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Identifying the Gap in Research on Development of Game-Based Learning Module Using Project-Based Learning for Home Science Subject: A Systematic Literature Review

Nor Hayati Kamisman
Instructional Technology & Innovation Module, Faculty of Education, Universiti Kebangsaan Malaysia,43600 UKM Bangi, Selangor, Malaysia
Email: hayatikamisman@gmail.com

Rosseni Din
Learning & Teaching Innovation Research Centre, Faculty of Education, Universiti Kebangsaan Malaysia,UKM Bangi, 43600 Selangor, Malaysia.
Email: rosseni@ukm.edu.my

Aidah Abdul Karim
Learning & Teaching Innovation Research Centre, Faculty of Education, Universiti Kebangsaan Malaysia,UKM Bangi, 43600 Selangor, Malaysia.
Email: eda@ukm.edu.my

Nur Hidayah Md Yazid
Centre of Foundation Studies, Universiti Teknologi MARA, Selangor Branch, Dengkil Campus, 43800 Dengkil, Selangor, Malaysia
Email: nurhidayah7945@uitm.edu.my

Noraini Kamisman
Politeknik Tun Syed Nasir Syed Ismail Pagoh Higher Education Hub, KM 1, Jalan Panchor 84600 Pagoh, Johor, Malaysia.
Email: aini84@gmail.com

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Abstract

A systematic literature review was undertaken to assess the existing collection of information pertaining to the design and development of project-based learning and game-based learning within the domain of Home Science. There are two primary methodologies: topical approach

and critical review technique. The article examines the process of conducting systematic literature review using PRISMA procedure. Initially, a research objective and a research question were established. Subsequently, a substantial selection of sources within the existing body of literature was discovered. The data were then obtained from these sources subsequent to the implementation of exclusionary filters. In the analysis and reporting of the findings, descriptive statistics was employed. Furthermore, the implications arising from these findings were thoroughly examined and analysed. The researchers were able to discover many themes through the literature review, revealing the presence of gaps in knowledge. Further investigation is necessary in the realm of Design and Development of Project-based Learning and Game-based Learning within the domain of Home Science.
Keywords: Critical Review, Design Development Research, Project-based Learning, Game-based Learning, Home Science

Introduction

The education system in Malaysia frequently undergoes revisions to align with the evolving needs and demands of the present period. The inevitable progress of the country necessitates reforms in the field of education. The exponential expansion of this nation is seen in the triumphant accomplishments attained by Malaysia in the realms of politics, economy, and society. Zakaria (2013) states that a significant factor in a country's prosperity is the presence of individuals who possess extensive knowledge, strong work ethics, advanced skills, and a competitive nature. The current government policy and national education system prioritize sectors that focus on developing skills necessary for advancing the country's economic sector (Kozma, 2005).

The Home Science subject is a pathway to cultivate students who have viable knowledge and abilities on a worldwide scale. Home Science is a recently introduced curriculum that replaced Home Economics as a specialized elective subject (MPEI) within the Science, Technology, Engineering, and Mathematics (STEM) group for students in Forms Four and Five. The Ministry of Education Malaysia (KPM) has implemented a new curriculum that is designed to develop the MPEI curriculum. This initiative aims to produce well-rounded individuals with a strong moral compass, the ability to think critically and creatively, and possess professional soft skills. The goal is to prepare students to effectively tackle the challenges of the 21st century. Home Science comprises four primary elements: Family and Resources Management, Clothing and Sewing, Food and Nutrition, and Food Preparation and Serving.

Multiple objectives in Home Science pertain to skills and vocations. One of the objectives is to gain and utilize information and skills in the field of Science Household to enhance personal, familial, and societal well-being. Additionally, it aims to promote the recognition of the need for continuous learning for professional advancement (Chong, 2013). To cultivate comprehensive human resources, it is essential to comprehend and to assess the confidence levels of the instructors or implementers to effectively meet the objectives of the Home Science curriculum.

