Interplay between playful learning, digital materials and physical activity in higher education

A systematic review of qualitative studies using meta-aggregation and GRADE-CERQual

Händel, Vici Daphne; Schrøder, Vibeke; Birkefoss, Kirsten; Händel, Mina Nicole

Published in:
International Journal of Educational Research Open

DOI (link to publication from Publisher):
10.1016/j.ijedro.2023.100284

Publication date:
2023

Document Version
Publisher's PDF, also known as Version of record

International Journal of Educational Research Open 5 (2023) 100284

Contents lists available at ScienceDirect

International Journal of Educational Research Open

journal homepage: www.elsevier.com/locate/ijedro

Interplay between playful learning, digital materials and physical activity in higher education: A systematic review of qualitative studies using meta-aggregation and GRADE-CERQual

Vici Daphne Händel [a,b,*], Vibeke Schrøder [a], Kirsten Birkefoss [c], Mina Nicole Händel [d,e]

[a] Department of Teacher Education, University College Copenhagen, Humletorvet 3, 1799 Copenhagen V, Denmark
[b] Department of Communication and Psychology, Aalborg University Copenhagen, A. C. Meyers Vænge 15, 2450 Copenhagen SV, Denmark
[c] StepChange ApS, Sommervej 41, 3520 Farum, Denmark
[d] Research Unit for Dietary Studies, The Parker Institute, Capital Region, Nordre Fasanvej 57, Vej 8, indgang 11, Bispebjerg and Frederiksberg Hospital, 2000 Frederiksberg, Denmark
[e] Research Unit OPEN, Department of Clinical Research, University of Southern Denmark, J.B. Winsløws Vej 19,3, 5000 Odense C, Denmark

ARTICLE INFO

Keywords:
Digital materials
Higher education
Physical activity
Playful learning
Systematic review

ABSTRACT

The aim was to conduct a meta-aggregation of qualitative studies on the interplay between playful learning, digital materials and physical activity in higher education. A literature search was performed across multiple databases and web pages up until May 2022. A critical appraisal following the JBI checklist for qualitative studies was conducted, and the GRADE-CERQual tool was used to evaluate confidence in the cumulative evidence. Three eligible studies were identified. We extracted 81 findings and 44 illustrations and synthesised them into six categories: (1) experience of playful approaches to learning; (2) interplay between play and learning; (3) experience with digital materials; (4) experience of collaboration; (5) experience with space significance; and (6) experience of getting a reward for participating in the activity. The synthesis showed that the benefits of interplay between playful learning, digital materials and physical activity in higher education were that students were motivated by gamified learning activities, including themes such as competitive spirits, receiving rewards, collaboration and creativity. Both students and educators experience that game-based learning strategies provide meaningful practice because they may facilitate the learning and retention of information by highlighting key information and breaking down information. The synthesis showed that the constraints of the interplay were time as a resource, frustration with using digital materials and that it challenges traditional learning strategies and learning spaces. Confidence in the evidence is low due to moderate concerns regarding methodological limitations and serious concerns regarding the adequacy of the data. Therefore, we highlight the need to expand the field both in practice and research.

1. Introduction

1.1. Playful learning: An emerging field in practice and research

Teaching methods and learning strategies that are primarily instructive and where students are passive and inactive are being challenged in favour of promoting a more active, engaging, creative and motivational form of teaching (Jensen et al., 2022; Jiménez-Olmedo et al., 2016; Jørgensen et al., 2023). In higher educational settings, there has been an increasing interest in experimenting with playful approaches to learning and teaching, thus exploring new teaching strategies, styles and learning methods (Boysen et al., 2022; Jensen et al., 2022; Jørgensen et al., 2023)). Playful learning is not a new approach to teaching and learning in higher education. Multiple teaching strategies and learning methods that encompass playful learning elements exist in higher education, for example, project-based learning (Saad & Zainudin, 2022) and challenge-based learning (Leijon et al., 2022). Additionally, game-based learning or gamification has also appeared in higher educational settings (Wiggins, 2016). However, we acknowledge that playful learning in higher education as its own field is

* Corresponding author at: Department of Teacher Education, University College Copenhagen, Humletorvet 3, 1799 Copenhagen V, Denmark and Department of Communication and Psychology, Aalborg University Copenhagen, A.C. Meyers Vænge 15, 2450 Copenhagen SV, Denmark.
E-mail address: vici@kp.dk (V.D. Händel).

https://doi.org/10.1016/j.ijedro.2023.100284
Received 10 April 2023; Received in revised form 2 September 2023; Accepted 7 September 2023
Available online 14 September 2023

still emerging, both in terms of practice and research (Boysen et al., 2022; Jensen et al., 2022; Jørgensen et al., 2023); Nørgård et al., 2017; Resnick, 2017; Whitton, 2018). The demands of education in the near future will revolve around how students achieve knowledge, skills and competences that can be successfully applied in the student's professional life, using learning methods that involve students being experimental and creative (Jiménez-Olmedo et al., 2016; Jørgensen et al., 2023). Several research studies have pointed out that playful learning can create a motivating learning environment as playful activities within the curriculum or as ice breakers or 'brain breaks' (Boysen et al., 2022; Kangas, 2010; Kangas et al., 2017). In a recent review on playful learning, it was pointed out that playful activities are often detached from specific learning goals and lack pedagogical planning and pedagogical learning design. The same review pointed out that there is a research gap regarding how play is incorporated into pedagogical learning design and how it is related to learning experiences and learning outcomes (Boysen et al., 2022).

1.2. Digital materials: An expanded agenda in higher education

In higher education, there is an expanded agenda that involves technology comprehension, digital Bildung and digital competences, and there is a growing interest in implementing digital materials in teaching and learning environments (Lisborg et al., 2021; Zhao et al., 2021). We think of digital materials in a broad sense because they are not a homogeneous category. In education, the first appearance of digital materials was 'standalone' computers in universities and high school classrooms in the 1960s (Cuban, 2001; Lisborg et al., 2021; Selwyn, 2013). Since then, various approaches, technologies and digital materials have permeated the educational system (e.g., learning management systems that support educational courses and outcomes in face-to-face learning, blended or hybrid learning and distance learning environments). In addition, the aforementioned increasing interest in experimenting with new learning methods and teaching strategies has given rise to new pedagogical approaches that encompass digital materials in a way to conduct student-centred teaching and enhance more active, engaging, creative and motivational teaching forms (Händel & Jensen, 2022; Whitton, 2009, 2018). In other words, digital resources—for example, tablets, phones, robots, (pocket-sized) computers, interactive boards and headsets (Selwyn, 2013)—are embedded into classrooms and learning environments. However, research has often pointed out that implementing digital materials in teaching and learning does not motivate students in and of itself (Botha-Ravyse et al., 2018; Martin et al., 2020).

The influence of political, professional, academic and commercial discursive factors also impacts the drive towards digitisation throughout education. Educational policy texts, academic research studies, commercial marketing and public debate are still placing digitalisation on the agenda (Selwyn, 2013; van der Vlies, 2020). In an educational context, the focus has been on enhancing information and communication technologies. However, in recent years, the agenda appears to have expanded; for example, in Danish teacher education, the focus is on including the critical, social and creative aspects of digital technologies and on student teachers gaining digital competences, technology comprehension and digital Bildung (Lisborg et al., 2021).

1.3. Physical activity

Physical activity has several positive effects on the academic performance, health and well-being of young adults (Kaneko et al., 2018). Active individuals have better fitness and a lower risk of developing lifestyle diseases such as obesity, cardiovascular disease and osteoporosis. Consequently, health guidelines recommend that adults do at least 150 to 300 min per week of moderate-intensity aerobic physical activity (World Health Organization, 2022). Unfortunately, for young adults, there may be a shift in health-related behaviour during the transition to higher education, resulting in, for example, less physical activity, and almost up to 50% of people of this age have high levels of sedentary behaviour (Wengreen & Moncur, 2009), which may influence life-long health. Given the substantial decrease in physical activity and increase in lifestyle-related diseases in the Western world, it would be of great value if a cultural shift that looks to increase physical activity and reduce risk of lifestyle diseases by introducing, implementing and maintaining innovative initiatives in the area of health. It seems obvious that health promotion should be introduced in all educational settings, including higher education. This would ensure that the majority of students get enough exercise in everyday life, regardless of ethnic and socioeconomic background, without stigmatising those who are at high risk. In general, health interventions targeting university and college students, including e-health interventions (Peng et al., 2022), show great promise (Kahn et al., 2002). However, the focus on physical activity in higher education does not seem to have the same political, societal or scientific interest as it does in education in the earlier years of life (Cooper et al., 2016).

