courses to

improve the content knowledge of students. For example, the pre-postgame survey' results of a study by Beranič and Heričko [62] showed a positive impact on students' knowledge in the business process and ERP transactions and in the domain of technical knowledge for SAP ERP. Similarly, a quantitative study by Angolia and Pagliari [119] discussed an ERP simulation game to aid students' conceptual learning of ERP systems in a supply chain course. ERPsim was also reported to increase students' knowledge of business processes. The study revealed that the simulation enhanced the distribution supply chain management's concepts, which increased the course content's understanding. One of the selected studies [46] also revealed knowledge gains in business processes and basic business concepts using ERPsim. Other studies confirmed the positive effect of using ERPsim games on business processes and supply chain knowledge [83, 86]. The ENTRExplorer game had a positive effect on students' accounting knowledge and business processes knowledge (Fernando [52]). Our review of selected papers revealed that simulations are directly linked to the course content, and their use allows applying a better understanding of theoretical concepts [41, 45, 81].

5.3.2. Skill Outcomes of Using BSGs. Cognitive abilities enable students to perform complex tasks such as logical critical thinking, problem-solving, and strategic decision-making [117]. These abilities are also sought after by the employers [120]. Twenty-eight papers were identified that reported the positive impact of using simulation games on students' cognitive skills. For example, Levant et al. [73] conducted a pre-postsurvey to determine the effect of a business simulation game on students' cognitive and interactive skills. This case study suggested positive results in the skills related to information management, communication, time management, project management, work-load management, team work, and problem-solving, which are considered higher-order cognitive skills [51]. The studies reporting the positive effects of using BSGs on the development and enhancement of cognitive skills are as follows:

- (i) Decision-making [39, 41, 46, 52, 67, 68, 73, 89, 117, 121]
- (ii) Critical thinking and scientific reasoning [19, 38, 43, 66, 81, 90]
- (iii) Problem-solving skills [19, 38, 43, 52, 54, 67, 73, 81, 90]

Simulation games are often perceived as powerful learning tools to enhance students' interactive or social skills as they are often played in teams. Most of the papers reported the positive impact of simulation games on different interactive skills.

- (i) Teamwork [4, 19, 38, 41, 42, 46, 50, 73, 99, 122]
- (ii) Collaboration [43, 47, 80]
- (iii) Social and emotional skills [123]