Home Science is intended to impart knowledge, values, and practical life skills, it is one of the most important subjects in the Malaysian educational system (Hafizan et al., n.d.). The subject covers a large and diverse cross-section of topics such as Clothing & Sewing, Food & Nutrition,

and Family & Home Management. Students find it difficult to master especially in the field of Food Science and Nutrition because the topic is rather broad. Thus, engaging teaching and learning strategies to improve retention consistency is essential to assist students in becoming proficient in this subject. By introducing creative and interesting educational strategies, it is hoped that students' curiosity can be stimulated and cultivated into a lifetime love of learning by making learning an exciting and entertaining adventure. In Malaysian education, the Home Science curriculum is always updated. Teachers are urged to use a variety of pedagogies in their instruction to improve the students' views of the learning environment, motivation, and subject accomplishment. Teachers have benefited greatly from the use of appropriate approaches, methods, strategies, and procedures in bridging skill development and subject understanding.

The design and development of instructional modules is a vital component for promoting effective learning experiences in the domain of Home Science. The design and development of these modules is critical in guaranteeing full subject content and increasing students' understanding. In Home Science education, the design and development approach strives to produce modules that blend theory and practical applications, adapting to different learning styles and improving the entire educational experience (Johnson et al., 2010). However, there is a noticeable need for further inquiry and identification of research gaps that can improve the usefulness of module development in Home Science within this domain. While progress has been achieved in the production of instructional modules for Home Science, there is still a dearth of thorough research aimed at the systematic evaluation of the design and development processes. The exploration of appropriate approaches for developing these modules, including the identification of essential learning objectives, pedagogical strategies, and evaluation frameworks, is an aspect that deserves more attention (Ibrahim & Jaafar, 2009).

Furthermore, a thorough understanding of the individual needs and preferences of varied learners within the domain of Home Science education could greatly aid in the enhancement of module development. Another aspect that has to be addressed is the incorporation of technological improvements into Home Science curricular. The use of digital tools, interactive platforms, and multimedia resources effectively presents a potential area for improvement in the design and development of these modules. Within the existing research landscape, identifying the most advantageous and practical ways to integrate technology while guaranteeing alignment with educational objectives and students' needs remains unknown. Further research is needed to evaluate and modify these modules to meet changing educational paradigms and societal developments. The subject's dynamism, driven by societal transformations, necessitates a constant assessment of the modules' relevance and adaptation to modern circumstances.

In brief, the production of Home Science instructional modules that employ a design and development approach is at a crossroads, demanding a more in-depth inquiry into many elements to bridge existing research gaps. Addressing these gaps will not only enrich pedagogical practises in Home Science education but will also considerably improve students' entire learning experience. Modifying a student's learning style in the classroom can be a constructive and efficient approach to meet their needs and improve their educational

experience as a whole. It entails identifying and addressing the variety of learning styles that students possess. It calls for adaptability, flexibility, and a dedication to creating a welcoming, inclusive learning environment that accommodates the requirements of every student.

This creative teaching strategy makes use of games' natural appeal to draw students in and improve their comprehension of a range of topics and abilities. Incorporating games into the learning process has been shown to be highly beneficial, regardless of the learning environment - classroom, corporate training, or casual. Using games to encourage project-based learning (PBL) is an innovative and entertaining technique to improve education. Meanwhile, design and development research (DDR) encompasses the study of the entire design and development process, specific components, and the impact of efforts, whether studying the work of others or engaging in design and development activities while simultaneously analysing the process (Richey & Klein, 2014).

The present article centres on how such tools have been incorporated in recent studies. More specifically, the extent the current knowledge on design and development research (DDR) with problem-based learning and game-based learning for the Home Science subject is explored and the gap of needs for future research. This has been accomplished through a systematic literature review (SLR) of recent literature. Adhering to standard research practices, the formulation of the problem is first addressed before a method of collecting and analysing data is presented. The results of this analysis are then presented with their implications.

Methodology

Review Protocol

The aim of Systematic Literature Review (SLR) is to enable researchers to make informed assessments and reach conclusions about the existing knowledge and gaps related to the review questions, while considering varying degrees of certainty, consistency, and confidence (Briner & Denyer, 2012). It begins with developing and validating the review protocol. The protocol aims to guarantee that the review is conducted in a systematic, procedural, transparent, and replicable manner (Briner & Denyer, 2012; Mohamed Shaffril et al., 2021). In this study, the SLR is guided by Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) protocol, developed by Moher et al., (2009) as illustrated in Figure 1.