1.4. The interplay between playful learning, physical activity and digital materials

Pedagogical activities, such as scavenger hunts, imitations of game shows or races that also take inspiration from television shows, board games or computer games—such as Expedition Robinson, Pokémon GO or Scotland Yard—may transform the preoccupation with computer games, television shows or board games into increased physical activity with an opportunity to incorporate academic topics and learning (Händel & Jensen, 2022).

Digital materials and technologies, such as GPS systems, video cameras, headsets, micro:bit, interactive screens and similar devices, can be used to encourage physical activity. We believe that, by exploiting the potential to playfully incorporate these types of digital materials into education, students can experience learning as joyful and meaningful and feel encouraged to engage in learning with both mind and body, which is a key characteristic of learning through play (Gudiksen & Skovbjerg, 2020; Händel, 2023; Mardell et al., 2019; Whitton & Moseley, 2019; Zosh et al., 2017).

We anticipate that implementing pedagogical activities using digital materials and physical activity in a playful approach to learning will have beneficial outcomes that could support students' health, improve their ability to learn, support their digital competences and create an active, engaging, creative and motivational learning environment. However, previous systematic reviews on the topic are currently lacking.

1.5. Research question and statement of purpose

The aim of our systematic review was to synthesise qualitative studies using meta-aggregation (Lockwood et al., 2015). We explored the interplay between playful learning, physical activity and digital materials integrated into lessons to promote curriculum-based learning or to obtain curriculum-based competences, knowledge and skills in higher education.

Based on our rationale, we posited the following research question:

How is the interplay between playful learning, physical activities and digital materials applied or experienced in curriculum-based teaching and learning in higher education?

2. Methods

The present systematic review and meta-aggregation were performed following the features of a systematic review outlined by Aromataris and Munn (2020) and Lockwood et al. (2015). Meta-aggregation summarises findings to produce lines of action and, thus, recommendations for practice.

The mega-aggregative framework synthesis approach consists of seven distinct steps. The steps are as follows: (1) a clearly defined

objective and question, (2) detailed inclusion and exclusion criteria, (3) a comprehensive search strategy, (4) quality appraisal of the included studies, (5) analysis of the data extracted, (6) presentation and synthesis of the findings and (7) transparent reporting of the approach undertaken (Lockwood et al., 2015, p. 181). The reporting followed the Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA) checklist (Page et al., 2021), with the exception of items specific to quantitative research, that is, items 10, 12 and 19 (see supplementary materials A1).

2.1. Eligibility criteria – PICo

The PICo approach identified and specified the population, phenomenon of interest and the context of the review question and was used to define the inclusion and exclusion criteria (Lockwood et al., 2015; see Table 1).

We included both educators and students at a higher educational institution in the study population. The phenomenon of interest was studies examining lessons, classes or learning activities within curriculum-based learning where playful learning, digital materials and physical activity were combined (see Table 1). There were no restrictions regarding whether the lessons/classes were conducted synchronously or asynchronously. Studies that only used learning activities conducted as 'brain breaks' or ice breakers with no link to the curriculum were excluded. There was no restriction in the study design of the included studies, but reviews and theoretical analyses were excluded.

2.2. Information sources and search strategy

The search was conducted over the period February to May 2022 (the last date was 9 May 2022), with no restriction on the initial date of the databases. In total, we performed searches in 13 databases and over 19 web pages. K.B. performed searches in 11 databases: CRISTin (Norwegian Pure Repository), NORA (Norwegian Open Research Archives), SwePub Juuulii, ERIC (Education Resources Information Centre), Academic Search Premium, Teacher Reference Centre, SocINDEX, Web of Science, DANS Easy (formerly Open Grey) and EBSCO Open. V.D.H. performed searches in two databases: NORA (National Open Research Analytics, DK) and Google Scholar. In addition, V.D.H. performed searches on 19 research-related web pages with selected keywords from the search strategy to identify both published and unpublished studies related to the objective of the review.

The search was restricted to studies published in English, Swedish, Norwegian or Danish, due to the language limitations of the author group. Databases were searched without restrictions in relation to the year of application; however, because the limited range of digital technologies in the educational field, we did not expect studies from before the 1960s. Higher education is wide ranging, and in the present review, we did not limit the enquiry to specific fields within higher education.

There was no demarcation regarding geographical or time limitations. We limited the search to qualitative studies, including mixed studies that used both qualitative and quantitative methods.

In addition to the electronic search of databases and web pages, a snowballing approach was used to examine the reference lists of the included primary studies (Horsley et al., 2011).

The full electronic search documentation and search strategies for all databases and searches of web pages are available in detail in the supplementary materials (see B1).

Table 1
Overview of PICo applied to the review question.

i. Population	ii. Phenomenon of interest	iii. Context
Educators/teachers at a higher educational institution Students enroled in a higher educational institution	Studies that examined experiences, learning potential, barriers/ constraints, behaviours, pedagogical approaches in curriculum-based activities that combined playful learning, digital materials and physical activity	Higher education

2.3. Selection process

Two reviewers (V.D.H. and M.N.H.) independently screened titles and abstracts according to the eligibility criteria (the PICo approach described in Section 2.1). The selection process for the full-text records was conducted by the same two reviewers independently by using the following procedure: studies were included if they fulfilled the eligibility criteria, and studies were excluded if they were (1) not playful learning; (2) not physical activity; (3) not engaging to learn the curriculum; (4) not digital materials; (5) not higher education/population not aligned with the purpose of the present study (studies that did not explicitly write that the study took place in a higher educational context were excluded); (6) study designs not aligned for the purpose of this study (reviews and theoretical analysis); and (7) language inaccessible to our team. The selection process was performed using Covidence software for literature screening and data management. The software ensures that the screening process, both at the title and abstract and full-text level, is conducted so that the reviewers are blinded to the selection process of the other reviewer. If there are any disagreements between the reviewers, the software highlights the affected record(s), and any disagreements during the selection process were resolved through discussion, and a decision is made in the software.

2.4. Data items and study risk of bias assessment

One reviewer (V.D.H.) conducted the data extraction in Excel to identify the qualitative finding quotes and the illustration quotes from the three primary studies. Moreover, the following data items were extracted: authors/year/title, study design, aims of study, conclusions of study, phenomenon of interest (playful learning, digital materials, physical activity, learning the curriculum), population and context (target group). The data items were selected to highlight trends and cultural differences and provide the PICo of all the included studies. Subsequently, two other reviewers (M.N.H. and V.S.) double-check the extraction. The extracted findings in a meta-aggregation are defined as the study author's analytical interpretation of the results.

A critical appraisal for each of the included primary studies separately, following the JBI checklist (Joanna Briggs Institute, 2020; Lockwood et al., 2015), for qualitative studies was conducted by two reviewers (V.D.H. and M.N.H.) in collaboration. The checklist consists of 10 key criteria and provides a structured framework for researchers or reviewers to critically appraise qualitative research articles. The 10 key questions are available in the supplementary materials (see D1).

The primary study authors were not contacted in relation to confirming the extracted findings or resolving uncertainties in the critical appraisal process.

2.5. Data synthesis

Three reviewers (V.D.H., V.S. and M.N.H.) conducted the meta-synthesis utilising the meta-aggregation proposed by Lockwood et al. (2015). We developed categories for each finding quote, with at least two findings per category, in an iterative process. By the end of the iterative process, we reviewed the categories and the assembled finding quotes one last time. The finding quotes with no accompanying illustrations were placed in the existing categories. There was good agreement amongst the three reviewers throughout the entire process.

Two reviewers (V.D.H. and M.N.H.) developed the synthesised findings (summary of review findings) for all six categories, including a step evaluating the need for improving the summary of the review findings to prepare the evaluation of coherence (domain 2 in the

GRADE-CERqual approach; please see Section 2.6), which were discussed with a third reviewer (V.S.). For each of the categories, the same two reviewers (V.D.H. and M.N.H.) developed the line of action. No software was used in the data synthesis process.