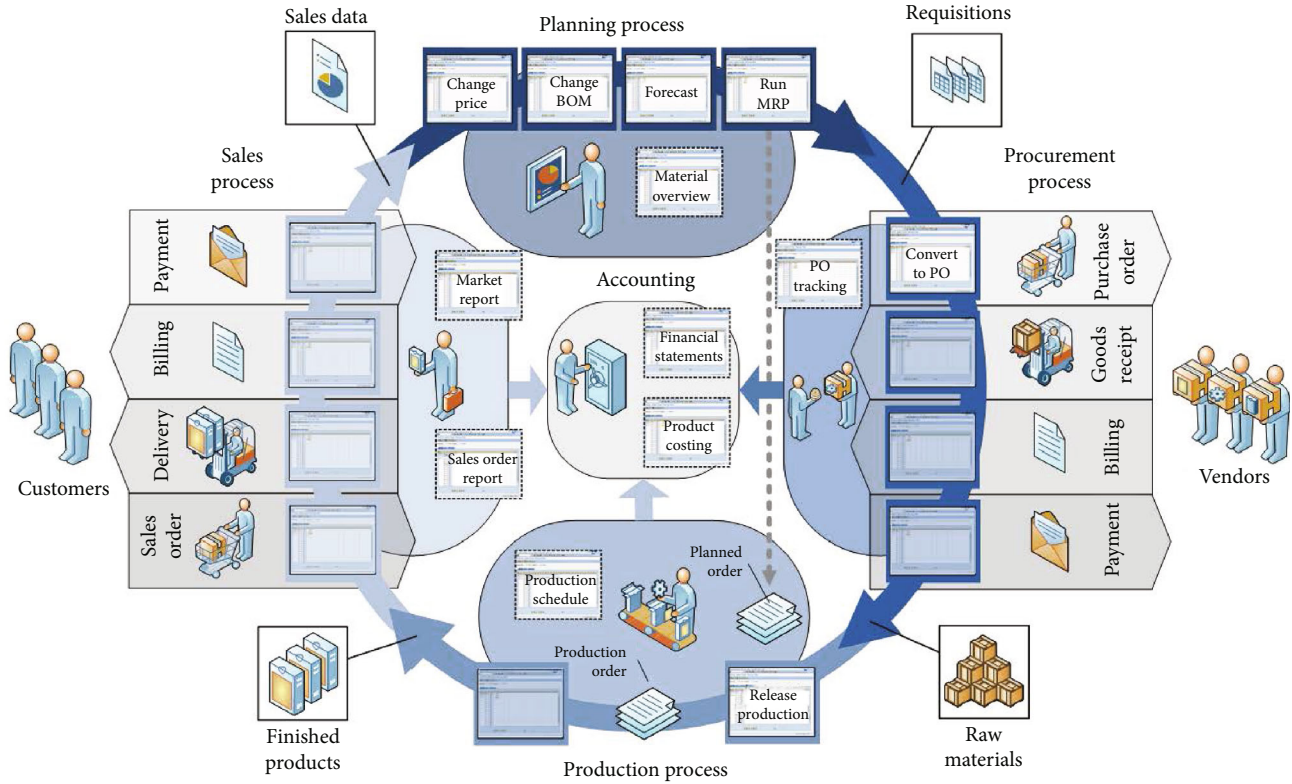


FIGURE 11: ERPsim manufacturing game.

TABLE 7: Learning outcomes in selected studies.

Learning outcomes	Papers measuring these outcomes
Communication	[19, 45, 47, 50, 52, 54, 88, 90, 91, 117]
Problem-solving	[4, 19, 43, 50, 52, 54, 73, 81, 90, 91]
Decision-making	[19, 39, 41, 46, 47, 50, 52, 54, 68, 71, 78, 80, 88, 117]
Analytical thinking	[19, 43, 47, 50, 66, 81, 86, 88, 90]
Teamwork	[4, 19, 42, 43, 46, 47, 50, 54, 73, 80, 88, 118]
Business process and operations knowledge	[41, 42, 46, 50, 52, 54, 62, 86]
Functional knowledge	[19, 41, 50, 52, 62, 64, 66, 68, 71, 78-80, 119]
Motivation	[4, 41, 42, 64-66]
Engagement	[43, 46, 62, 65, 67, 68, 76, 78, 82, 83]
Self-efficacy	[50, 61, 64, 68, 88, 91]

(iv) Learner-learner interaction [41]; the paper examined the impact of a simulation game called ERPsim by analysing the messages posted by the students on an online discussion forum during the game. They observed students' active participation and social interaction and reported an overall positive impact on interactive skills. Other studies reported that the interactive skills enhanced by playing BSGs are communication, persuasion, and conflict resolution

5.3.3. *Behavioural Outcomes of BSGs.* Many papers highlighted the behavioural and affective outcomes of computer simulation games.

- (i) Positive effects were reported concerning students' engagement with the simulation activity [43, 46, 62, 65, 67, 68, 76, 83]
- (ii) Increased motivation toward playing simulation [4, 41, 42, 64, 65, 69, 84]
- (iii) Higher satisfaction levels with the course content [4, 42, 47, 65, 84]
- (iv) Increased self-efficacy [39, 50, 64, 66, 68, 76]
- (v) Increased self-awareness and confidence [38, 39, 68, 91]

To conclude, most of the selected papers reveal positive effects regarding the use of computer simulation games on learning outcomes. Figure 12 shows the most common learning outcomes of BSGs identified in the selected papers of this review.

5.4. *Evaluation Methods Used in BSG Literature.* Analysis of the selected studies shows the absence of a uniform agreed evaluation framework to assess the impact of using simulation games in learning [124]. Instructors use different assessment methods to evaluate the simulation activity performance of students and other evaluation methods

