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Games in education: a systematic review of studies in international and Iranian contexts

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Abstract
This systematic review, utilizing the PRISMA framework, analyzes 248 international and 143 Iranian articles to provide an overview of studies on games in education. It examines five key themes: common terminology, methodology, type of study, variables studied, and technologies used, presenting findings in the same order of priority. Internationally, the term "serious games" is more prevalent, particularly among European scholars, while in the Americas and Asia, generic terms like "digital games" are more common. In contrast, Iranian research predominantly uses the term "computer games". Methodologically, both international and Iranian studies primarily employ quantitative approaches, with questionnaires as the common data collection tool. However, international studies are more likely to employ experimental and quasi-experimental designs in explanatory-type research, while Iranian studies often use correlational designs to explore relationships between variables without intervention. In examining variables, both sets of literature frequently assess cognitive outcomes such as learning and motivation, with international studies showing a broader use of varied assessment tools. Technology-wise, international research shows a prevalent use of computer-based platforms and a rising interest in mobile technologies, reflecting a similar trend in Iranian studies but with a noticeable lag in adopting newer technologies. The findings of this study serve as a benchmark for scholars in various regions studying the use of games in education. Additionally, they provide new insights into how linguistic and cultural differences may influence scientific discussions. The paper concludes with key suggestions for future studies to improve research practices in the field and increase the generalizability of findings across contextual and regional boundaries.

Keywords Games in education · Game-based learning · Educational games · International research · Iranian research

Introduction

In the digital age, playing games has become a popular daily activity for individuals of all ages, from the young (Stephen & Edwards, 2017) to the elderly (De Schutter, 2011). According to Caillois (1961), playing a game is "an activity that is voluntary and enjoyable,

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separate from the real world, uncertain, unproductive in that the activity does not produce any goods of external value, and governed by rules" (p. 442). Statista's report from August 2021 indicates there are approximately 3.243 billion game players worldwide, with Asia ranking first at 1.48 billion gamers, followed by Europe with 715 million gamers. This widespread interest in playing games can be attributed to their immersive, enjoyable, and exciting nature (Wang et al., 2022), which often causes players to "lose track of real-world time" (Chen & Hsu, 2020).

The immersive and enjoyable nature of gaming has also captured the attention of educational researchers worldwide (Zeng et al., 2020). There is a growing body of research dedicated to exploring the effects of using games in educational settings on various learning outcomes (Chen et al., 2021). Initially, the focus was on the potential educational applications of commercial games, primarily designed for entertainment (Connolly et al., 2012). Over time, however, research interest shifted towards the development of games specifically for educational purposes, such as serious games (Zhonggen, 2019). Meta-analyses have consistently demonstrated the positive effects of incorporating various forms of games into educational practices on cognitive, metacognitive, and affective learning outcomes (Barz et al., 2024; Gui et al., 2023; Noroozi et al., 2020; Thompson & von Gillern, 2020). Scholars attribute this positive effect to several factors, including increased student engagement (Annetta et al., 2009) and motivation (Chen & Wu, 2023), and the opportunity for experiential learning within a meaningful context (Chang et al., 2024), all of which contribute to a more effective and dynamic learning experience (Zeng et al., 2020).

Problem statement

The use of games in education has grown significantly in recent years, resulting in the publication of numerous research articles worldwide (Ekin et al., 2023). Although this research offers valuable insights, the large number of studies has caused fragmentation in the field (De Freitas, 2018). This fragmentation arises from different interpretations of what constitutes a "game" (Zhan et al., 2022), varied research methods and technologies used (Chen et al., 2021), and the application of games across different subjects (Bado, 2022) and for various learning goals (Barz et al., 2024). More importantly, these studies span various regions, such as the US, Europe, and Asia (Hwang & Chen, 2022), each with its own distinct culture, approach to learning, and views on using games in education (Jossan et al., 2021). These regional differences greatly limit the generalizability of findings, as results from one region may not be readily applicable to another due to contextual variations (Alfarah et al., 2010). For instance, meta-analyses have shown that using games in education in countries with collectivist cultures generally results in higher effect sizes on students' science achievement (Lei et al., 2022), computational skills (Lu et al., 2023), and critical thinking skills (Mao et al., 2022) compared to countries with individualistic cultures.

To synthesize these fragmented insights and provide a more comprehensive overview, many systematic reviews have been conducted to date. However, these reviews often have a narrow focus, usually limited to a specific interpretation of what a game is (Connolly et al., 2012), subject area (Chen et al., 2021), educational level (Guan et al., 2024), or learning outcomes (Qian & Clark, 2016). Consequently, there is still no overarching synthesis of international studies on using games in education. This synthesis is particularly needed to understand how researchers in different regions interpret the game concept, the common research methodologies and study designs used, the variables studied, and the technologies used. Recognizing

such regional disparities is crucial for generalizing findings across different cultural and educational settings (Bray et al., 2003). Additionally, it facilitates cross-regional learning and collaboration, which could help exchange ideas and experiences, inform policy-making, and lead to more impactful research (Murray & Warleigh-Lack, 2013).

Research purposes and questions

The current study aims to address the identified gap in the literature by conducting a systematic review of research on the use of games in education. This review provides a comprehensive overview of key aspects of studies on the use of games in education, including common terminology, research methodologies, types of studies, variables examined, and technologies implemented. It does so by examining articles published in the six journals that have the highest number of publications in this field, as detailed in the Methods section. Additionally, the analysis includes a regional breakdown, offering a nuanced understanding of the global landscape of game-based education research.

Moreover, the findings from various regional clusters are compared with those from similar studies in Iran, a country with a distinct linguistic and cultural characteristics. This comparison between international and local publications provides two significant advantages. Firstly, it elucidates how linguistic differences shape educational technology practices. Such a nuanced understanding is essential for identifying how local contexts shape the adoption and implementation of educational technologies. According to Marín et al. (2023), researchers from diverse linguistic backgrounds often interpret similar educational technology concepts differently, which leads to varied research outcomes. Secondly, by aligning local developments in Iran with international benchmarks, this comparison facilitates a comprehensive understanding of the state of the art in the field for local researchers and practitioners. It helps identify areas that require improvement and fosters the adaptation of best practices from the global arena. This approach not only enhances the relevance and efficacy of educational technologies within Iran but also contributes to a more inclusive and diversified global discourse in educational technology research, as advocated by Marín et al. (2023).

Accordingly, the following research questions aim to be addressed in the current study:

RQ1. What terminology is commonly used in game-based education research in international and Iranian contexts?
RQ2. What methodologies are prevalent in game-based education research in international and Iranian contexts?
RQ3. What types of study designs are employed in game-based education research in international and Iranian contexts?
RQ4. Which variables are frequently examined in game-based education research in international and Iranian contexts?
RQ5. What technologies are commonly implemented in game-based education research in international and Iranian contexts?