2.6. Confidence in the evidence: The GRADE-CERQual approach

Two review authors (V.D.H. and M.N.H.) applied the GRADE-CERQual (Confidence in the Evidence Reviews of Qualitative Research) approach to summarise our confidence in each synthesis of findings (Lewin et al., 2018). The four following components were assessed: (1) methodological limitations of the included primary studies; (2) coherence of the review findings; (3) adequacy of the data contributing to a review finding; and (4) relevance of the included primary studies to the review question. As a last step, we made a final judgement about the overall confidence in the review findings. All findings started as 'high confidence' and were then downgraded if there were important concerns regarding any of the GRADE-CERQual components. The grading order was high, moderate, low or very low concerns.

3. Results

3.1. Study selection

The search performed by K.B. resulted in 1712 records, which were imported into RefWorks, where duplicates were removed. A pragmatic search performed by V.D.H. in Google Scholar resulted in 99 records, of which 10 records were duplicates. In total, we identified 1811 records, and 267 duplicates were removed. The remaining 1544 records were imported into Covidence software for literature screening and data management. In addition, V.D.H. searched the database NORA (National Open Research Analytics, DK), which resulted in 257 records. The search in NORA (National Open Research Analytics, DK) and the search through 19 different research-related web pages were not added to the Covidence software because no new or relevant records appeared in these searches, nor did the snowballing approach provide additional records to be included.

At the title and abstract level, we considered 1469 records to be irrelevant according to the inclusion and exclusion criteria described in the methods section. Thus, 75 records were assessed for eligibility at the

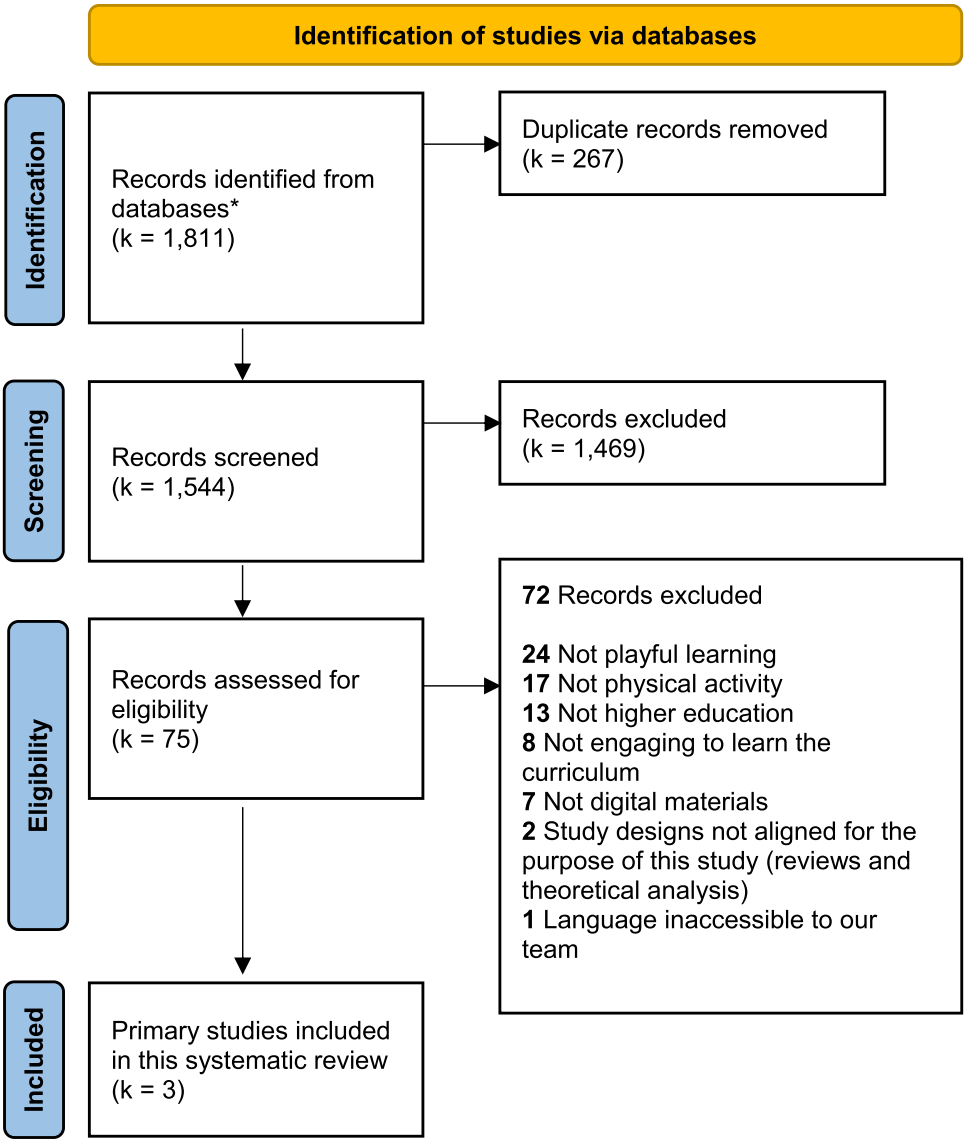

Fig. 1. PRISMA flowchart.
* Excluding 257 records from the search in NORA (National Open Research Analytics, DK), the search within 19 different research-related webpages and the search using snowballing.

Table 2
Summary of study design, aims of the study and conclusions of the included primary studies.

Authors/year/title	Study design	Aims of study	Conclusions of study
Alajaji and Alshwiah (2021) Effects of combining gamification and a scavenger hunt on preservice teachers' perceptions and achievement	Mixed method: Online scales, questionnaires, a student focus group, classroom observations and interviews with the two faculty members who were teaching the course	To investigate the application of game elements to a nongaming context (gamification), specific to an early teacher-training course Mapping students' perceptions of gamification in the form of combining Quizizz and a scavenger hunt game To obtain the students' perceptions of the effectiveness of Quizizz To obtain teachers' views of gamification as a teaching strategy and of the game implemented in their classroom To investigate how scavenger hunt activities influence learners' motivation and engagement To provide educators with a pedagogical tool to implement gamification	Gamification was found to improve trainee teachers' perceptions of the selected teaching strategy. It also increased their motivation to learn from and engage with their peers, thereby showing Quizizz to be a useful gamification tool, despite some technical difficulties.
Botha-Ravyse et al. (2018) Lessons learned from gamification of a learning experience: A case study	A survey and self-reporting of students' perceptions of the value of the gamification approach Open-ended qualitative student feedback	To investigate a gamification initiative making use of a mobile app to prepare students for their summative assessment and the usefulness and successful application of it. To explore lessons learned from using a gamification approach in sports and recreation management and to investigate how the use of a mobile app adds value to the execution and experience of students in an adventure gamification approach during learning and content knowledge	The use of a mobile app and technology must be carefully considered. It has to be well designed, implemented correctly and tested in the exact setting. Students also do not want to use an app if it is not user-friendly. In the current study, the technology was considered to aid in improving the activity. The students had a positive experience with the gamification activity. It was considered to be a fun and constructive event to help students prepare for their examinations. Recreational and creative play activities need to be aligned with the outcomes of the modules.
Nessler et al. (2021) Proof of concept: Game-based mobile learning – the first experience with the app Actionbound as case-based geocaching in education of veterinary neurology	Evaluation questionnaire and additional free-text questions were given regarding the students' likes and dislikes for course improvement	To prove the concept and describe the first experience with Actionbound as a tool for mobile game-based and case-orientated learning in veterinary education	Actionbound is a feasible tool to offer unconventional case-based learning via GPS-based scavenger hunts. The present proof of concept confirmed that case-based geocaching is accepted well by students, a well-perceived elective and supplementation to traditional teaching methods. Most students highlighted the outdoor activity, fresh air and exercise. Currently, this tool seems to be a good supplement to the desk-based approaches of case-based learning and other conventional learning methods. For implementation in a curriculum, comparative studies with conventional teaching methods are needed.

full-text level, and of these, 72 records were excluded. A list of excluded records at the full-text level and the reasons for excluding the records can be found in the supplementary materials (see C1). In total, we identified three eligible primary studies that were included in the meta-aggregation. The PRISMA flow diagram can be found in Fig. 1.