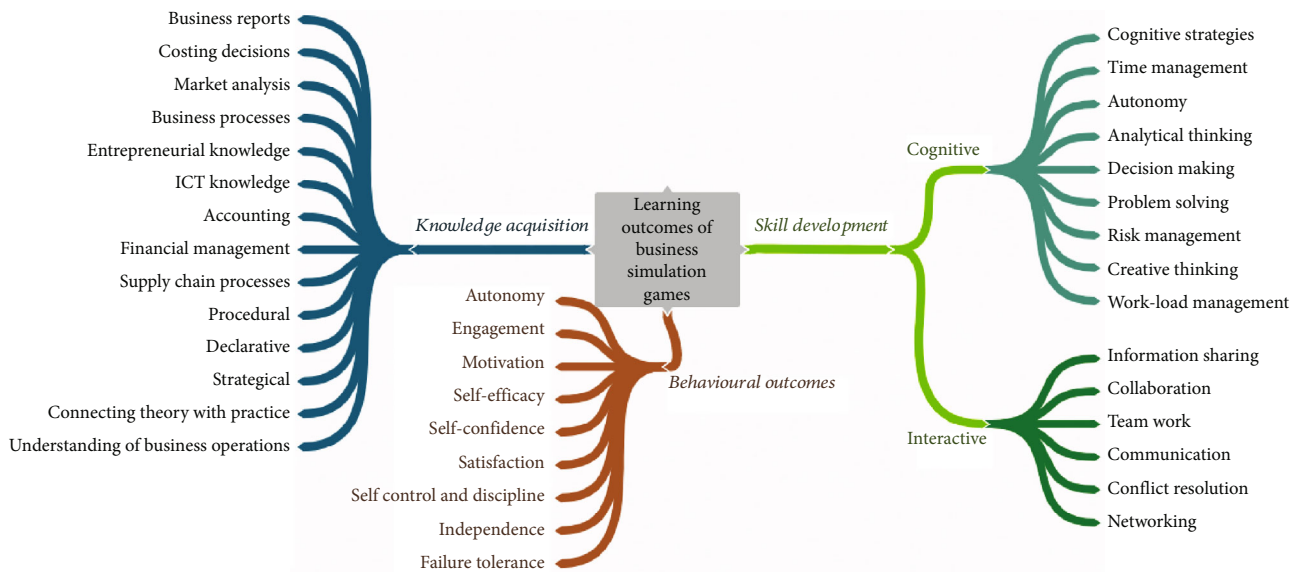


FIGURE 12: Learning outcomes of BSGs.

used by the researchers to assess the impact of simulation activity on the learning outcomes in the selected studies.

- (i) Instructors used game results (profit gains) to indicate better game performance [39, 42, 79, 80, 83]
- (ii) Reflection reports submitted by the students act as a formative assessment for the game activity [19, 66]. Reflection reports usually contain questions related to students' opinions on the simulation activities, their perceived gains from participating in the activity, their intention to use it again, the decisions they made, and the mistakes they wanted to rectify in the next session
- (iii) Exam grades are used as performance indicators as objective measures to assess students' knowledge gains [43, 79]

During the pregame stage, questionnaires are the most frequently used assessment tools. Researchers can use this tool to collect data from many respondents regarding their previous knowledge, demographic information, perceptions of innovative pedagogical tools, and prior learning styles. This information can help educators set goals and the pace and pattern of the game as they can indicate students' current knowledge and skill levels. Pregame surveys are rarely stand-alone. They are always followed by postgame surveys, which help researchers compare and analyse students' knowledge gains and achievement of the desired learning outcomes. Out of forty-nine selected studies, six [47, 65, 66, 73, 86, 89] used pregame surveys followed by postgame surveys.

The in-game assessments include observations of players while playing the game, in-group discussion, and reflection reports. Classroom observation is helpful to obtain instant feedback on game experience and enable a cognitive analysis of students as players to verbalise their thinking and

decision-making process during discussions. In addition, observations provide insight into students' interaction with the interface and other game designs [85]. Reflection reports are also a part of in-game assessment where students qualitatively assess their learning outcomes, experience, and knowledge gain. Reflection reports can be conducted once or multiple times during the game. Overall, in-game assessments measure students' mood, understanding, learning, and performance. The literature search revealed the importance of in-game assessment as only this can provide instant feedback about overall learning processes and other behavioural changes resulting from this process [125]. However, it is the least adopted method in BSG literature because of its complexity, time constraints, and issues regarding permission to access participants.