Formulation of Research Question

The researchers formulated a research question based on the PICo method. PICo is one of the research question tools to assist the researchers in developing appropriate questions for this review. PICo has three main components that must be included in formulating a question, which are population (P), the interest of the study (I), and context (Co). Hence, the researchers included three main components in formulating a research question, which are the Home Science subject (Population), game-based learning and project-based learning approaches (Interest), and design and development research (Context). By combining those three main elements, the research question formulated is – To what extent do recent and respected publications deal with the theme of DDR with project-based learning strategy and game-based learning strategy for Home Science subject?

Procedures in SLR

Identification

SLR process needs to align with a developed research question. In the first process, known as identification, the researchers identified four main keywords from the research question, which are "DDR", "PBL", "GBL", "Home Science". To make the searching technique rigorous and efficient, keyword enrichment is necessary. Gazendam et al. (2010) suggest using an online thesaurus website to enrich more keywords from synonymous results.

Once the keywords had been enriched, the researchers developed a full search string using Boolean operator, phrase searching, truncation, wildcard, and field code functions in the Scopus database. Table 1 shows how the researchers developed search strings on Scopus. The field code search is based on title, abstract, and keyword. As a result, Scopus identified 394 articles. The following protocol is screening.

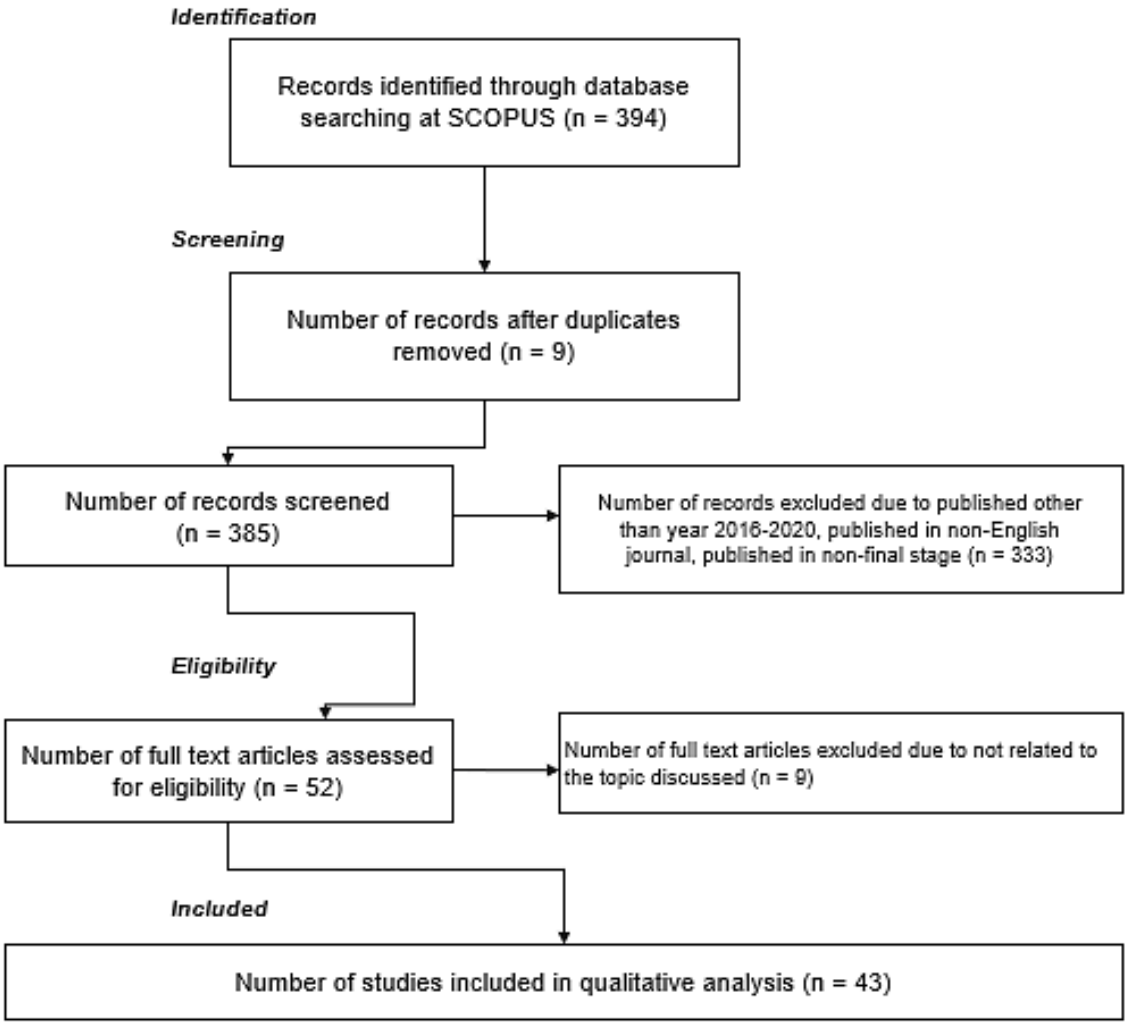

Figure 1: PRISMA flow diagram. Guided from Moher et al. (2009)

