International Journal of Evaluation and Research in Education (IJERE)
Vol. 14, No. 1, February 2025, pp. 621~628
ISSN: 2252-8822, DOI: 10.11591/ijere.v14i1.31831

Development of a teacher competency model in game-based learning: a need analysis

Jinchuan Jiang, Azidah Abu Ziden
School of Educational Studies, Universiti Sains Malaysia, Pulau Pinang, Malaysia

Article Info

Article history:

Received Jun 26, 2024
Revised Sep 2, 2024
Accepted Oct 1, 2024

Keywords:

Challenges
Competency model
Game-based learning
Need analysis
Teacher competencies
Teacher development

ABSTRACT

This paper conducts a need analysis study to identify the requirements for developing a competency model for teachers implementing game-based learning (GBL) in Chinese secondary schools. Additionally, it investigates the practices and challenges of teachers while implementing this pedagogical approach. Through a quantitative survey involving 384 teachers, key findings reveal significant challenges, such as technological issues, limited instructional time, a lack of high-quality games aligned with the curriculum, and inadequate teacher training. The majority of teachers expressed a positive attitude towards game-based learning but reported limited classroom usage due to these obstacles. The results highlight the need for the development of a competency model tailored to game-based learning teachers, emphasizing the importance of structured training opportunities. Such a model would provide essential guidance and support, enabling teachers to enhance their competencies and effectively integrate game-based learning into their teaching practices. Consequently, the next step of this research is to design and develop a comprehensive competency model that encompasses both technological and pedagogical skills, which will aim to enhance teacher preparedness and improve the integration of game-based learning in education, ultimately benefiting student engagement and learning outcomes.

Corresponding Author:

Azidah Abu Ziden
School of Educational Studies, Universiti Sains Malaysia
Jalan Sungai Dua, 11700 Gelugor, Pulau Pinang, Malaysia
Email: azidah@usm.my

1. INTRODUCTION

Game-based learning (GBL) refers to the use of games in educational settings to support learning or as educational tools [1]. Several studies have highlighted the benefits and challenges associated with game-based learning [2], [3]. Game-based learning pedagogy can have a significant complementary role in blended learning approaches [3], [4]. Games are important for students' cognitive development, as they provide an enjoyable and challenging learning environment while enhancing their academic performance and social skills [5], [6]. Game-based learning has gained recognition as an effective teaching and learning method due to the potential of games to enhance students' motivation and stimulate their curiosity and interest through activities that are meaningful to them [7]. The pedagogical approach adopted by many games is related to their potential as mediators, linking learning objectives to curriculum-defined activities [8]. Because students often consider games to be engaging, more and more teachers are exploring ways to incorporate educational games into their classrooms [9].

Despite growing interest in educational games, their integration into teaching remains an underexplored research field [10], [11]. The education community currently faces a crucial challenge: elucidating the reasons and methodologies behind the effectiveness of games and offering practical guidance

on integrating games into the classroom. Research indicates that teachers often feel underprepared to integrate games into their curriculum [12]. Despite a strong interest in using games for teaching, many teachers report difficulties in systematically integrating games into their teaching practices [13], [14]. For example, there are issues such as a mismatch in the relative importance of enjoyable and educational effects and a lack of integration between gaming and instruction [15]. Furthermore, the effectiveness of game-based learning is often limited by technological constraints and the availability of resources [16]. According to many teachers, the frequent use of these forms of game-based learning makes it challenging to mobilize students' enthusiasm in class, and the real advantages of game-based learning are hardly realized [17], [18]. Consequently, these pedagogical challenges have the potential to significantly impact teachers' enthusiasm and confidence.

Incorporating a game-based learning pedagogy in the classroom presents significant challenges. The intermediary who links game-based learning to the curriculum is the teacher [19]. Teacher perspectives are significant since teachers play an important role in choosing, implementing, and assessing educational games for their students. Teachers' competence in using games for instruction can provide meaningful learning experiences for students [20]. In the digital age, and with the increasing realization of multiculturalism, there is a growing need to focus on the important changes related to educational competencies [21]. It demands a considerable level of expertise and competence from the teacher, whose skills significantly influence the pedagogical approach and the overall efficacy of the teaching and learning process [22]. The unique requirements of game-based learning necessitate that teachers actively enhance their teaching competencies to effectively address these challenges and enhance student learning. Identifying and determining the essential components and elements of these competencies is crucial, serving as a roadmap for cultivating proficient game-based learning instructors. As highlighted, the competencies of teachers in both teaching and learning realms are crucial and indispensable for ensuring effective educational outcomes.

Cultivating qualified teachers is a difficult task due to the complex interaction of factors. These include the teacher's expertise, the complex relationship between theoretical and practical aspects of the teaching process, and potential issues that may arise while instructing a specific topic. To address these challenges, teacher preparation programs need to incorporate game-based learning instructional strategies, helping prospective teachers overcome potential barriers. Core principles for advocating game-based learning in teacher education have been identified, emphasizing that teachers' knowledge of teaching and learning using games is evolving and accumulating over time [19]. It is emphasized that teachers should master effective teaching methods, including guided instruction and assessment procedures based on students' abilities [23].