Method

This study follows a systematic review method, as a replicable and transparent review process (Goagoses & Koglin, 2020), to provide a clear understanding of advancements in the use of games in education. The Preferred Reporting Items for Systematic Reviews and

Meta-Analyses (PRISMA) framework (see Moher et al., 2009) was adopted and used to develop a review protocol that included information about identification, screening, eligibility, and analysis for conducting the study (see Fig. 1).

Identification phase

This review employed a systematic search strategy to identify relevant articles using the keyword "gam*" for international and "bazi*" for Iranian journals, as part of the search string. These keywords were targeted to appear in the titles, keywords, and abstracts of the articles. The search was conducted by the lead author in December 2022. Given the importance of conducting review studies based on quality publications (Chen et al., 2021), the search was limited to six renowned international journals in the educational technology field with high impact factors, namely: "*Computers & Education*", "*British Journal of Educational Technology*", "*Educational Technology Research and Development*", "*Journal*

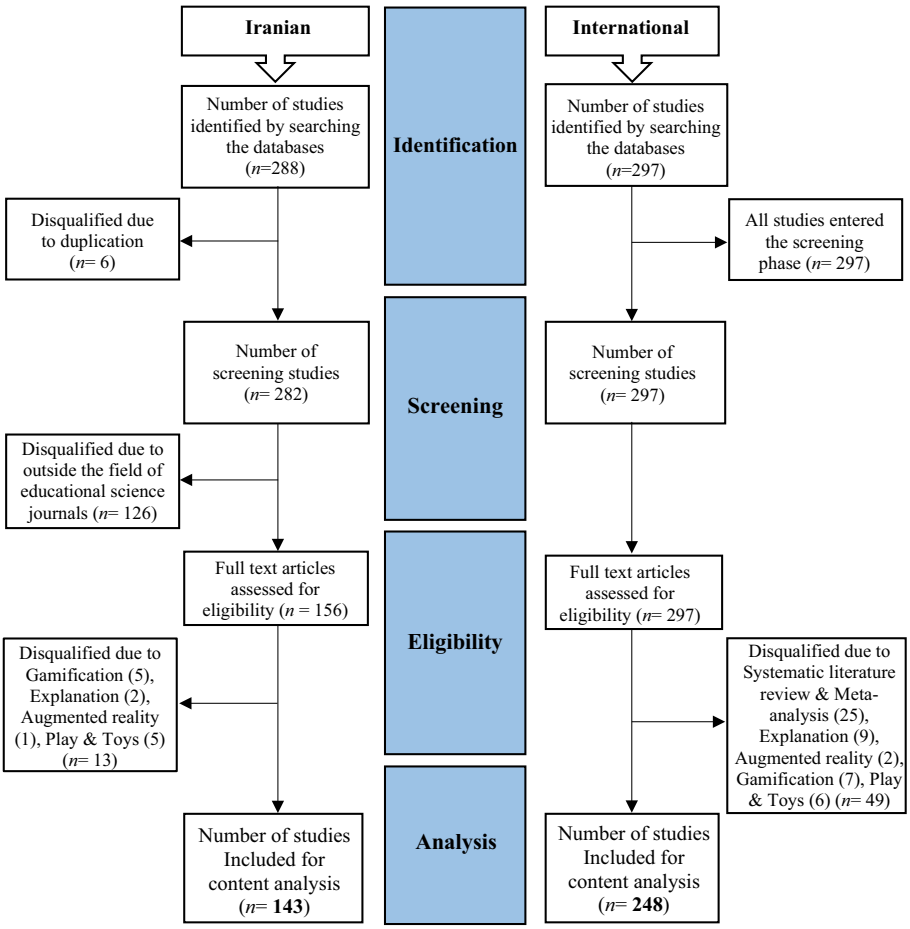

Fig. 1 Adapted PRISMA flow diagram

of Research on Technology in Education", "*Journal of Computer Assisted Learning*", and "*Technology Pedagogy and Education*". Most of these journals were identified in previous bibliographic studies as having a significant number of publications in the field of game-based education (e.g., Chen et al., 2021; Hwang & Chen, 2022).

For the identification of Iranian research, the search was limited to studies conducted by Iranian researchers, published in Iranian journals, written in Persian, and indexed in a comprehensive online database of Iranian journals, namely "*Magiran*".

As the first inclusion criterion, the search was limited to the last 50 issues[1] of the international journals, with no time limit applied to the search in the Iranian journals. The search resulted in 297 articles from international journals and 282 articles from Iranian journals, after the removal of six duplicated articles.

Screening phase

In the screening phase, the titles and abstracts of the 579 retrieved articles were screened to identify potentially relevant articles. In accordance with the second inclusion criterion, only articles employing games within an educational context to enhance learning were selected for further analysis. Consequently, a total of 126 Iranian articles were excluded due to their focus on non-educational purposes such as entertainment, marketing, or game development.

Eligibility phase

In this phase, the remaining 453 articles, including 297 international and 156 Iranian studies, were examined to identify the most appropriate for inclusion. Under the third set of inclusion criteria, articles were considered eligible for content analysis if they met the following conditions: (1) their full text was available, (2) they were empirical in design, (3) they were published in peer-reviewed journals (specifically for Iranian articles), and (4) they focused on the use of games in educational settings. Consequently, 49 international and 13 Iranian articles were excluded. These exclusions were due to the articles being conceptual (11) or review/meta-analysis (25), or because they focused on the use of game elements (i.e., gamification) in education (8) or using games for non-educational purposes (11). Consequently, a total of 391 articles—248 international and 143 Iranian—met the eligibility requirements and proceeded to the content analysis phase.

Analysis phase

The selected articles were entered into ATLAS.ti 8 for content analysis. To facilitate the content analysis process, a coding scheme was developed in two steps. In the first step, the researchers developed an initial version of the coding scheme inductively during a group discussion, based on the objectives of each research question. This coding scheme included the following categories:

[1] The decision to review the last 50 issues was primarily made to prevent the review from becoming overly extensive, given the high number of publications on using games in education, while offering a substantial timeframe to observe emerging patterns and establish benchmarks in academic research.

Terminology

This category was established to capture how different studies articulate and define gaming applications within educational settings. For a comprehensive understanding and inclusion of relevant terminologies, we adopted the classification proposed by Martí-Parreño et al. (2016) in their bibliometric study. This classification categorizes games into traditional games and video games. The latter category is further subdivided into COTS (commercial off-the-shelf) games, serious games, and authored games.

Methodology

This category pertains to all the necessary information required for readers to assess the merit of the study and its conclusions, while also providing a blueprint for replicating the study in the future. To identify this information in the selected articles, we adopted the four key elements that every empirical research should include, suggested by Hahn Fox and Jennings (2014): (1) data collection approach, (2) study design, (3) selection of participants, and (4) data analysis (or analytic strategy).

Type of Study

This category incorporates the classification system used to categorize the research, as introduced by Graham et al. (2013) and based on the earlier study by Gibbons and Bunderson (2005). To determine the types of studies, the articles are coded into three categories: (1) explore (scientific and technological), (2) explain (scientific), and (3) design (technological). This categorization aids in aligning the studies with their respective scientific and technological focuses.