Table 1
The Search String

Database	Search String		No. of results
SCOPUS	#1	TITLE-ABS-KEY ((“project-based learning” OR “PBL” AND “game-based learning” OR “GBL”))	48
	#2	TITLE-ABS-KEY ((“design development research” OR “DDR” AND “project-based learning” OR “PBL”))	2
	#3	TITLE-ABS-KEY ((“design development research” OR “DDR” AND “game-based learning” OR “GBL”))	3
	#4	TITLE-ABS-KEY ((“design development research” OR “DDR” AND “teaching” OR “school”))	221
	#5	TITLE-ABS-KEY ((“design development research” OR “DDR” AND “teaching” AND “school”))	25
	#6	TITLE-ABS-KEY ((“Home Science”))	95
Total			394

Screening

The second process of PRISMA protocol in this study is screening. The screening procedure involves the researchers’ decision-making on which articles to include or remove from the review. This process is assisted automatically by the database using a filter system. The screening method offers the researchers the benefit of ensuring that the selection criteria derived from the database are appropriate, striking a balance between being too restrictive and too inclusive (Kraus et al., 2020; Meline, 2006).

The researchers eliminated the redundant articles containing duplicate records from the Scopus database (Moher et al., 2015). This process is necessary to avoid double review, resulting in 9 duplications detected. After that, the researchers made exclusions based on the timeline of the study (the year 2012 to 2023), article language (English), document type (journal or article), and publication stage (final). As a result, there were 333 articles to be excluded as they did not match the desired criteria.

Eligibility

The third process in PRISMA protocol is eligibility. The complexity of this process stems from its manual nature, excluding the steps of identification and screening (Mohamed Shaffril et al., 2021). Therefore, it is a thorough process conducted by the researchers. There were 52 articles available for the eligibility process. The researchers implemented the recommendation proposed by Kraus et al. (2020), which involves commencing the reading of papers by examining the title and abstract. Then, the researchers could identify whether the article was eligible and matched the research question in this study. As a result, 9 articles were not eligible because they did not match the desired research question. After the eligibility process, the researchers performed the following process called inclusion.

Inclusion and Data Extraction

After the eligibility process was completed, the researchers agreed to take 43 articles to be reviewed. Then, the researchers performed data extraction by preparing an extraction sheet at the beginning. The data extraction assisted the researchers in answering the research

question. A matrix table serves as a valuable aid in promoting transparency and enhancing the understanding of the ongoing synthesis process (Kraus et al., 2020; Mohamed Shaffril et al., 2021).

Analysis

In this study, the researchers analysed the data by conducting data synthesis. The synthesis was critical to perform analysis by disseminating the findings from the matrix table among the 43 articles to be reviewed. Hence, the result of the synthesis was analysed and presented in the qualitative method, which was via thematic analysis. The goal of thematic analysis is to locate, examine, and evaluate themes or meanings that exist within the qualitative data (Braun & Clarke, 2022). There are several themes identified by the researchers in this study based on the selected articles' key findings to be discussed in the next section.

Reporting of the Results

Background on the Selected Articles

The researchers identified and selected 43 articles to be reviewed, which were then categorised according to the specific domains as seen in Table 2. The methods used, the countries in which the studies were conducted, and the contributions of each study were also reported. Malaysia (42%) shows the most articles related to the keywords of the present study. Additionally, the table reporting on the review also indicates the citation of each article. One particular study conducted in Taiwan demonstrated the highest citation rate among other studies, with a total of 345 citations. The analysis of the evaluated research revealed that a significant proportion, specifically 21%, demonstrated causal correlations between variables. The remaining (79%) studies made valuable contributions to the overall study outcomes by providing modules, models, or instructional aids.