Postgame assessments are the most used evaluation methods in the selected studies (45) and assess students' actual knowledge gain and improvement in skills. In this assessment, games are evaluated considering their usefulness in achieving desired learning outcomes. Questionnaires are the most common tool for postgame assessment, followed by interviews and focus groups. Although most studies used quantitative surveys to conduct postgame assessments, a few used qualitative methods. For example, Loon et al. [81] conducted interviews with 36 students to explore their simulation activity views after they had taken part in the simulations. Goi [4] conducted focus group discussions with 17 students who played Total Enterprise Simulation as part of an undergraduate course to explore the role of authentic team-based learning in enhancing students' learning outcomes and satisfaction. In several studies, game results (financial and nonfinancial indicators) are also used as postgame assessments [39, 66, 79, 92]).

The most popular assessment tool is questionnaires due to their ease of use with larger sample sizes. However, qualitative assessments such as reflection reports, classroom

observation, and interviews give more profound insight into the learning experience [126]. In the research, there was not an assessment framework used to evaluate BSGs, as most studies used self-developed frameworks. This lack of a univocal assessment framework raises questions about the validity of the results. The analysis of the 57 selected papers shows that the evaluations are done at different phases of BSGs. Researchers used other qualitative and quantitative measurements to assess the impact of BSGs on learning outcomes. Based on the analysis, researchers presented a comprehensive evaluation framework (Figure 13) to evaluate the learning outcomes of simulation games. Instead of focusing on just a single point of time. Different learning outcomes are gained at various game stages; this framework can help educators assess them all.

6. Limitations and Future Research Directions in Selected Studies

This literature review of the BSG literature found three significant limitations that point to future research recommendations.

- (i) The most common limitations in the selected studies are the limited context of the study [54, 64, 79, 81] and the small convenience sample size which created issues in generalizing the results [19, 43, 64–66, 78, 85, 89]

Future recommendations: different studies proposed different recommendations to overcome these limitations. Vos [43] suggested future studies with a broader cross section of BSG users from business and other fields. The diverse sample will include participants with different characteristics, which may increase the chances of generalizability. Tao et al. [64] advised the expansion of the sample sizes in future studies to cover more classes in different universities for more in-depth and extensive analyses. Loon et al. [81] recommended collecting data from various sources (e.g. students' academic records) to establish the relationship between learning through simulation and academic performance. Urquidi-Martín et al. [54] conducted postgame surveys from 58 students from a single university in Romania. She suggested future research comparing the impact of using BSGs in different cultures and countries.

- (ii) Another limitation discussed in selected studies is either including limited variables or ignoring moderating and mediating factors that can influence the effectiveness of using BSGs to enhance learning outcomes

Future recommendations: Chen et al. [44] only examined two factors (enjoyment and cognitive appraisal). He recommended that more elements be included in the learning outcomes model to understand learning behaviour and outcomes, for example, students' concentration, curiosity, innovative attitudes, personal skills in IT, and understanding of business processes. [67] compared the learning outcomes of three teaching methods (lectures, case studies, and simu-

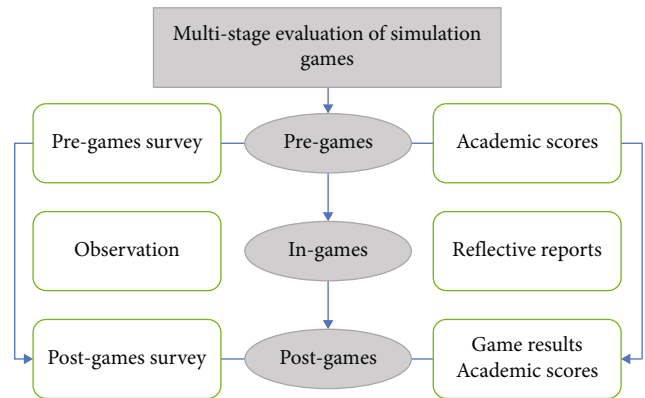


FIGURE 13: Evaluation methods at different stages of BSGs.

lation) by conducting surveys with students and instructors. The study did not consider the wide range of individual and group-level variables affecting BSGs' performance and students' learning outcomes. To overcome this limitation, he suggested investigating the factors that help predict or influence the use of BSGs may impact students' attainment of learning outcomes. Additional variables that can be analysed in the future were presented by Buil et al. [76]. The study focused on personal factors but not on contextual factors. For future studies, the study suggested that contextual variables should be analysed. Other learning components, such as retention or transfer learning, can be assessed objectively (e.g., students' academic grades and application tests).