Variables studied

The dependent variables examined in various studies were coded depending on whether they belonged to cognitive, affective, or behavioral learning outcomes, in line with Dehghanzadeh et al. (2024). Cognitive outcomes include variables related to mental processes such as knowledge acquisition, problem-solving skills, critical thinking, and learning achievements. Affective outcomes pertain to emotions, attitudes, motivations, and engagement levels, reflecting the emotional aspects of learning. Behavioral outcomes encompass observable behaviors and actions, such as performance, interaction, collaboration, or usage patterns.

Technologies used

This category pertains to the mediums or methods utilized for game delivery in an educational context. To facilitate the coding process in this category, we adopted the coding framework presented by Abdul Jabbar and Felicia (2015) in their review article. This framework identifies various gaming platforms utilized by researchers, including key ones such as computers, mobile devices, online/web-based systems, board and card games (non-digital), and virtual reality.

In the second step, the coding scheme was applied to the selected articles, which resulted in refined codes and sub-codes. The first researcher applied an iterative process of testing the codes, iteratively summarizing the data, identifying new codes, connecting codes to one another, developing new themes, and applying the revised codes, until reaching a saturation point (i.e., no new codes or themes were generated). During this process, other members of the research team checked the themes and codes independently of the lead researcher. Finally, each code was operationally defined so that any coder could identify relevant content. To establish coding reliability, the first and second authors randomly picked 10 articles and blind-coded them. Cohen's Kappa statistic was used to examine the inter-rater reliability, testing the coding quality. The test indicated a high agreement between reviewers' coding ($\kappa = .93$, $p < .001$), which confirmed the reliability of the final coding scheme. After finalizing the coding scheme, the lead author coded all identified articles to synthesize their findings.

Results and discussion

Building on the content analysis, further detailed insights were gathered regarding the use of games in education across international and Iranian contexts. Table 1 highlights that *the British Journal of Educational Technology* featured the most publications among other journals, followed by the *Journal of Computer Assisted Learning* and *Computers & Education*. These results align closely with previous bibliometric studies, which also identified these journals as the principal venues for disseminating international research in game-based education (e.g., Hwang & Chen, 2022; Schöbel et al., 2021).

The Fig. 2 illustrates the geographical distribution of the international studies, the majority of publications originated from European countries, with the Netherlands ($n = 14$) and the UK ($n = 11$) contributing the highest number of publications. This was followed by Asia and the Americas, which exhibited a relatively similar number of publications, 73 and 71 respectively. In the Americas, the USA reported the highest number of publications on the use of games in education ($n = 64$). In Asia, Taiwan was identified as the leading contributor to research in this area ($n = 51$). These findings are consistent with those of other studies that focus on specific domains such as science and mathematics education (Chen et al., 2021), as well as studies with a broader scope (Hwang & Chen, 2022). These studies underscore the significant contributions of the US, Taiwan, the Netherlands, and the UK to the field of game-based education at the international level.

Table 1 The number of articles extracted from six important international journals

Continents					Number of articles	Title of journal
Africa	Oceania	Europe	Asia	Americas		
1	4	40	16	12	73	British journal of educational technology
0	2	22	18	11	53	Journal of computer assisted learning
0	4	14	16	18	52	Computers & education
0	0	11	13	22	46	Educational technology research and development
0	2	6	9	2	19	Technology pedagogy and education
0	0	0	0	5	5	Journal of research on technology in education

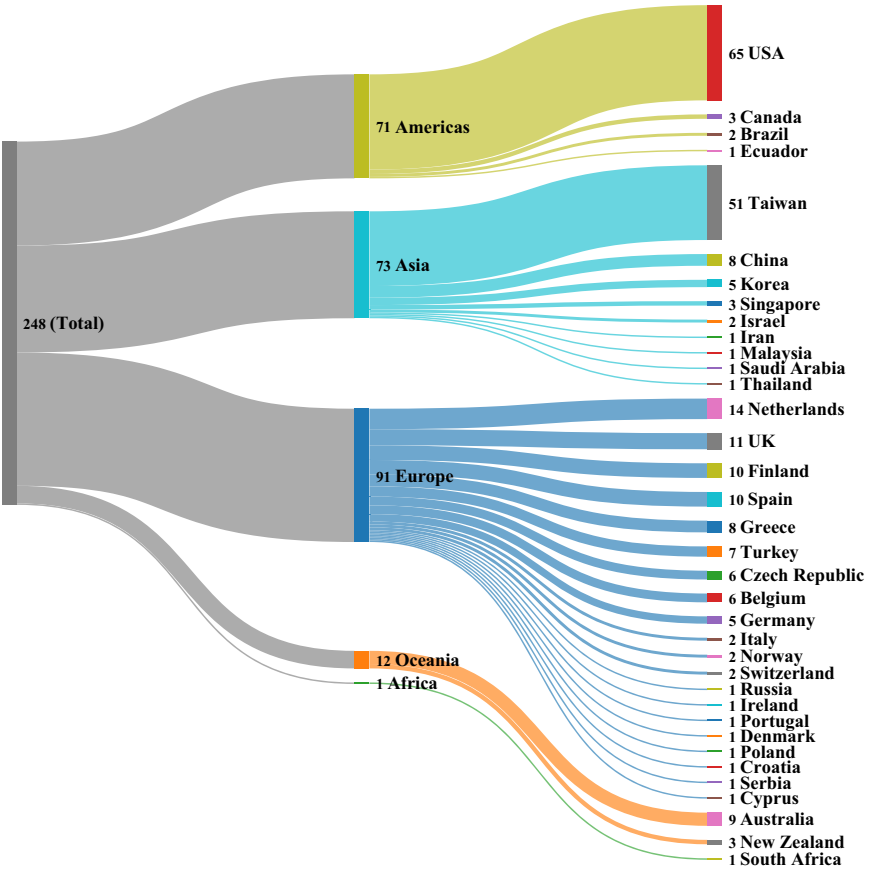

Fig. 2 The geographical distribution of the international studies

Table 2 The list of Iranian journal with more than three articles

Number of articles	Title of journal
16	Information and communication technology in educational
13	Technology of education journal
4	Journal of Iranian cultural research
3	Journal of new media studies
3	Research in curriculum planning

For the Iranian publications, as shown in Table 2, the *Journal of Information and Communication Technology in Education* and the *Technology of Education Journal* emerged as the leading journals. These two peer-reviewed publications are recognized as the foremost Persian-language journals in the field of educational technology, containing the highest number of empirical studies on educational gaming. Moreover, the findings indicated that out of 143 Iranian articles published on the use of games in education, 135 articles have

been published since 2010 (94.4%), with 77 articles published in the past six years. This trend aligns with the global publication trend of using games in education as reported by Ekin et al. (2023), indicating that while the years 2002–2011 accounted for 24.6% of the total publications, the number of publications between 2012 and 2021 increased approximately threefold, comprising 70.4% of the total.