The themes

The researchers generated five themes: (1) DDR for teaching in school, (2) DDR using project-based strategy, (3) DDR using game-based strategy, (4) project-based learning and game-based learning strategies in education, and (5) modules for the Home Science subject presented based on the 43 selected articles.

Table 2
Report of the Analysis of the Literatue

NO	AUTHORS	YEAR	SOURCE TITLE	Cited by	DDR	PBL	GBL	HS	COUNTRY	METHODS	CONTRI-BUTION
1	Sahrir M.S. et al.	2012	Turkish Online Journal of Educational Technology	12	√		√		MALAYSIA	DDR	WEB GAME
2	Nasir S.M.M. et al.	2023	International Journal of Educational Methodology	0	√		√		MALAYSIA	DDR	TEACHING AIDS
3	Yoon C.S. et al.	2022	International Journal of Interactive Mobile Technologies	2	√		√		MALAYSIA	DDR	BOARD GAME
4	Padzil M.R. et al.	2021	International Journal of Advanced	3	√	√			MALAYSIA	DDR	MODULE

			Computer Science and Applications							
5	Adnan M. et al.	2023	Journal of Higher Education Theory and Practice	0	√	√		MALAYSIA	DDR	TEXTBOOK CONTENT
6	Jaya S. et al.	2021	Review of International Geographical Education Online	4	√			MALAYSIA	DDR	MODEL
7	Yusof Y.M. et al.	2020	Bulletin of Electrical Engineering and Informatics	2	√			MALAYSIA	DDR	MODULE
8	Rezli N. & Phoong S.Y.	2022	International Journal of Technology Enhanced Learning	0	√			MALAYSIA	DDR	TEACHING AIDS
9	Maaruf S.Z. et al.	2021	Asian Journal of University Education	0	√			MALAYSIA	DDR	MODULE
10	Zakwandi R. et al.	2023	Education and Information Technologies	0	√			INDONESIA	DDR	ASSESSMENT TOOLS
11	Ismail K. et al.	2021	TEM Journal	3	√			MALAYSIA	DDR	MODEL
12	Yahawa N.F.B. & Maaruf S.Z.	2019	Asian Journal of University Education	2	√			MALAYSIA	DDR	MODULE
13	Aziz A.A.M.A. et al.	2021	Review of International Geographical Education Online	0	√			MALAYSIA	DDR	MODEL
14	Sharif A.M. et al.	2021	Jurnal Pendidikan IPA Indonesia	1	√			MALAYSIA	DDR	TEACHING KITS
15	Kim How R.P.T. et al.	2022	Pegem Egitim ve Ogretim Dergisi	0	√			MALAYSIA	DDR	MODULE
16	Suhaizal H.et al.	2023	International Journal of Interactive Mobile Technologies	0	√			MALAYSIA	DDR	APPLICATION
17	Santosa M.H. et al.	2022	TESL-EJ	0	√		√	INDONESIA	DDR	HANDBOOK
18	Kwangmu ang P. et al.	2021	Heliyon	29	√			THAILAND	DDR	MODEL
19	Gibson D.	2021	Educational Technology Research and Development	0			√	AUSTRALIA	LITERA-TURE REVIEW	MODEL
20	Wang Y.H.	2020	Educational Technology and Society	21		√	√	TAIWAN	MIXED-METHODS	MODEL
21	Tariq H. et al.	2018	International Journal of Advanced Computer Science and Applications	1		√	√	PAKISTAN	MIXED-METHODS	MODEL