- (iii) Students' perceptions and reports about learning outcomes were also a limitation in a few studies

Future recommendations: Burdon and Munro [45] suggested further research to focus on students' objective performance instead of just including students' perceptions. Similarly, [47] only used students' self-reported learning outcomes to measure simulation activity success. This can present a bias in the results as many factors can influence students' responses. To reduce this bias, in future studies, researchers suggested using objective measures such as student grades and application tests to measure learning. Another study [65] advised conducting interviews with instructors in addition to surveys with students to determine teachers' viewpoints concerning the use of digital games to facilitate learning. The researchers also suggested investigating factors such as students' self-efficacy, population demographic characteristics, curriculum, and instructors' experience with BSGs in future studies focusing on the impact of game play on learning efficiency. The results in another study [4] were only based on students' self-reported measures obtained by conducting post-game surveys with students. However, other factors like differences in student demographic characteristics and teaching approaches used by instructors, which may impact learning outcomes, were not considered. To overcome these limitations, researchers suggested a future study where objective measures of learning gains, for example, grades, alongside self-reported measures, for instance, postgame surveys, can be used to reduce biases in studies. Another suggestion was

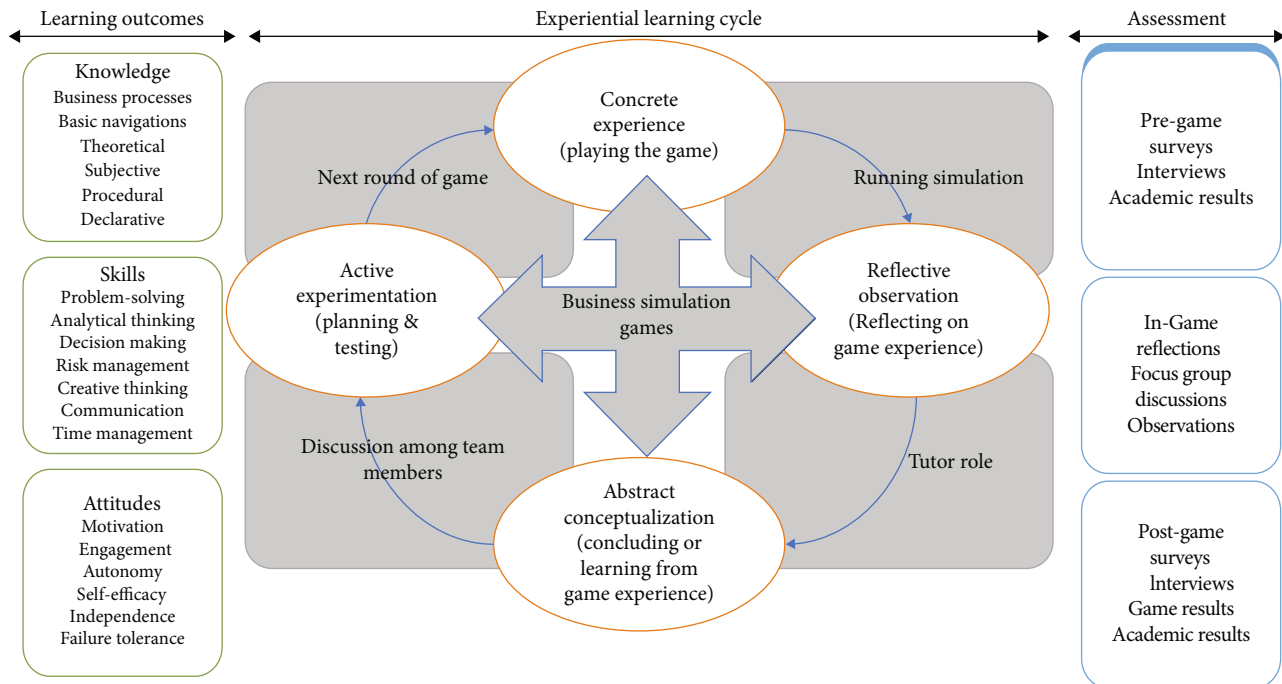


FIGURE 14: Overview of review findings.

to explore instructors' views regarding teamwork facilitating the acquisition and development of learning outcomes when using online BSGs.

The selected studies in this review presented myriad future research recommendations in the growing field of BSG research. These recommendations can further expand researchers' and instructors' knowledge to take advantage of the full potential of using BSGs in teaching and learning.