3.2. Study characteristics of the included primary studies

A summary of study design aims of the study and conclusions extracted from the included primary studies can be found in Table 2.

3.2.1. Year of publication and geographical location

The three included primary studies (Alajaji & Alshwiah, 2021; Botha-Ravyse et al., 2018; Nessler et al., 2021) were all published in the years between 2018 and 2021. The empirical data in these primary studies were from the geographical regions of South Africa, Saudi Arabia and Germany.

3.2.2. Study design

The study design of the research by Alajaji and Alshwiah (2021) used a mixed methods approach. They used online scales, questionnaires, a student focus group, classroom observations and interviews with the two teachers facilitating the learning activity. The other two primary studies conducted questionnaires with a survey, including an open-ended qualitative student feedback or evaluations questionnaire with some free-text answers (Botha-Ravyse et al., 2018; Nessler et al., 2021) (see Table 2).

3.2.3. Phenomenon of interest

In Table 3, an overview of PICo in the included primary studies is given. In short, none of the primary studies identified their intervention as a playful learning activity but instead as gamification or a game-based activity. Gamified learning and gamification can be defined as the application of game elements to nongame contexts (Deterding et al., 2011; Subhash & Cudney, 2018). The focus is often on competition, outcome and extrinsic motivational drivers. Game-based learning involves the use of games or game-like activities as the core instructional method. It integrates educational content into a game format, where learners actively participate in game play to achieve learning objectives (Subhash & Cudney, 2018). Game-based learning and gamification are seen as useful ways to enhance engagement amongst students. In the higher educational sector, there has been an interest in obtaining a more wide-ranging definition, in which playful learning focuses on the learning process, learning from failure and risk-taking while allowing the students to explore and practice in a safe environment (Nørgård et al., 2017). Nonetheless, game-based learning and gamification in an

educational context can be placed within a broad range of playful learning activities or experiences because they have related theoretical and practical implications (Plass et al., 2020). In addition, all three primary studies framed their learning activities in a manner that can be categorised as adventurous play or as a location-based learning activity, such as a scavenger hunt, geocaching, a race or similar (Plass et al., 2014).

The digital materials were either integrated into the learning activity or used to conduct the learning activity. In the first primary study (Alajaji & Alshwiah, 2021), a barcode generator was used to create barcodes that were linked with a quiz; the barcode also led students to the next barcode. The students used their own phones with their own personal internet connections. All students had to download a specific app containing an online gamification quiz prior to participating in the learning activity. In the second primary study (Botha-Ravyse et al., 2018), experiences from the first race, where no digital materials were used but were instead created manually, prompted the lecturers to develop an app to be used for clues and questions. To create clues and questions for the app, tablets were used. One tablet was then placed at each of the 15 locations. In the third primary study (Nessler et al., 2021), the students used their own smartphones, onto which they had to download a specific app. After downloading the app, the students had to scan a QR code provided through an online platform. The QR code was used only to start the activity.

Regarding physical activity, all primary studies used location-based games. None of the primary studies gave an indication of physical activity modality or indicated the time spent on physical activity, nor did they specify how the students physically went from one clue to the next. In one of the primary studies, there was no requirement to perform all of the bounds in one sequence (Nessler et al., 2021). One primary study used sequential cards with QR codes that were hidden around the college campus; the QR code led them to an online quiz (Alajaji & Alshwiah, 2021). Another primary study used GPS-located stations with approximately 200–500 metres between the sections (Nessler et al., 2021). In the primary study by Nessler et al. (2021,) there was also a corona home edition that had no physical activity applied to the activity. In one primary study, the activity consisted of 15 different locations, with diverse physical activity at each location (Botha-Ravyse et al., 2018).

3.2.4. Population

In the first primary study, 41 students were selected from the Early Childhood Department of the School of Education (Alajaji & Alshwiah, 2021). In the second primary study, the students' cohort comprised 103 students from first to third year enroled in a degree and diploma in sports and recreation management and sports science (Botha-Ravyse et al., 2018). Finally, in the third primary study, there were 42 students from second to fourth year at the University of Veterinary Medicine (Nessler et al., 2021; see Table 3).

3.2.5. Context

All primary studies were performed in a higher educational setting; the aim was to learn the curriculum through answering academic questions (Alajaji & Alshwiah, 2021; Botha-Ravyse et al., 2018; Nessler et al., 2021) or to introduce the students to gamification as a pedagogical tool or as a teaching strategy (Alajaji & Alshwiah, 2021). The learning activity in the first primary study (Alajaji & Alshwiah, 2021) was conducted over a period of 4 weeks as part of a face-to-face teaching session. The second primary study (Botha-Ravyse et al., 2018) was conducted as a voluntary activity. The participants were students enroled in various programmes and in different years of study. In the third primary study (Nessler et al., 2021), the students could participate in the learning activity at any preferred time within a time frame of 4 weeks; the activity alternated with synchronous online classes (see Table 3).

3.3. Quality appraisal of the included primary studies

The result of the qualitative appraisal was found to be that none of the three primary studies described their philosophical perspective or the influence that the researcher had on the research and vice versa. In addition, one primary study did not adequately represent the participants (Nessler et al., 2021), and one primary study did not describe the ethical aspects of the study (Alajaji & Alshwiah, 2021; see supplementary materials D1). Regardless of the recommendation to exclude low-quality studies (Small, 2023), all three primary studies were appraised for inclusion because they fulfilled the PICo criteria.

3.4. Results of meta-aggregation

In total, 81 finding quotes and 44 illustration quotes were extracted (see Supplementary Materials E1). The meta-synthesis utilising meta-aggregation revealed six categories with several themes. The six categories were (1) experience of playful approaches to learning; (2) interplay between play and learning; (3) experience with digital materials; (4) experience of collaboration; (5) experience with space significance; and (6) experience of getting a reward for participating in the activity. All categories included all three primary studies, except for categories 4 and 6, which included only two primary studies (Alajaji & Alshwiah, 2021; Botha-Ravyse et al., 2018). A summary of the findings of the included primary studies is presented in Table 4 and elaborated on in the supplementary materials F1.

3.4.1. Experience with playful approaches to learning

When looking at experiences of playful approaches to learning, the included primary studies dealt with four different themes: motivation, meaningful practice, time as a resource and challenges of traditional learning strategies. The students were motivated by game-based or gamified learning activities, and this may be a learning strategy that can help them overcome various tasks and barriers. Game-based or gamified learning strategies provide a meaningful practice for both students and teachers/educators; there was a focus on applying the learning strategies in their future careers (students) or in subsequent teaching materials (teachers/educators). Both teachers and students may be conscious of time as a resource as part of playful approaches to learning. Awareness of how long it takes to design and create a playful learning activity was relevant for teachers at the planning stage, while students may be concerned with speedy task completion and time limits during the activity. A playful approach to learning can give rise to teaching that challenges traditional learning strategies; however, there was a discrepancy in the experience of the students in terms of independent task resolvement.

3.4.2. Interplay between play and learning

When looking at the interplay between play and learning, the included primary studies dealt with four different themes: competitive elements in games, playing games to learn the curriculum, playing games as a preparation for an upcoming examination and preparation efforts amongst students. It seems that playing games as a learning activity may facilitate a competitive spirit. This may result in students being preoccupied with strategies to give speedy replies rather than correct answers, that is, not reading instructions. Under the condition of a meaningful learning purpose and practice, gamification can be applied as a form of preparation for an exam or linked to module outcomes of the curriculum because it may facilitate learning and retention of information by highlighting key information and breaking down information. However, some students may have trouble linking the playful activity with an upcoming examination.

3.4.3. Experiences with digital materials

According to the category 'experience with digital materials', the included primary studies dealt with three different themes: teachers' attitudes towards using digital materials, students' perceptions of using

Table 3
Overview of PICo identified in the included primary studies.