22	Sutton M.J. et al.	2021	Journal of Applied Learning and Teaching	0	√	√	SINGAPORE	MIXED-METHODS	TOOLS
23	Porat E. et al.	2023	Journal of Computer Assisted Learning	2	√	√	ISRAEL	QUALITA-TIVE (SEMI-STRUC-TURED INTER-VIEW)	MODEL
24	Estrada-Molina O.	2022	Journal of Engineering Education Transformations	1	√	√	SPAIN	SYSTEMA-TIC LITERA-TURE REVIEW	CAUSE-EFFECT RELATIONSHIP
25	Asthana P. et al.	2022	International Journal on Recent and Innovation Trends in Computing and Communication	0		√	INDIA	QUALITA-TIVE	MODEL
26	Lopez-Fernandez D. et al.	2023	IEEE Transactions on Games	1		√	SPAIN	EXPERI-MENT	VIDEO
27	Slattery E.J.et al.	2023	TechTrends	0		√	IRELAND	MIXED	APPLICATION
28	Afikah A. et al.	2022	International Journal of Advanced Computer Science and Applications	2	√	√	INDONESIA	SYSTEMA-TIC LITERA-TURE REVIEW	BEST TOOLS & APPROACHES
29	Krpan D. et al.	2019	International Journal of Engineering Education	1		√	CROATIA	MIXED	MODEL
30	Sun L. et al.	2022	Education and Information Technologies	9		√	CHINA	LITERA-TURE REVIEW	MODEL
31	Blonder R. & Sakhnini S.	2012	Chemistry Education Research and Practice	49	√	√	ISRAEL	QUALITA-TIVE	MODULE
32	Dol S.M. & Halkude S.A.	2018	Journal of Engineering Education Transformations	0	√	√	INDIA	QUANTITA-TIVE (EXPERI-MENT)	MODULE
33	Hsu T.-C. et al.	2018	Computers and Education	345	√	√	TAIWAN	META ANALYSIS	CAUSE-EFFECT RELATIONSHIP
34	Anuar N.H. et al.	2020	International Journal of Learning, Teaching and Educational Research	3	√	√	MALAYSIA	CASE STUDY	CAUSE-EFFECT RELATIONSHIP
35	Chaves R.O. et al.	2015	IEEE Transactions on Education	34	√	√	BRAZIL	EXPERI-MENT	CAUSE-EFFECT RELATIONSHIP
36	Rathi N. et al.	2017	Health Education	14			√ INDIA	SURVEY	CAUSE-EFFECT RELATIONSHIP
37	Burns E.C et al.	2023	Journal of Research in Science Teaching	1			√ AUSTRALIA	SURVEY	FRAMEWORK

38	Takko M. et al.	2020	International Journal of Learning, Teaching and Educational Research	2	√	MALAYSIA	EXPERI-MENT	CAUSE-EFFECT RELATIONSHIP
39	Azman M.N.A. et al.	2023	Asian Journal of University Education	1	√	MALAYSIA	QUALITA-TIVE	APPLICATION
40	Abeer K.A.A.	2021	African Journal of Food, Agriculture, Nutrition and Development	0	√	UAE	QUANTA-TIVE (QUESTIO-NAIRES)	CAUSE-EFFECT RELATIONSHIP
41	Fitzgerald T.	2020	Paedagogica Historica	2	√	NEW ZEALAND	QUALITA-TIVE (STRUCTU-RED INTER-VIEW)	CAUSE-EFFECT RELATIONSHIP
42	Azman M.N.A. et al.	2022	Journal of Higher Education Theory and Practice	0	√	MALAYSIA	INTERVIEW	APPLICATION
43	Albrecht N. & Upadhyay B.	2018	Urban Review	7	√	SOMALIA	CASE STUDY	CAUSE-EFFECT RELATIONSHIP

Note: DDR=Design Development Research; PBL=Project-based Learning; GBL=Game-based Learning; HS=Home Science

Discussion

The first finding that is reported in this systematic literature review relates to the lack of articles dealing with all four aspects of the current research: DDR, project-based learning, game-based learning, and Home Science subject. This study also found that there were no articles that met all four aspects of the study, which indicates a significant gap for studies related to those aspects.

At best, the articles reported findings on two of these aspects (40% of all articles), but the majority focused on only one. This clearly represents a gap in the current knowledge of the design and development of modules or models of the Home Science subject with these two approaches: project-based learning and game-based learning, as shown in Figure 2.

The articles were spread roughly evenly between these two approaches, with 30% of all academic publications focusing on project-based learning, 49% on game-based learning, and 19% on Home Science related topics. Conversely, only one article reported on a study that utilised DDR but did not incorporate project-based learning, game-based learning, or Home Science. This discovery emphasises a second gap that strongly justifies further investigation in this domain.