The Common terminology used in the international and Iranian studies

In an analysis of terminological preferences in scholarly discourse regarding the application of games in educational contexts, a distinct regional variation was observed (see Fig. 3). Scholars in the Americas and Asia primarily employ generic terms such as “digital games”, “educational games”, and “(digital) game-based learning”. In contrast, European scholars, although they occasionally use these terms, more frequently adopt the term "serious games". This pattern echoes findings from a recent review study reporting a predominance of European scholars focusing on using serious games in educating for sustainability (Hallinger et al., 2020). However, this seems to contrast with the historical fact that the concept of “serious games” was initially proposed by scholars in the US and tends to attract a larger audience in the Americas than in European countries at the beginning (Susi et al., 2007). This shift could be influenced by European Union initiatives, such as

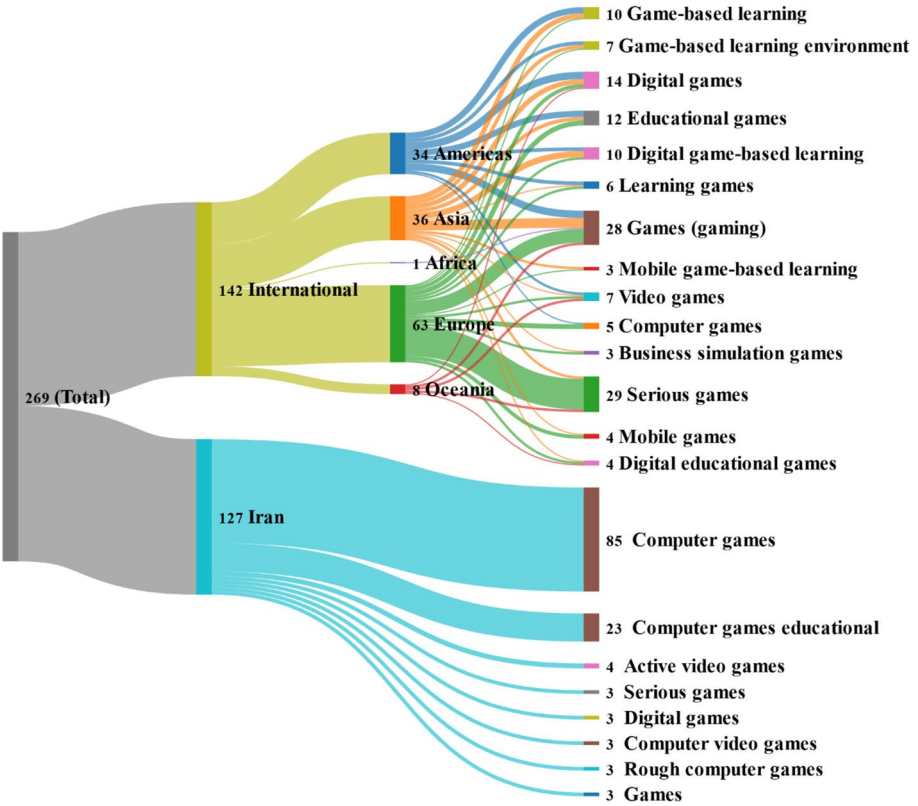

Fig. 3 The overview of terminology used by international and Iranian scholars (terms used more than three)

the Games and Learning Alliance Network of Excellence on Serious Games (Zhonggen, 2019), shaping the serious games movement in European countries and the UK in past decade (Bellotti et al., 2010).

The examination of scholarly articles published by Iranian academics reveals a significant divergence in the terminology used for games in education. The majority of reviewed articles employ the Persian equivalents of "computer (educational) games". In contrast, terms such as "digital games" and "serious games," which are more commonly used in other regions, appear less frequently in Iranian context. This finding corroborates previous studies showing that, despite working in the same field, educational technology scholars from different countries may interpret the same concepts differently due to linguistic differences, leading to country-specific topical clusters (Marín & Zawacki-Richter, 2019; Marín et al., 2023). In the case of Iran, the term “computer games,” as opposed to “serious games,” resonates more deeply within the Persian-speaking academic community due to its direct reference to familiar and widely used computer technology (Rezaeifar, et al., 2023; Bakhtiari, 2022).

Research methodology of international and Iranian studies

Data collection approach

The data collection approach particularly is about the instruments used for data gathering when using games in educational contexts.

As indicated in Table 3, in the international studies, questionnaires (surveys) are the most frequently used data collection approach, appearing in 187 out of 248 studies (75.4%), followed by knowledge tests in 129 studies (52.0%), and interviews in 82 studies (33.1%). Lesser-used methods include observations (taking notes) and log files, appearing in 39 (15.7%) and 38 (15.3%) studies respectively. Regionally, this trend shows nuanced differences among the continents. For instance, in the Americas, questionnaires are predominant, used in 57 out of 71 studies (80.3%), knowledge tests in 35 studies (49.3%), and interviews in 21 studies (29.6%). In Asia, questionnaires are even more dominant, used in 65 out of 73 studies (89.0%), followed by knowledge tests in 51 studies (69.9%), but with fewer interviews at 23 studies (31.5%). Europe shows a slightly lower reliance on questionnaires, with 62 out of 91 studies (68.1%), and a balanced use of knowledge tests and interviews in 41 (45.1%) and 33 (36.3%) studies respectively.

In Iran, the reliance on questionnaires is similarly high, used in 106 out of 143 studies (74.1%). However, the usage of knowledge tests drops significantly to just 9 studies (6.3%), and interviews appear in 10 studies (7.0%). The finding regarding the discrepancy in the use of knowledge tests suggests that Iranian studies may have placed less emphasis on developing learners’ domain-specific knowledge. Moreover, the comparison of findings at international and Iranian levels indicates that international scholars are more inclined to use multiple measurement approaches to capture different dimensions of learning and interaction when using games in education.

The current study’s findings corroborate previous review studies (e.g., Gao et al., 2020; Guan et al., 2024), showing that researchers tend to favor traditional approaches such as questionnaires, knowledge tests, and/or interviews to collect data and assess the impact of using games in education on various learning outcomes. Besides overlooking the limitations of self-report assessment methods (see Noroozi et al., 2024), this suggests that the potential of technologies like games to provide valuable data during the learning process

Table 3 Data collection approach in international and Iranian studies

	Continents					Total (n = 248)	Iran (n = 143)
	Americas (n = 71)	Asia (n = 73)	Europe (n = 91)	Oceania (n = 12)	Africa (n = 1)		
Questionnaire (survey)	57	65	62	3	0	187	106
Knowledge test	35	51	41	2	0	129	9
Interview	21	23	33	4	1	82	10
Observation (taking notes)	16	9	12	2	0	39	3
Log files	14	11	12	1	0	38	2
Video/audio recorder	11	9	16	1	0	37	0
Class discussion	4	2	5	0	0	11	0
Completing a task	3	3	3	1	0	10	0
Learning activity	5	3	2	0	0	10	0
Solving a problem	6	1	3	0	0	10	0
Screen recording	4	0	2	0	0	6	0

Some studies used more than one data collection approach

has been largely neglected, particularly in Iran. In educational settings where games are used, learners generate diverse information about their learning progress and needs, which is saved as log files. This enables researchers to gather user-specific data through "non-invasive" approaches (McClarty et al., 2012). Additionally, the emergence of new digital tools, such as eye-tracking, offers highly accurate and detailed records of students' learning behaviors while playing games in educational contexts (Tsai et al., 2016). Employing such data-collection techniques allows researchers to avoid continuous monitoring, thereby reducing students' anxiety about being assessed (Shute, 2011).