Authors/year	Phenomenon of interest Playful learning	Digital materials	Physical activity	Learn the curriculum	Population and context Target group
Alajaji and Alshwiah (2021)	Scavenger hunt Gamification	Digital games Barcode QR codes Using software to create quizzes Quizizz – an online app Quiz	Search for clues Cards hidden around the college campus Students thought the best feature of gamification was the physical activity when searching for cards in the scavenger hunt.	The course 'Production and Utility of Teaching Aids' in the field of educational technology Introduction to an app and gamification quizzes as a teaching strategy Pedagogical tools to implement gamification	Higher education Preservice teachers (p. 284) registered in three different classes of the same course Two faculty members of the Education Department
Botha-Ravyse et al. (2018)	The activities in the race were imitations of the television series, *The Amazing Race®*, a reality television game show The students had to perform a task throughout the race; those activities ranged from creative play to team-building activities	Mobile application (app) to be used for clues and questions Android Studio A digital databank of questions Tablets or phones	The activities comprised 15 different stations with diverse physical activities at each one.	Examination preparation Answering academic, subject-related questions	Higher education A lecturer in the sport and recreation department. The student cohort comprised 103 sport students ($n = 103$) from first to third years enroled in either a diploma in sports science or degree in sports and recreation management at a rural residential university in South Africa.
Nessler et al. (2021)	Interactive scavenger hunts Gamification	The app Actionbound GPS-based scavenger hunt QR code provided on an online platform Smartphones or tablets	Similar to geocaching Walking distance 3–5 km for each bound; 200–500 metres between each section Corona home-edition bound (not with GPS) Active outdoor exercise	Combined case-based teaching with the app Actionbound and created three cases on the basis of real clinical patients in the field of veterinary neurology	Higher education 42 students of veterinary medicine in their second, third or fourth year of enrolment

digital materials and the function of the digital materials. The teachers expressed a positive attitude towards using digital materials and using them again in different contexts. The teachers expressed that digital materials had a positive impact on learners' motivation and perceptions. Digital materials had no influence on the students' perceptions of whether or not the gamified activities were enjoyable.

Students' awareness of and experience with the function of the digital materials (apps) were important because the students expressed that leaderboards and game summaries may create a positive, challenging and motivating atmosphere for them. Delivery of technical answers in a creative way, that is, through a video or audio answer, was enjoyed by most students, even though some may have felt uncomfortable recording themselves. Asking questions and providing clues may be characterised as an efficient and effective gamified activity, but it may also negatively influence the flow of the activities and prolong the time spent on the activity. There may be technical difficulties and frustration with using digital materials, that is, challenges with the internet connection, especially when using multiple locations in the physical activity; challenges with differentiating between correct or incorrect answers due, for instance, to misspelling; multiple answers that are partially correct being counted as null; or information being typed multiple times. When using apps, it is an advantage if they are free and compatible with all smartphones. Digital materials should be intuitive and easy to use, and technical errors should be minimised; otherwise, the students may become demotivated. Devices should be available for all students so that they do not experience exclusion.

3.4.4. *Experience of collaboration*

In the category 'experience of collaboration', the two contributing primary studies noted that collaboration seemed to be a prominent feature of gamification and that employing collaboration in a gamified activity occurs to be different from other types of collaboration in other classes. Examples of collaboration are when students explained things to each other, helped each other and engaged in discussion and analysis of the content before answering the question. After answering each question, the students complimented and encouraged one another. However, if the question was easy, some students would answer without asking their peers. The teachers also expressed that they considered collaboration to be a dominant factor in the students' learning and enjoyment.

3.4.5. *Experience with space significance*

Three themes are present in the category 'experience with space significance': experiences of teaching sessions outside the classroom, experiences of searching for clues and locations and students' preferences in relation to the route. Students' experiences with lessons placed outside the classroom seemed contradictory. Some students enjoyed them and preferred being outside in a team, while others complained about it, were concerned about noise disturbing other classes or said they would rather be inside with a better opportunity to take notes. Furthermore, hiding questions in different locations may be controversial; some students enjoyed this, while others did not. In addition, students may prefer a visualisation of the route beforehand and for it to be kept clear and short, without detours or zigzagging.

3.4.6. *Experience of getting a reward*

Two contributing primary studies dealt with students' experiences of getting a reward. The overall theme in this category was extrinsic motivational factors. Some students experienced that they were more motivated in these gamified activities when there was a leaderboard with scores and rankings, free food and extra marks.

3.5. *Results from the GRADE-CERQual*

When assessing the confidence in evidence using the GRADE-CERQual approach (Lewin et al., 2018), the methodological limitations were assessed as moderate concerns. This was because none of the included primary studies stated the congruity between their philosophical perspectives and the research methodology. Moreover, none of the primary studies addressed whether there was influence of the researcher on the research, or vice versa. The primary study by Alajaji et al. (2021) did not describe any ethical considerations. The primary study by Nessler et al., 2021) did not provide a statement locating the researcher culturally or theoretically and did not represent participants and their voices adequately because of lack of illustration quotes.

Table 4
Summary of findings of the included studies.

Categories	Number of primary studies	Synthesis of findings	Confidence in findings	Summary
Category 1 Experience of playful approaches to learning	3	(1) Concern with phenomena such as motivation amongst the students, that is enjoyable, excitement, stimulating, energised physical activity and competition. This was regarding accomplishing the tasks by the end of the day, performing the tasks, encountering practical and case-based aspects of learning, having a positive attitude and high level of engagement, experiences of better performance and intense and specific engagement with a selected topic. (2) The next phenomenon concerns the students' and educators' experiences of a meaningful practice. They experienced that the learning strategy may be applied in their future careers (students) or be used with other students or courses (educator). (3) Regarding the phenomenon of time as a resource within playful approaches to learning, one study showed that the average time students spent completing each task was just under four to six minutes. Students may have been conscious of answering the questions within the time limit. One study showed that creating one case takes the teacher approximately 6–10 working hours. (4) The final phenomenon reveals that experiences with a playful approach to learning can give rise to teaching that challenges traditional learning strategies. First, the students are given several ways of completing the same task; second, the new learning strategy could provide some energy into the class by the end of the day; and third, you could bring your dog to classes, which could be helpful in solving the task. Finally, there are issues relating to how independent a student must be within this new learning strategy	Low confidence	Moderate concerns regarding methodological limitations, minor concerns regarding coherence and serious concerns regarding the adequacy of data
Category 2 Interplay between play and learning	3	(1) Playing games may facilitate a competitive spirit to emerge, which may result in students being occupied with strategies to obtain speedy replies rather than correct answers, that is, not reading instructions (2) Gamification may facilitate learning and retention of information by highlighting key information and breaking down information into subcontent but only under the condition of meaningful learning purposes and practices; for example, it can be applied as preparation for an exam or linked to module outcomes of the curriculum. (3) Some students may have trouble deciding which examinations make sense for their case. (4) Some students may anticipate that they do not need to prepare for a lesson utilising playful approaches to learning.	Low confidence	Moderate concerns regarding methodological limitations and serious concerns regarding adequacy of data
Category 3 Experience with digital materials	3	(1) The teachers expressed a positive attitude towards using digital materials and an interest in using them again in different contexts. The teachers expressed that digital materials had a positive impact on learners' motivation and perceptions. (2) Using digital materials may not, by itself, influence students' perceptions of how enjoyable gamified activities are (3) The functions of the digital materials (apps) are important to the students' experience with digital materials: (A) Leaderboards and game summaries may create a positive, challenging and motivating atmosphere for the students, including highlighting previous results. (B) Delivery of technical answers in a creative way, that is, through video or audio answers, was enjoyed by most students, even though some felt uncomfortable recording themselves. (C) Asking questions and providing clues may make for an efficient and effective gamified activity but may also negatively influence the flow of the activities and prolong the time spent on the activity (D) There may be technical difficulties and frustration using digital materials, that is, challenges with the internet connection, especially when using multiple locations in the physical activity; challenges with differentiating between	Low confidence	Moderate concerns regarding methodological limitations and serious concerns regarding adequacy of data

(*continued on next page*)

Table 4 (*continued*)