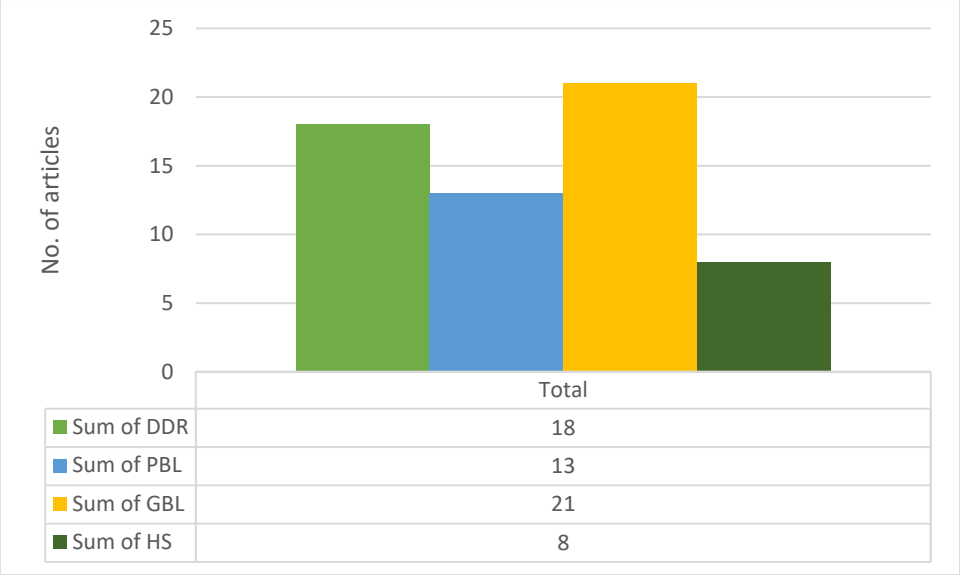

Figure 2: Frequency of articles found on the themes

The learning approach in schools in Malaysia includes various strategies and methods. One approach is the implementation of online distance learning (ODL) using platforms such as WhatsApp, Telegram, Google Meet, Hangout, and Google Classroom (Chinnasamy & Faizal, 2023). Collaborative learning is another effective approach that promotes improved learning outcomes and better communication skills (Aboudahr, 2023). KPM has also introduced 21st-century learning (PAK-21) which focuses on student-centred learning and includes elements such as communication, collaboration, critical thinking, creativity, values, and ethics (Sonte et al., 2022). In addition, the teaching of English for Science and Technology (EST) subject involves the use of comprehensive and effective learning and teaching strategies, such as the Cognitive and Academic Language Learning Approach (CALLA) (Sultan et al., 2022). Furthermore, the education system in Malaysia strives to align with Industrial Revolution 4.0 by combining elements such as industry involvement, work-based learning, blended learning, and technology involvement (Puteh, 2022).

In the present era, educators have moved away from utilising whiteboards and chalk as teaching tools in the classroom. In addition to fostering an enjoyable educational atmosphere, it also improves the efficiency of students' learning by eliminating constraints related to difficult and boring topics. The impact extends beyond the realm of education to the sphere of health, as the appropriate utilisation of technology and approaches can contribute to improved learning outcomes through the utilisation of a suitable method of development (Azman et al., 2023). Regarding the current review, 43 publications demonstrated that the study's results were associated with a product that may be utilised to improve the effectiveness of learning, such as teaching aids, applications, and modules.

Out of the 43 articles analysed in the critical evaluation, 18 (42%) were created utilising DDR as the development approach. The remaining 25 articles utilised various approaches to development, including the implementation of the ADDIE model and the utilisation of mixed-method research. Unfortunately, no article was found discussing DDR as a method for development especially the Home Science subject. While these articles did not explicitly address DDR, they were nevertheless applicable to the domain of Home Science. They included findings in many educational settings that span multiple disciplines.

Limitations

Some limitations of the current review should be noted. First, the reviewed articles were limited by the search terms, the database, the journals, and the publication language. Hence, some caution is required when extrapolating the results to other contexts of research foci. In particular, language barriers were a major issue when conducting this systematic literature review, as the range of research databases was limited and search engines available in English only were inadequate. As a result, it is possible that we missed out on a number of important research studies on the themes conducted in other countries because they were published in their local languages, and not in English.

Conclusion

The main implication that resulted from the systematic review was the discovery of three gaps in the literature. These were (1) the absence of findings on DDR for learning the Home Science subject, (2) the virtual absence of research on project-based learning with DDR, and (3) the virtual absence of research using game-based learning with DDR. Although there would only need to be one knowledge gap to justify conducting a study, the occurrence of the three gaps enhances the need for more studies. Although the identification of these gaps paved the way for additional research on this topic, further research is necessary particularly in the aspect of module development for the Home Science subject with the approaches of project-based learning and game-based learning using the DDR method.

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