Study design

Table 4 presents the findings on study design in terms of the research method and research design.

The analysis of international research methods and designs reveals a predominance of quantitative methods (111 out of 248, 44.8%), with quasi-experimental (65 out of 111, 58.6%) and experimental designs (27%) being the most common. Mixed methods are also significant, comprising 36.7% of studies, with explanatory and exploratory sequential designs being the primary approaches, respectively, 17.6% (16 out of 91) and 16.5%. Qualitative methods make up 18.5% of the studies, predominantly using case studies (34 out of 46, 73.9%). Regional trends show variations: in the Americas and Europe, quantitative and mixed methods are most prevalent, with a notable emphasis on experimental designs in Europe (18 out of 38, 47.4%). Asia stands out with a stronger preference for quantitative methods (39 out of 73, 53.4%), especially through using quasi-experimental designs (34 out of 39, 87.2%).

In reviewing the methodology of Iranian studies, it became evident that quantitative methods are predominantly favored among Iranian researchers (108 out of 143, 75.5%), reflecting the broader international trends. Within this dominant methodology, the most common research designs include quasi-experimental (54 out of 108, 50.0%) and survey designs (23.1%). In addition, the correlational research design stands out in some of the Iranian studies (18 out of 108, 16.7%), a notable contrast to its lesser prevalence internationally (2 out of 111, 1.8%). Qualitative methods are considerably less frequent, used in only 3.5% of the Iranian studies, with case studies being the only used qualitative research design.

The predominant preference for quantitative methods in both international and Iranian research landscapes suggests a global academic inclination toward empirical analyses, as also demonstrated in previous review studies on the use of games in education (Gao et al., 2020; Kara, 2021). European countries, in particular, show a strong emphasis on using experimental designs, which may be indicative of their robust research infrastructure's ability to manage rigorously controlled studies. Conversely, both Iran and Asia tend to focus more on using quasi-experimental designs. This difference may be driven by logistical challenges but also by ethical considerations concerning the targeted populations, making fully controlled experiments less feasible. For instance, based on the current study's findings, the majority of research studies from Iran (44.1%) and Asia (38.4%) targeted primary students (refer to Sect. *3.5.3*). This demographic focus likely influences the choice of methodology, as studies involving younger populations often necessitate adjustments in design to comply with ethical standards and practical realities. This consideration is apparent in a review study by Hainey et al. (2016), which reported that the majority of studies on the use of games in primary education utilized quasi-experimental designs.

Table 4 The design of international and Iranian studies

	Continents					Total (n = 248)	Iran (n = 143)
	Americas (n = 71)	Asia (n = 73)	Europe (n = 91)	Oceania (n = 12)	Africa (n = 1)		
Research method							
Quantitative	29	39	38	5	0	111	108
Mixed method	28	26	36	1	0	91	30
Qualitative	14	8	17	6	1	46	5
Research design							
Quasi-experimental	9	34	20	2	0	65	54
Case study	16	4	12	2	0	34	5
Experimental	8	5	18	0	0	31	4
Survey study	5	6	7	1	1	20	25
Explanatory sequential design	5	5	6	0	0	16	3
Exploratory sequential design	7	2	5	1	0	15	3
Analytical	1	1	3	2	0	7	12
Cross-sectional	3	0	0	0	0	3	9
Causal-comparative	2	0	1	0	0	3	0
Concurrent triangulation design	2	0	1	0	0	3	2
Correlational research	2	0	0	0	0	2	18
Longitudinal study	0	0	1	1	0	2	0
Ethnographic research	0	0	1	1	0	2	0
Action research	1	0	1	0	0	2	0

The list of research design only includes those with more than 2 repetitions overall

Selection of participants

This section presents the findings regarding the selection process of participants, including the targeted group and the sampling method used (see Table 5).

Targeted group The findings of the current study indicate that, at the international level, more attention has been given to primary school students, who are the most frequently targeted group, appearing in 88 out of 248 studies (35.5%). This is followed by secondary school (29.0%) and higher education (24.6%) students. When examining the data by continent, it is clear that there are distinct regional preferences in target groups. In the Americas, secondary school students are the most targeted group, appearing in 25 out of 71 studies (35.2%), followed closely by higher education (28.2%) and primary school (26.8%) students. In Asia, primary school students are predominantly studied, appearing in 28 out of 73 studies (38.4%), while secondary school students and higher education students receive less emphasis, appearing in 17 (23.3%) and 19 studies (26.0%), respectively. Europe shows a similar pattern to Asia, with primary school students being the most studied group, targeted in 36 out of 91 studies (39.6%), followed by secondary school (27.5%) and higher education (22.0%) students.

In Iran, the focus on target groups reveals a distinct pattern. Secondary school students are the most targeted group, appearing in 66 out of 143 studies (46.2%), which is a higher proportion compared to the international and regional trends. Primary school students follow closely, targeted in 63 studies (44.1%), indicating a significant focus on the early stages of education. However, there is a substantial drop in the focus on higher education, with only 8 studies (5.6%) targeting this group. This significant difference suggests that Iranian research places a heavier emphasis on pre-university education compared to other regions.

The findings of the current study at the international level align well with the findings of previous review studies (e.g., Chen et al., 2021; Cheng et al., 2015a; Kara, 2021). Moreover, the comparative analysis of the current study illustrates that while primary school students are a common focus internationally and particularly in Europe and Asia, the Americas and Iran display a stronger preference for secondary education. This observation underscores the influence of local educational priorities on the specific educational levels emphasized in research studies. For instance, the lower focus on the higher education context in the Iranian studies could be attributed to the unique educational atmosphere at higher education institutions, which includes rigid academic structures, a strong emphasis on traditional teaching methods (Hajhosseini & Bazargan, 2018), and possibly a general perception that games are less suitable for adult learning environments (Gao et al., 2020).

Sampling method The majority of international studies on games in education employed non-randomized sampling techniques (165 out of 248, 66.5%), with only 82 studies (33.1%) used randomized methods. In contrast, Iranian studies demonstrated a more balanced pattern, with 67 (out of 143, 46.9%) studies using randomized sampling methods and 63 studies (44.1%) using non-randomized methods. These findings align with previous research that report a frequent use of non-randomized sampling techniques in studies on games in educational contexts (Kara, 2021). This prevalence may be due to the practical challenges in social science of collecting a truly random sample, making non-random sampling methods, such as convenience or snowball sampling, more common (Hahn Fox & Jennings, 2014). Such methods allow an easier access to the reachable sample sites in quantitative, qualitative and mixed designs in educational contexts (Kara, 2021).