Categories	Number of primary studies	Synthesis of findings	Confidence in findings	Summary
		correct or incorrect answers due, for instance, to misspelling; multiple answers that are partially correct being counted as null; or information being typed multiple times. (E) When using apps, it is an advantage if they are free and compatible with all smartphones. Digital materials should be intuitive and easy to use, and technical errors should be minimised; otherwise, the students may become demotivated. Devices should be available for all students so that students do not experience exclusion.		
Category 4 Experience of collaboration	2	(1) Collaboration seems to be a prominent feature of gamification, and using collaboration in a gamification activity occurs to be differing from other types of collaboration in other classes. (2) Within collaborations, students explained things to each other, helped each other and engaged in discussion and analysis of the content before answering the question. After answering each question, the students complimented and encouraged one another. However, if the question was easy, some students would answer without asking their peers. (3) The teachers' evaluation showed that they considered group work a dominant factor in the students' learning and enjoyment of it.	Low confidence	Moderate concerns regarding methodological limitations and serious concerns regarding adequacy of data
Category 5 Experience with space significance	3	(1) The students' experience with lessons outside the classroom, for example, physical activities, seemed contradictory. Some students enjoyed it and preferred being outside in a team, while others complained about it, were concerned about noise disturbing other classes or would rather be inside with, so they had better opportunity to take notes. (2) Hiding questions in different locations may be controversial; some students enjoyed that they were hidden in difficult locations, while others did not. (3) Students may prefer a visualisation of the route beforehand and for it to be kept clear and short, without detours or zigzagging.	Low confidence	Moderate concerns regarding methodological limitations and serious concerns regarding adequacy of data
Category 6 Experience of getting a reward for participating in the activity	2	(1) Extrinsic motivators amongst the students in gamified activities were the presence of a leaderboard with scores and ranking, free food and extra marks.	Low confidence	Moderate concerns regarding methodological limitations and serious concerns regarding adequacy of data

There were no concerns regarding coherence. However, the category 'experience of playful approaches to learning' was assessed as having low concerns. This assessment was made because we removed unnecessary contextual information that was included in the summary of the review findings.

The adequacy—and, thus, the degree of richness and the quantity of data supporting the review findings—was evaluated to be of serious concern because the underlying data were not sufficiently rich and came from a small number of studies (up to three primary studies included) in the context of the phenomenon of interest (both students and teachers).

Table 5
Line of actions for each of the categories 1–6.

Categories	Line of action
Category 1 Experience with playful approaches to learning	When challenging traditional learning strategies, consider facilitating a learning environment that is enjoyable and meaningful and in conjunction with *didaktik* design elements, such as time and differentiated teaching, that enables the student's engagement and motivation.
Category 2 Interplay between play and learning	When facilitating a learning environment with interplay between play and learning, consider how competitive elements, retention of information and the student preoccupation with (exam) preparation influences the condition of meaningful learning purposes and practices.
Category 3 Experience with digital materials	When facilitating a learning environment using digital materials, consider the educators' own attitude towards digital materials and how digital materials influences motivation and perception. It is crucial that the function of the digital materials is intuitive and easy to use.
Category 4 Experience of collaboration	When facilitating a learning environment with interplay between playful learning, digital materials and physical activity, consider that collaboration can engage the students to participate in discussions with their peers, motivate the students to help each other and enable the students' learning and enjoyment
Category 5 Experience with space significance	When facilitating a learning environment that requires more space, that is, physical activity, consider the students contradictory experiences of being outside the traditional classroom
Category 6 Experience of getting a reward for participating in the activity	Consider applying extrinsic motivation element such as leaderboards, free food or extra marks

All the included primary studies addressed the review objectives, phenomenon of interest and inclusion criteria; thus, there were no concerns regarding relevance.

All the above-mentioned assessments were taken into account, and overall, there was low confidence in the evidence (see supplementary materials G1).

3.6. Meta-synthesis

When educators are planning to facilitate a learning environment with interplay between playful learning, digital materials and physical activity in curriculum-based teaching and learning in higher education, they need to conduct it in a meaningful practice for the students to be motivated. The educators need to have an understanding of the key factors that either enable or constrain the students' motivation. Thus, the line of action for each of categories 1 to 6 is presented in Table 5.

4. Discussion

Our synthesis identified several influential factors that may be taken into consideration when planning a playful learning activity using digital materials and physical activity. The interplay can increase students' motivation and facilitate an environment in which students display a high level of engagement and, in the learning activity, energetic physical activity. Students experience that they were improving their academic performance. Also, gamified activities (leaderboards, scores, competitive elements and rankings), free food and extra marks create extrinsic motivational factors for the student's willingness to participate in a learning activity. Play is often associated with the world of children; this may give rise to resistance and concern amongst educators regarding taking a playful approach to learning in curriculum-based teaching in higher education (Carden, 2018; Händel & Buhl, 2021; Pyle et al., 2017). Synthesis of the primary studies further revealed several limitations and constraints that researchers, educators or other stakeholders must take into consideration. A playful learning activity with digital materials and physical activity could be time-consuming to develop, plan and execute. In addition, some students may anticipate that they do not need to prepare for a lesson utilising playful approaches to learning. However, the factor that appeared to be the most decisive was incorporating digital materials. Several limitations and constraints appeared in this category. Technical problems may occur, especially if the activity depends on a high-speed internet connection or the functionality of an app. Thus, digital materials must be intuitive and easy to use so that errors are minimised. Another perspective to consider is that there must be digital materials or devices available for all students as part of the activity so that no one feels excluded. Moreover, it must be taken into consideration that, even though the teachers expressed that digital materials had a positive impact on learners' motivation and perceptions, using digital materials may not in and of itself influence students' perceptions of how enjoyable gamified activities are. Finally, the space where the learning activity is planned to take place is important. If the learning activity is conducted outside the classroom, some students may not enjoy the activity because of concern that the noise could disturb the other classes or that there could be difficulties in taking notes.

Implementing a playful approach to learning using digital materials and physical activity is one approach to challenging traditional learning strategies. Therefore, it must not be implemented without ongoing pedagogical *didaktik* (central and northern European tradition) reflections. A professional dialogue and discussion between educators, researchers and students that looks at both potential and limitations must be undertaken to ensure a meaningful practice.

4.1. Limitations of the included primary studies

In our GRADE-CERQual assessment, we found low confidence in the evidence. We had serious concerns about the adequacy of the evidence because only three primary studies were eligible for inclusion. However, all three primary studies pointed out the lack of research within this field. Some scholars have advocated for arbitrary minimum cut-offs for the number of studies needed to perform a meta-aggregation, for instance 6–14 (Booth, 2016) or even 10–20 studies (Major & Savin-Baden, 2010). However, meta-aggregation facilitates an interpretation that would otherwise be difficult to achieve, for instance, a summary report of each study rather than yielding a summary of findings.

Furthermore, we found that none of the included primary studies stated the researchers' philosophical perspectives. We acknowledge that the researchers may have had a philosophical perspective, but we could only deal with the content reported. This may have led us to take a more critical assessment of the included primary studies. At this point, standardised reporting guidelines for qualitative research should be developed and followed.

All three primary studies utilised both quantitative and qualitative data, but because we had chosen to focus only on the qualitative data, we ended up with a limited number of finding illustrations and finding quotes. We were limited by the study design of the three primary studies: one primary study only had one student focus group, some classroom observations and interviews with two teachers (Alajaji & Alshwiah, 2021). The other two primary studies were limited to qualitative data derived from open-ended student evaluations or free-text opportunities in their questionnaires (Botha-Ravyse et al., 2018; Nessler et al., 2021).

We wanted to include studies in which the interplay took place in a curriculum-based learning setting. We did not consider beforehand whether the learning activity should be part of compulsory lessons or whether it could be conducted as part of voluntary lessons. One study was designed for students to participate on a voluntary basis outside of school hours, but they were given extra marks and free food to participate (Botha-Ravyse et al., 2018).

4.2. Strengths and limitations of the present review

We used standardised methods to perform this systematic review, that is, a synthesis of qualitative studies using meta-aggregation, the JBI checklist of qualitative studies, the PRISMA checklist for qualitative studies and GRADE-CERQual. In addition, the reporting followed PRISMA.