7. Conclusion

This paper has presented a systematic literature review of the empirical research on BSGs published between January 2015 and February 2022. The analysis of the fifty-seven selected studies, fulfilling the inclusion and exclusion criteria set by researchers, presented four significant themes within BSG research. These themes are techniques for the integration of BSGs in the existing curriculum, the use of BSGs to achieve learning outcomes, evaluation methods used in BSGs by instructors and researchers, and learning theories used to explain learning processes in BSG use. A significant part of BSG research is concerned with the use of BSGs to attain learning outcomes, the assessment of those outcomes, and integration of BSGs to achieve those learning outcomes. Figure 14 presents an overview of the findings of this review. As presented, BSGs follow the experiential learning cycle and by doing so can be used to attain verity of learning outcomes at different stages of games. Educators usually use one or mix of assessment methods to evaluate the learning outcomes.

All empirical studies included in this review focused on the impact that the use of BSGs might have on the achievement of different learning outcomes: skill development,

knowledge acquisition, and/or behavioural outcomes. Three conclusions can be drawn from this review:

- (i) The use of BSGs in higher education courses positively affects students' achievement of learning outcomes
- (ii) Three critical factors should be kept in mind while integrating BSGs in existing courses (integration process, the specificity of the game, and the instructors' role)
- (iii) There is a need for a univocal multistage evaluation framework (from both students' and instructors' perspectives) to assess how using BSGs might enhance learning outcomes

Like all SLRs, this research has a few limitations that should be considered when evaluating the reported findings: limited search terms, period of the paper published, and the databases included. However, the articles in this SLR provide an overview of the recent empirical research on BSGs. Given the growing number of studies in this field, several papers that discuss the impact of computer simulation games on learning outcomes may have been omitted in this study. However, it would not have been a deliberate, systematic omission. The review excluded theoretical and opinion papers and only included empirical studies as it was necessary to ground our understanding of the effects of the use of BSGs on students' attainment of learning outcomes in research evidence rather than suppositions.

Another limitation is that the review only included open access papers. The choice regarding the inclusion of open access papers is motivated by their worldwide visibility

without barriers. These open access publications reach non-scholarly, industry, and academic audiences in less developed areas of the world, where there is minimal access to commercial databases and journals [127]. The sample excluded dissertations, books, and grey literature. The significance of this is that the quality standards of peer-reviewed publications do not have to be fulfilled by grey literature. Articles reviewed by academics must conform to the standards of the peer reviewer and the editorial board responsible for ensuring the journal's content and quality [128]. Therefore, many studies were excluded from the review, which might otherwise have provided additional insight to this review. It is important to note that, although not considered a literary form of publication, grey literature is often produced by experts in the field [129]. In future studies, the grey literature can be used to minimise publication bias, improve the comprehensiveness of the review, and offer a more informed image of the available evidence [130].

Our review will contribute to the BSG literature by consolidating the latest evidence to help researchers to explore the effective use of BSGs to facilitate learning processes. The study has many methodological and applied implications. From a methodological standpoint, we suggest that researchers consider the concordance between learning outcomes and the evaluation measures used to assess them. While most of the papers used surveys to determine knowledge and skill gains, combining different learning measures could be more appropriate. We suggest a multistage multi-method evaluation strategy to capture the full potential of using the BSGs to enhance student attainment of learning outcomes as each stage presents an opportunity for students to gain different skills and knowledge. An authentic and embedded assessment should include multiple measurement procedures to cover various aspects of games [125], reduce bias, and increase the results' validity. Another piece of advice for the researchers is to consider both instructors' and students' perspectives while evaluating the impact of using BSGs on student achievement of learning outcomes as it would reduce biases in results. From an applied standpoint, this review may help instructors choose the best possible BSG according to their needs. It may also allow universities to integrate these games effectively into existing graduate and undergraduate courses. Our findings present an extensive avenue for future research in the BSG field, especially regarding the effects of BSGs on employability and transferrable skills of graduates.

Data Availability

Since this paper is a systematic review of published articles, it does not involve primary data collection, and there were no data to make available for public access. Similarly, no ethics approval was necessary as this paper was a review paper.

Conflicts of Interest

The authors declare no conflict of interest in the work reported here.

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