Table 5 The selection of participants in international and Iranian studies

	Continents						
	Americas (n = 71)	Asia (n = 73)	Europe (n = 91)	Oceania (n = 12)	Africa (n = 1)	Total (n = 248)	Iran (n = 143)
Targeted group							
Primary school	19	28	36	5	0	88	63
Secondary school	25	17	25	4	1	72	66
Higher education	20	19	20	2	0	61	8
Preschool	0	3	6	2	0	11	5
Ordinary users of games	4	2	3	0	0	9	0
Cross-levels	3	0	3	2	0	8	0
Elderly	2	2	3	0	0	7	0
Nursery school	3	1	1	0	0	5	0
Experts and researchers	0	0	3	0	0	3	2
Game developers	0	0	1	0	0	1	2
Mentally retarded children	0	0	1	0	0	1	2
Sampling method							
Non-randomized	44	55	58	7	1	165	63
Randomized	23	18	36	5	0	82	67
Combined	1	1	2	0	0	4	3
Delphi	0	1	0	0	0	1	0

Data analysis (or analytic strategy)

The review of data analysis methods used in international and Iranian studies reveals distinct trends, as shown in Table 6.

Internationally, the T-Test is the most frequently used method, appearing in 91 out of 248 studies (36.7%), followed by ANOVA in 72 studies (29.0%) and ANCOVA in 58 studies (23.4%). Regression analysis is used in 44 studies (17.7%), while qualitative methods such as coding, thematic analysis, and/or content analysis are employed in 26 (10.5%), 20 (8.1%), and 20 (8.1%) studies, respectively. Regionally, the same pattern can be observed with nuanced differences among various continents. For instance, in the Americas, the T-Test and Regression are predominant, while in Asia, ANOVA and ANCOVA are more common, with less emphasis on Regression. The findings also indicate that European studies frequently use the T-Test, ANOVA, and ANCOVA. Similarly, in Iran, the T-Test is the most commonly used method, appearing in 46 out of 143 studies (32.2%), followed by ANOVA in 39 studies (27.3%) and ANCOVA in 44 studies (30.8%). Notable use is also seen in in bivariate correlations (27 studies, 18.9%) and chi-square tests (15 studies, 10.5%).

The prevalence of inferential statistical measures such as T-Test, ANOVA, and ANCOVA in both international and Iranian studies indicates a strong focus on comparing group means, characteristic of experimental and quasi-experimental research designs, the most common in the reviewed studies. These findings align with previous review studies (e.g., Guan et al., 2024). Additionally, the significant use of regression analysis internationally highlights an interest in exploring the relationships between variables. Regression analysis provides insights into how variables interact and predict outcomes (Schroeder et al., 2016), which is particularly valuable in understanding the dynamics of educational interventions involving games (Iten et al., 2016). Furthermore, the presence of qualitative methods like coding and content analysis in international studies demonstrates the integration of qualitative data to capture rich, contextual insights (Bryman, 2017). In contrast, the notable use of bivariate correlations and chi-square tests in Iranian studies suggests a distinct focus on examining relationships within data. This emphasis aligns with Iranian researchers' methodological preference for correlational research, which can help uncovering underlying patterns and relationships crucial for research on games in education (Cheng et al., 2015b).

The type of international and Iranian studies

The results of the content analysis revealed that the predominant type of international studies (135 out of 248, 54.4%) had the "explain" type (see Fig. 4). These studies primarily investigate causality and correlation, to explain "*why*" and "*how*", specifically through "experimental inquiry into cause" (Gibbons & Bunderson, 2005, p. 927, 929). This is followed by studies of the "explore" type (43.5%), which focus on identifying the main characteristics and methodologies for more effective design of games. The goal here is to uncover the mechanisms and potential of games as educational tools, providing foundational knowledge on what constitutes effective games in educational contexts. Lastly, a smaller proportion of the international studies falls under the "design" type (24.2%). These studies focus on the practical implementation of game-based interventions aimed at achieving specific educational outcomes. In such studies, a target outcome is first identified, and

Table 6 The data analysis method of international and Iranian studies

	Continents					Total (n = 248)	Iran (n = 143)
	Americas (n = 71)	Asia (n = 73)	Europe (n = 91)	Oceania (n = 12)	Africa (n = 1)		
T-Test	39	19	31	2	0	91	46
ANOVA	22	18	29	3	0	72	39
ANCOVA	11	28	17	2	0	58	44
Regression	25	8	9	2	0	44	10
Coding	11	10	4	1	0	26	0
Thematic analysis	7	4	5	3	1	20	0
Content analysis	7	4	9	0	0	20	0
MANOVA	4	2	10	0	0	16	11
Bivariate correlations	4	9	2	1	0	16	27
Wilcoxon test	2	1	7	0	0	10	0
Chi-square test	4	3	3	0	0	10	15
Cluster analysis	3	4	3	0	0	10	0
Mann–Whitney U-test	1	4	3	0	0	8	0
Factor analysis	2	3	2	0	0	7	0

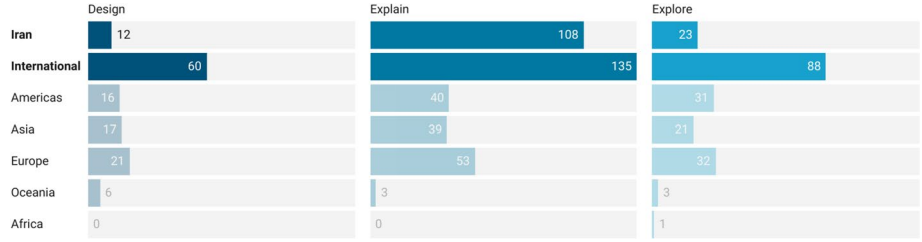

Fig. 4 The type of international and Iranian studies. If studies used two types of three in their research (e.g., Syal & Nietfeld, 2020; Van der Meij et al., 2020), both types of studies were counted

interventions undergo experimentation and revision until that outcome is achieved (Graham et al., 2013).

The breakdown of findings in regional studies reveals comparable inclinations among scholars, with some notable differences. European researchers predominantly conducted “explain” studies (53 out of 91, 58.2%) and a significant number of “explore” studies (35.2%). Similarly, scholars from the Americas showed a preference for "explain" studies (40 out of 71, 56.3%) and a higher proportion of "explore" studies (43.7%). Asian researchers also conducted “explain” studies (39 out of 73, 53.4%) but had a lower number of “explore” studies (21 out of 73, 28.8%). Overall, while the preference for “explain” studies is consistent across all regions, the Americas exhibit a relatively higher inclination towards “explore” studies compared to Europe and Asia. The review of studies published in Iran also indicated a similar pattern in the type of studies conducted by researchers. The majority of Iranian studies were “explain” studies, comprising 88 out of 143 (61.5%), followed by “explore” (28.7%) and "design" (9.8%) studies.