Our systematic search, which was deep and broad in scope, is, to the best of our knowledge, the first systematic review addressing the interplay between digital materials, physical activity and playful learning in curriculum-based activities in higher education. However, search terms such as 'playful learning', 'physical activity' and 'digital materials' are complex. They arise from and are connected to different scientific and theoretical traditions; for example, the exploration of physical activity can be found in both science and the humanities. Therefore, our key search terms had many variants and synonyms and have several different meanings; for example, 'movement' can be used for physical activity, political movements or simply objects or materials being moved. In addition, the word 'play' appeared in several contexts that had nothing to do with playful learning, for example, playing a role, playing a part in, something being 'in play' and the like. We included all the meanings of the search terms to ensure that we extensively covered the field.

We acknowledge that there is a difference in how adults and children become motivated and engaged to participate in playful approaches to learning; that is, play in adulthood and in higher education can present various barriers or constraints that are not apparent amongst children because it challenges the student's perception and comprehension of how and what learning should be in higher education (Gudiksen & Skovbjerg, 2020; Nørgård et al., 2017; Whitton & Moseley, 2019). For these reasons, we did not expand our PICo to include children.

We defined playful learning in our phenomenon of interest very broadly, but the included primary studies aimed to either prove a specific concept or investigate game-based learning or gamification in

higher education. Thus, none of the primary studies provided insights into playful learning in its own right. We included these primary studies based on the theoretical similarities existing between playful learning, game-based learning and gamification. We also included the primary studies because they were conducted as location-based learning, for example, a scavenger hunt, which is theoretically categorised as a playful activity. Because there are theoretical similarities between playful learning and game-based learning or gamification in education, some of the strengths and limitations that we found could also be applied when developing, planning and executing playful approaches to learning using digital materials and physical activities either in a research project or in practice.

In our extraction of data from the included primary studies, we discovered several finding quotes that could have been placed under several categories or themes. This occurred because several of the finding quotes could be interpreted in different ways based on the categories. If a similar iterative process were conducted, some finding quotes may have been placed in a different category, but we had a discussion based on our professional knowledge of the field, and there was a strong consensus amongst the reviewers by the end of the iterative process.

4.3. Additional recommendations for practice

We highlight the need to expand the field in both practice and research. The primary studies could have particular focal points, for example, students' embodied presence, educators' perspectives on implementing the interplay in class, students' or educators' agency, motivational factors, limitations and barriers to implementing the interplay in higher education or academic pros and cons. These studies could provide an increased understanding of the field and add new, valuable knowledge in the areas of digital competences, physical activity and playful learning in higher education, both separately and combined. Pedagogical tools, learning design and teaching and learning strategies that enhance playful learning, digital materials and physical activities need to be developed and implemented in educational contexts across educational levels.

5. Conclusion

The present review showed that, when synthesising the literature on the interplay between playful learning, digital materials and physical activity in higher education, several categories and themes emerged. Most importantly, the students appreciated competitive spirits, receiving rewards, collaboration and creativity when participating in game-based learning activities in combination with digital materials and physical activity; these were all extrinsic motivational factors. Moreover, both students and teachers experienced game-based learning strategies in combination with digital materials and physical activity as facilitating the learning and retention of information by highlighting key information and breaking down information, which increased the experience of meaningful practice. Time as a resource, frustration with using digital materials and the fact that this type of activity challenges traditional learning strategies and learning spaces are some of the constraints of this approach. Thus, the meta-aggregation revealed a line of action indicating that educators need to have an understanding of the key factors presented in this systematic review when planning and facilitating a teaching session with interplay between playful learning, digital materials and physical activity in curriculum-based teaching and learning in higher education. Thus, it must be conducted in a meaningful practice for the students to be motivated. Our confidence in the evidence was low, due to moderate concerns regarding methodological limitations and serious concerns regarding the adequacy of the data. Primary studies are greatly needed to progress the research further, especially research investigating teachers' or educators' perspectives, both in practice and in research.

Funding

The research is funded by the LEGO Foundation and University College Copenhagen, KP, as part of an ongoing PhD project. The Parker Institute at Bispebjerg and Frederiksberg Hospital is supported by a core grant from the Oak Foundation (OCAY-18–774-OFIL). The sponsors did not have any influence in the study design; in the collection, analysis and interpretation of data; in the writing of the report; or in the decision to submit the article for publication.

Research data

Data are available in supplementary materials.

CRediT authorship contribution statement

Vici Daphne Händel: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Data curation, Writing – original draft, Writing – review & editing, Visualization, Project administration, Funding acquisition. **Vibeke Schrøder:** Validation, Formal analysis, Investigation, Data curation, Writing – review & editing. **Kirsten Birkefoss:** Investigation, Writing – review & editing. **Mina Nicole Händel:** Conceptualization, Methodology, Validation, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing, Visualization, Supervision, Funding acquisition.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgment

We would like to thank Professor Mie Buhl for valuable feedback on this work. Scribendi provided proof reading of the article.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.ijedro.2023.100284.

References

Alajaji, D. A., & Alshwiah, A. A. (2021). Effect of combining gamification and a scavenger hunt on pre-service teachers' perceptions and achievement. *Journal of Information Technology Education, 20*, 283–308. https://doi.org/10.28945/4809

Aromataris, E., Munn, Z., Aromataris, E., & Munn, Z. (2020). Chapter 1: JBI systematic reviews. *JBI manual for evidence synthesis*. JBI. https://doi.org/10.46658/JBIMES-20-02

Booth, A. (2016). Searching for qualitative research for inclusion in systematic reviews: A structured methodological review. In *Systematic Review, 5* p. 74). https://doi.org/10.1186/s13643-016-0249-x

Botha-Ravyse, C., Lennox, A., & Jordaan, D. (2018). Lessons learned from gamification of a learning experience: A case study. *South African Journal for Research in Sport, Physical Education and Recreation, 40*(2), 23–40.

Boysen M.S.W., Sørensen M.C., Jensen H., Von Seelen J., & Skovbjerg H.M. (2022). Playful learning designs in teacher education and early childhood teacher education: A scoping review. Teaching and Teacher Education, 120, 103884. 10.1016/j.tate.2022.103884.

Carden, C. (2018). *Primary teaching: Learning and teaching in primary schools today. Learning Matters*. SAGE publications.

Cooper, K. H., Greenberg, J. D., Castelli, D. M., Barton, M., Martin, S. B., & Morrow, J. R. (2016). Implementing policies to enhance physical education and physical activity in schools. *Research Quarterly for Exercise and Sport, 87*(2), 133–140. https://doi.org/10.1080/02701367.2016.1164009

Cuban, L. (2001). *Oversold and underused: Computers in the classroom*. Harvard University Press. https://doi.org/10.2307/j.ctvk12qnw

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness: Defining "gamification. In *Proceedings of the 15th international academic MindTrek conference: Envisioning future media environments* (pp. 9–15).

Gudiksen, S., Skovbjerg, H. M., Gudiksen, S., & Skovbjerg, H. M. (2020). Prologue uncovering the qualities of play design. *Framing play design: A hands-on guide for designers, learners & innovators* (pp. 15–36). BIS.

Händel, V.D., & Buhl, M. (2021). Playful online learning environments promote student teachers' renegotiation of their learner role. In C. Busch, M. Steinicke, R. Frieß, & T. Wendler (Eds.), Proceedings of the 20th European Conference on e-Learning, ECEL 2021 (pp. 567-573). Academic Conferences and Publishing International.

Händel, V.D., and Jensen, E.O. (2022) Introducing the play activity wheel: Designing social, physical and playful learning activities from digital game universes, in Lockton, D., Lenzi, S., Hekkert, P., Oak, A., Sádaba, J., Lloyd, P. (eds.), DRS2022: Bilbao, 25 June - 3 July, Bilbao, Spain. https://doi.org/10.21606/drs.2022.294.

Händel, V. D. (2023). Student teacher's prerequisite to be embodied playful presence in lessons with playful approaches to learning. *The Journal of Play in Adulthood, 5*(1), 82–106. https://doi.org/10.5920/jpa.1297

Horsley, T., Dingwall, O., & Sampson, M. (2011). Checking reference lists to find additional studies for systematic reviews. *Cochrane Database Systematic Review, 2011* (8). https://doi.org/10.1002/14651858.MR000026.pub2. MR000026.