In short, the findings of the current study show a high emphasis on "explain" studies in both international and regional research, with Iran following this trend even more strongly. This implies that most researchers focus on explaining why and how games work, often neglecting the exploration of what games are and how to design them. Such an approach may be inadequate for addressing teachers’ skepticism regarding the integration of games into educational curricula, as it does not provide clear guidance on the relevance of specific (commercial) games to curriculum objectives (Backlund & Hendrix, 2013; Egenfeldt-Nielsen, 2006). To better support educators, there is a need for more exploratory and design-oriented research that investigates the characteristics of effective educational games and develops design principles tailored to specific learning objectives and contexts. This shift in research focus could bridge the gap between theoretical understanding and practical application, thereby enhancing the utility of games in educational settings.

The variable(s) examined in the international and iranian studies

The most common dependent variables examined in the international studies are shown in Table 7.

Overall, the most common dependent variables examined across 248 international studies are primarily within the cognitive category, particularly focusing on learning (achievement) with 114 studies (46%), followed by knowledge acquisition in 38 studies (15.3%), and problem-solving in 31 studies (12.5%). The affective category is also prominently studied, with motivation being the most examined variable in 53 studies (21.4%) and

engagement in 46 studies (18.5%). When comparing the performance of various continents, Asia demonstrates the highest emphasis on cognitive variables, particularly learning with a substantial 67.1%. Europe shows a balanced interest in both cognitive and affective variables, notably learning at 38.5% and motivation at 27.5%. The Americas also display a strong preference for cognitive variables but with a significant focus on engagement at

Table 7 The variable(s) examined in the international studies

		Continents					Total (out of 248)
Category	Dependent variable	Americas (n = 71)	Asia (n = 73)	Europe (n = 91)	Oceania (n = 12)	Africa (n = 1)	
Cognitive	Learning (achievement)	29	49	35	1	0	114
	Knowledge acquisition	10	11	16	1	0	38
	Problem solving	13	10	6	2	0	31
	Academic performance	6	6	7	1	0	20
	Reading	1	1	10	1	0	13
	Cognitive load	3	6	2	0	0	11
	Critical thinking	1	7	0	0	0	8
	Reasoning	0	0	4	1	0	5
	Argumentation	2	1	0	0	0	3
	Computational thinking	0	1	2	0	0	3
	Metacognition	0	3	0	0	0	3
	Self-determination	0	1	0	1	0	2
Affective	Motivation	14	13	25	1	0	53
	Engagement	22	12	11	1	0	46
	Enjoyment	5	3	7	0	0	15
	Interest	7	2	5	0	0	14
	Perception	3	6	4	1	0	14
	Flow experience	4	7	2	0	0	13
	Attitude	2	7	2	0	0	11
	Self-efficacy	3	2	3	1	0	9
	Satisfaction	1	4	3	0	0	8
Behavioral	Collaboration	3	3	6	1	1	14
	Social interaction	5	3	4	0	1	13
	Behavior	6	6	0	0	0	12
	In-game performance	2	3	3	0	0	8

The list of variables only includes those with more than 2 repetitions

31%. The behavioral category, although overall less studied, reveals notable interest in collaboration and social interaction across different regions.

The analysis of Iranian studies reveals similarities but also notable differences compared to international findings (see Table 8). While both Iranian and international studies heavily focus on cognitive variables, the specific areas of interest differ. Iranian studies place more emphasis on creative thinking (11 out of 143 studies, 7.7%) and attention (5.6%) compared to their international counterparts. Both contexts value motivation in the affective category, though it is more prominent in international studies (53 out of 248 studies, 21.4%) than in Iranian studies (17 out of 143 studies, 11.9%). The behavioral category, although less studied overall, highlights unique areas of interest in Iranian studies, particularly in terms of usage rates (14 out of 143 studies, 9.8%) and aggression behavior (14 out of 143 studies, 9.8%).

The current study's findings reinforce a global emphasis on cognitive outcomes in the educational use of games, particularly highlighting learning, knowledge acquisition, and problem-solving skills. This is consistent with the trends reported by Chen et al. (2021), who noted a substantial increase in the focus on these cognitive outcomes over the past three decades. In Iran, the distinct emphasis on creative thinking and attention might reflect a regional adaptation of educational game applications, likely influenced by local educational challenges (Asa et al., 2021). This focus not only addresses creativity, which has received less attention across other continents, but also aligns with a broader educational movement towards fostering holistic learning experiences—an approach that Cheng et al. (2015a) argue is essential for equipping 21st-century learners with necessary skills. Moreover, Iranian studies' unique attention to behavioral variables such as aggression suggests a nuanced approach to exploring the broader impacts of game-based learning on student behavior. This exploration is particularly important as it provides critical insights into the socio-emotional effects of gaming (see Shoshani et al., 2021), a domain that warrants further research to fully understand its global implications.

Table 8 The variable(s) examined in the Iranian studies

Category	Dependent variable	Total (out of 143)
Cognitive	Learning (achievement)	27
	Creative thinking	11
	Attention	8
	Academic performance	7
	Problem Solving	5
	Self-regulation	5
	Critical thinking	2
Affective	Motivation	17
	Self-efficacy	3
Behavioral	Rate of usage	14
	Aggression behavior	14
	Visuo-motor	4
	Social interaction	5
	In-game performance	2

The list of variables only includes those with more than 2 repetitions

The technologies implemented in international and iranian contexts

The analysis of international studies highlights a significant preference for using computers as the primary platform for integrating games into education, with computers employed in 111 out of 248 studies (44.8%), followed by mobile devices in 82 out of 248 studies (33.1%) (see Fig. 5). These findings align well with the trends identified in a review of educational games in science and mathematics over the past three decades (Chen et al., 2021). In particular, computers are often cited as the optimal delivery method for educational games due to their widespread availability and robust capabilities (Hainey et al., 2016). However, the advent of immersive technologies such as virtual reality, extended reality, and augmented reality suggests potential enhancements in using games in educational settings (Chen et al., 2021). These technologies could offer richer, more interactive learning experiences that might surpass the common methods of using games in education in terms of engagement and effectiveness (Oyelere et al., 2020; Pellas et al., 2019).

In the context of Iran, the analysis reveals that computers dominate as the primary platform, with 102 out of 143 studies (71.3%) leveraging this technology, whereas only *five* studies utilize mobile phones. This marked regional difference can be attributed to socio-economic factors that limit access to advanced mobile technologies, compelling researchers and educators to rely on more universally accessible computers. This constraint underscores the importance of context in choosing educational technologies and suggests that while emerging technologies like VR and AR hold promise, their integration into educational practices must consider local accessibility and infrastructure capabilities.