Jørgensen, H. H., Schrøder, V., & Skovbjerg, H. M. (2023). Playful learning, space and materiality: An integrative literature review. *Scandinavian Journal of Educational Research, 67*(3), 419–432. https://doi.org/10.1080/00313831.2021.2021443

Jensen, J. B., Pedersen, O., Lund, O., & Skovbjerg, H. M. (2022). Playful approaches to learning as a realm for the humanities in the culture of higher education: A hermeneutical literature review. *Arts and Humanities in Higher Education, 21*(2), 198–219. https://doi.org/10.1177/14740222211050862

Jiménez-Olmedo J.M., Pueo B., & Penichet-Tomás A. (2016). Learning methodology research in physical education: An educational proposal based on digital platforms. EDULEARN16, proceedings. (pp 7889–7895). doi: 10.21125/edulearn.2016.0730.

Joanna Briggs Institute. (2020). Critical appraisal tools. Checklist for qualitative research. Critical Appraisal Tools for Use in JBI Systematic Reviews. Available at: https://jbi.global/critical-appraisal-tools.

Kahn, E. B., Ramsey, L. T., Brownson, R. C., Heath, G. W., Howze, E. H., Powell, K. E., et al. (2002). The effectiveness of interventions to increase physical activity: A systematic review. *American Journal of Preventive Medicine, 22*(4), 73–107. https://doi.org/10.1186/s12966-015-0203-7

Kaneko, K., Saito, Y., Nohara, Y., Kudo, E., & Yamada, M. (2018). Does physical activity enhance learning performance? Learning effectiveness of game-based experiential learning for university library instruction. *The Journal of Academic Librarianship, 44* (5), 569–581. https://doi.org/10.1016/j.acalib.2018.06.002

Kangas, M., Siklander, P., Randolph, J., & Ruokamo, H. (2017). Teachers' engagement and students' satisfaction with a playful learning environment. *Teaching and Teacher Education, 63*, 274–284. https://doi.org/10.1016/j.tate.2016.12.018

Kangas, M. (2010). Creative and playful learning: Learning through game co-creation and games in a playful learning environment. *Thinking Skills and Creativity, 5*(1), 1–15. https://doi.org/10.1016/j.tsc.2009.11.001

Leijon, M., Gudmundsson, P., Staaf, P., & Christersson, C. (2022). Challenge based learning in higher education: A systematic literature review. *Innovations in Education and Teaching International, 59*(5), 609–618. https://doi.org/10.1080/14703297.2021.1892503

Lewin, S., Booth, A., Glenton, C., Munthe-Kaas, H., Rashidian, A., Wainwright, M., et al. (2018). Applying GRADE-CERQual to qualitative evidence synthesis findings: Introduction to the series. *Implementation Science, 13*(1), 2. https://doi.org/10.1186/s13012-017-0688-3

Lisborg, S., Händel, V. D., Schrøder, V., & Rehder, M. M. (2021). Digital competences in Nordic teacher education: an expanding agenda. *Nordic Journal of Comparative and International Education (NJCIE), 5*(4), 53–69. https://doi.org/10.7577/njcie.4295

Lockwood, C., Munn, Z., & Porritt, K. (2015). Qualitative research synthesis: Methodological guidance for systematic reviewers utilizing meta-aggregation. *JBI Evidence Implementation, 13*(3), 179–187. https://doi.org/10.1097/XEB.0000000000000062

Major, C. H., & Savin-Baden, M. (2010). *An introduction to qualitative research synthesis: Managing the information explosion in social science research.* London: Routledge.

Mardell, B., Lynneth Solis, S., & Bray, O. (2019). The state of play in school: Defining and promoting playful learning in formal education settings. *International Journal of Play, 8*(3), 232–236. https://doi.org/10.1080/21594937.2019.1684157

Martin, F., Polly, D., Coles, S., & Wang, C. (2020). Examining higher education faculty use of current digital technologies: Importance, competence, and motivation. *International Journal of Teaching and Learning in Higher Education, 32*(1), 73–86.

Nørgård, R. T., Toft-Nielsen, C., & Whitton, N. (2017). Playful learning in higher education: Developing a signature pedagogy. *International Journal of Play, 6*(3), 272–282. https://doi.org/10.1080/21594937.2017.1382997

Nessler, J., Schaper, E., & Tipold, A. (2021). Proof of concept: Game-based mobile learning – the first experience with the app Actionbound as case-based geocaching in education of veterinary neurology. *Frontiers in Veterinary Science, 1508*. https://doi.org/10.3389/fvets.2021.753903

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., et al. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ, 372*(71). https://doi.org/10.1136/bmj.n71 (Clinical Research Ed.).

Peng, S., Yuan, F., Othman, A. T., Zhou, X., Shen, G., & Liang, J. (2022). The effectiveness of e-health interventions promoting physical activity and reducing sedentary behavior in college students: A systematic review and meta-analysis of randomized controlled trials. *International Journal of Environmental Research and Public Health, 20* (1), 318. https://doi.org/10.3390/ijerph20010318

Plass, J. L., Homer, B. D., & Kinzer, C. K. (2014). Playful learning: An integrated design framework. In *In Games for Learning Institute. White paper, 2* p. 2014). https://doi.org/10.13140/2.1.4175.6969

Plass, J. L., Homer, B. D., Mayer, R. E., Kinzer, C. K., Plass, J. L., Mayer, R. E., & Homer, B. D. (2020). Theoretical foundations of game-based and playful learning. *Handbook of game-based learning* (pp. 3–24). MIT Press.

Pyle, A., DeLuca, C., & Danniels, E. (2017). A scoping review of research on play-based pedagogies in kindergarten education. *Review of Education, 5*(3), 311–351. https://doi.org/10.1002/rev3.3097

Resnick, M. (2017). *Lifelong kindergarten: Cultivating creativity through projects, passion, peers, and play.* MIT Press.

Saad, A., & Zainudin, S. (2022). A review of project-based learning (PBL) and computational thinking (CT) in teaching and learning. *Learning and Motivation, 78*, Article 101802. https://doi.org/10.1016/j.lmot.2022.101802

Selwyn, N. (2013). Discourses of digital 'disruption' in education: A critical analysis. *Fifth international roundtable on discourse analysis* (pp. 1–28). Hong Kong: City University. May 23–25.

Small, S. P. (2023). Reflections on critical appraisal of research for qualitative evidence synthesis. *JBI Evidence Synthesis, 21*(6), 1064–1065.

Subhash, S., & Cudney, E. A. (2018). Gamified learning in higher education: A systematic review of the literature. *Computers in Human Behavior, 87*, 192–206. https://doi.org/10.1016/j.chb.2018.05.028

Van der Vlies, R. (2020). Digital strategies in education across OECD countries: Exploring education policies on digital technologies. *OECD education working papers, 226*. OECD Publishing.

Wengreen, H. J., & Moncur, C. (2009). Change in diet, physical activity, and body weight among young-adults during the transition from high school to college. *Nutrition Journal, 8*(1), 1–7. https://doi.org/10.1186/1475-2891-8-32

Whitton, N., & Moseley, A. (2019). *Playful learning: Events and activities to engage adults.* Routledge.

Whitton, N. (2009). *Learning with digital games: A practical guide to engaging students in higher education.* Routledge.

Whitton, N. (2018). Playful learning: Tools, techniques, and tactics. *Research in Learning Technology, 26*. https://doi.org/10.25304/rlt.v26.2035

Wiggins, B. E. (2016). An overview and study on the use of games, simulations, and gamification in higher education. *International Journal of Game Based Learning (IJGBL), 6*(1), 18–29. https://doi.org/10.4018/IJGBL.2016010102

World Health Organization. (2022, October 5). Physical activity. https://www.who.int/news-room/fact-sheets/detail/physical-activity.

Zhao, Y., Pinto Llorente, A. M., & Sánchez Gómez, M. C. (2021). Digital competence in higher education research: A systematic literature review. *Computers & Education, 168*, Article 104212. https://doi.org/10.1016/j.compedu.2021.104212

Zosh, J. M., Hopkins, E. J., Jensen, H., Liu, C., Neale, D., Hirsh-Pasek, K., et al. (2017). *Learning through play: A review of the evidence.* The LEGO Foundation.