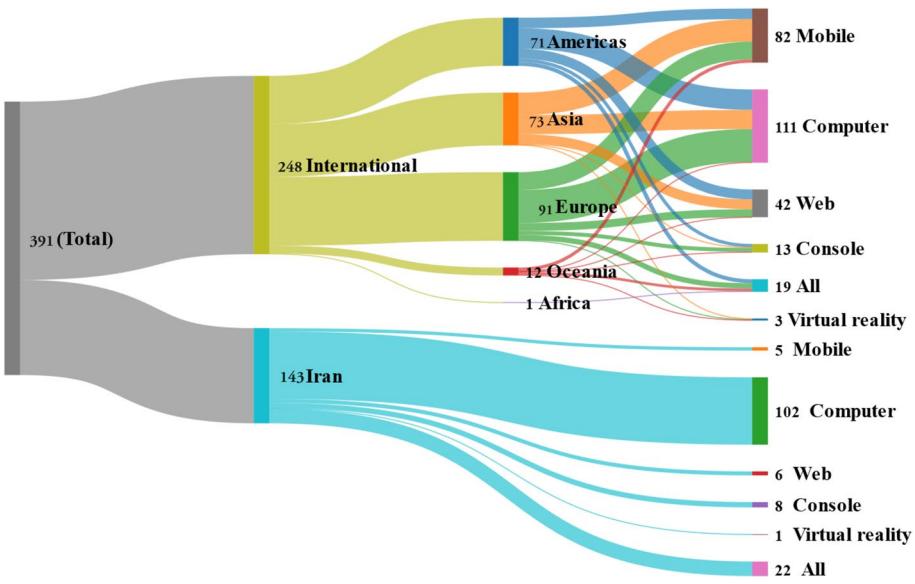

Fig. 5 Technologies used in international and Iranian studies. "All" refers to studies that use several or no specific types of technology

Conclusion and suggestions for future research

This systematic review study aimed to provide a comprehensive overview of research on the use of games in education, comparing international and Iranian perspectives. It examined the most common terminology, prevalent research methodologies, study designs, variables studied, and technologies utilized. The analysis revealed significant similarities and nuanced differences among researchers, highlighting the diverse scholarly discourse across different geographic and cultural landscapes. These findings facilitate cross-regional learning, enabling scholars both internationally and in Iran to learn from best practices and better inform their future studies. To this end, the following suggestions are proposed based on the specific findings related to each research question:

(1) The findings of the current study reveal regional variations in the terminology commonly used in research on games in education. These differences likely stem from contextual factors such as linguistic and cultural variations (Marín et al., 2023), but it can also be a consequence of an existing lack of consensus regarding terminology within the field (Gorbanev et al., 2018). To enhance the transferability of research findings across different regions, addressing this inconsistency is crucial. Researchers should carefully select terms that align with scholarly discussions on a global scale, rather than solely focusing on local contexts. This approach does not necessarily mean adopting only the most widely accepted terminology, such as "serious games" (Ekin et al., 2023), regardless of its relevance to specific research objectives. Instead, researchers should clearly explain how their chosen terminology fits within the broader discourse of the field (see, for instance, Martí-Parreño et al., 2016). Additionally, underpinning their choice with a widely-accepted theoretical framework, such as the taxonomy of game attributes for learning (Bedwell et al., 2012), can increase the generalizability of their findings (van Gaalen et al., 2021).

(2) The findings indicate a strong preference for quantitative methods among both international and Iranian scholars studying the use of games in educational contexts, with quasi-experimental designs being the most common. Although this preference does not inherently pose a limitation, future research could benefit from incorporating more robust methodologies to strengthening the validity of findings. Implementing true experimental designs such as randomized control trials more frequently in quantitative research could provide stronger causal inferences (Hainey et al., 2016). Additionally, incorporating qualitative analyses of learners' interactions with educational games could yield deeper insights into the cognitive and emotional processes involved, offering a more comprehensive understanding of the impact of such games. Moreover, qualitative data provides a content-rich and context-sensitive breadth of information that, while subjective, captures behaviors and developments in real-time (Almalki, 2016). Last but not least, future research could also leverage log data collected during gameplay as a methodologically robust alternative (see for example, Moon et al., 2024). This approach offers a less invasive and potentially more precise means of measuring various process and outcome variables (Shute, 2011), compared to traditional methods such as self-reported measurement tools (Syal & Nietfeld, 2020).

(3) The majority of the studies reviewed, both at international and Iranian levels, were found to have an explanatory nature, focusing on elucidating "*why*" and "*how*" specific games facilitate learning within particular contexts. While these insights are valuable, there is a significant need for research that adopts exploratory and design-focused

approaches to broaden perspectives and foster innovation within the field of game-based education. Exploratory studies could identify key characteristics and methodologies for more effective game design, while design studies could develop games that enhance specific learning outcomes in educational settings. Such explorations not only provide new insights but also support the development of theoretical models and innovative design frameworks (Graham et al., 2013). This is particularly crucial given the current shortage of well-established theoretical frameworks in the field that would help unify the scholarly discourse on using games in education (Melchor-Ferrer & Davia-Rodriguez, 2023).

(4) The current study's findings demonstrated a strong emphasis on using games in educational contexts to enhance cognitive learning outcomes, with a primary focus on learning and knowledge acquisition. This outcome has both broad and specific implications. At a broader level, it indicates that other domains, such as affective and behavioral outcomes, have received less attention. Exploring these areas is essential as they play a critical role in the "*holistic development*" of learners (O'Flaherty & McCormack, 2019). At a more specific level, it highlights a relative lack of focus on essential cognitive skills such as creativity, critical thinking, digital literacy etc., which are crucial in today's complex world and for future job prospects (Mehrvarz et al., 2021; Qian & Clark, 2016; Tüzün et al., 2023). These observations underscore the need for future research to diversify its focus to include these underrepresented areas, thereby providing a more comprehensive understanding of the impact of educational games.

(5) Findings from the current study show that the majority of scholars, both internationally and in Iran, primarily use computer and mobile games to facilitate learning. However, less attention has been given to immersive technologies like virtual and augmented reality, despite their ability to provide more authentic game experiences (Oyelere et al., 2020). Future research should delve deeper into these technologies to fully harness their educational potential. It is important to note, however, that the selection of technology should also be tailored to specific research needs and objectives. For example, virtual reality is ideal for simulating real-world scenarios (Oyelere et al., 2020), while augmented reality can enhance interactions with physical environments, which is beneficial for contextual learning (Sungkur et al., 2016). Meanwhile, mobile games are valued for their accessibility and convenience, particularly suitable for location-based learning (Ribeiro et al., 2021). In some cases, even non-digital games might be a better option depending on the specific research needs and educational objectives. Traditional games, such as board games, can offer valuable opportunities for interactive and social learning, especially for populations such as children and older adults, who may benefit from more tactile and face-to-face interaction (Cès et al., 2024).

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Conflict of interest The authors declare no conflict of interest in the current research.

Ethical approval Ethics approval was not required for this systematic review.

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