The shift towards game-based learning requires teachers to possess strong technological instruction and deep content knowledge. Increased technical support and facilitation are essential for effective game-based learning implementation. In brief, teachers must consistently enhance their skills to ensure that students access the most current information and knowledge. This needs analysis study was conducted to identify the necessity of designing and developing a teacher competency model in game-based learning as well as to investigate the practices and challenges faced by teachers in implementing game-based learning, underscoring the importance of continuous professional development to ensure the effectiveness of this innovative pedagogical approach. The analysis of the components of needs analysis is crucial for refining users' feedback and leveraging related theories identified from the literature review [24]. The primary objective of needs analysis is to identify issues or problems within the target population. This process is pivotal in determining the most effective solutions for researchers' concerns. Additionally, the importance of planning before development in guiding subsequent research endeavors is underscored.

2. METHOD

2.1. Participant

This study adopts a quantitative approach, focusing on teachers in Chinese secondary schools as the target population for data collection. The study involves five secondary schools, with a total teacher population of 1,400. Respondents were selected through a purposive sampling method to ensure the selection of participants capable of providing relevant information aligned with the research objectives. Specifically, the researchers targeted secondary school teachers actively implementing game-based learning pedagogy in their classrooms. The determination of an appropriate sample size relied on Krejcie and Morgan's table, which provides guidance based on population range as shown in Table 1 [25]. Given the estimated population size of 1,400 teachers, a sample size of 302 respondents was deemed necessary for the needs analysis study.

Table 1. Sample size for a given population size

Population	Sample size
1,200	291
1,300	297
1,400	302
1,500	306
1,600	310
1,700	313

2.2. Research instrument

In this study, a questionnaire served as the primary instrument for data collection. The development of the questionnaire was informed by the initial literature review analysis and comprised structured and open-ended questions aimed at prompting comprehensive responses from the participants. Structurally, the questionnaire is organized into four main sections:

i) Section A: Gathering demographic information from the respondents.
ii) Section B: Exploring practices related to the implementation of game-based learning.
iii) Section C: Investigating the challenges encountered in implementing game-based learning.
iv) Section D: Investigating the requirements necessary for the development of a competency model.

Before its utilization in the study, the questionnaire underwent a rigorous review and validation process conducted by two quantitative research experts. This process ensured the reliability and validity of the questionnaire, enhancing the quality of the data collected. Furthermore, the initial version of the instrument, originally composed in English, was translated into Chinese since a majority of the respondents were not native English speakers. Subsequently, the instrument underwent a process of back-translation to English. This "back-translation" technique is of paramount significance, as it ensures the accuracy of the responses while mitigating cultural differences that might lead to result misinterpretation [26].

2.3. Data collection

It is important to note that the choice of data collection method can greatly influence the quality of the data obtained. To optimize the data collection process, the researchers took several precautions, including the careful selection of appropriate methods, the identification of the target population, and the determination of the sample size. In the initial stage of the need analysis phase, the researchers distributed 50 quantitative questionnaires to game-based learning teachers. The data obtained from this pilot study were crucial in assessing and ensuring the reliability of the questionnaire. Based on the findings from the pilot study, necessary corrections and adjustments were made, culminating in the finalization of the questionnaire. To guarantee a high response rate, the researchers employed online questionnaires, providing participants with the flexibility to complete them at their convenience. During the actual need analysis survey, a total of 384 respondents completed the questionnaires, representing a diverse range of educational institutions and various demographic backgrounds.

2.4. Data analysis

A crucial step in the research process involves data analysis and critical discussion. The researchers employed Statistical Package for the Social Sciences (SPSS) version 26 software to conduct quantitative data analysis, focusing on the distribution of the data by examining the frequency and percentage of each item within the questionnaire. These statistical measures underscore the necessity of developing a competency model for Chinese secondary school teachers to effectively implement game-based learning.

3. RESULTS AND DISCUSSION

The discussion of the results of the need analysis study aimed at obtaining the initial views of the teachers involved in the implementation of game-based learning and identifying the needs for the development of this competency model.

3.1. Demographic profile

A total of 384 participants completed the demographic instrument. Table 2 provides an overview of the respondents' profiles. Among the participants, 101 (26.3%) were male, and 283 (73.7%) were female. In terms of age, most respondents fell into the age group below 30 years old (N=251, 65.3%), with a significant portion in the 30-39 years old category (N=89, 23.2%). A smaller number of participants were aged between 40 and 49 years old (N=41, 10.7%), while a very small percentage belonged to older age groups (N=3, 0.8%). Given that the retirement age in China is 55 for women and 60 for men, there were no respondents over the age of 60. Regarding the highest academic qualification, the breakdown of respondents was as: 8 (2.0%) held

a diploma, 300 (78.2%) held a bachelor's degree, 72 (18.8%) held a master's degree, and 4 (1.0%) held a doctorate degree. Concerning game-based learning teaching experience, 143 respondents (37.2%) had 3 to 5 years of experience, 116 (30.2%) had more than or equal to six years of experience, 92 (24.0%) had 1 to 2 years of experience, and 33 (8.6%) had less than one year of teaching experience. According to the survey data, games were primarily used in the teaching of subjects such as mathematics, information technology, physics, English, and Chinese; the details are presented in Table 2.

Table 2. The demographic characteristics of respondents

Demographic profile	Category	Frequencies (N=384)	Percentage (%)
Gende	Male	101	26.3
	Female	283	73.7
Age	Below 30 years old (<30)	251	65.3
	30-39	89	23.2
	40-49	41	10.7
	50-59	3	0.8
	Above 60 years old (≥60)	0	0
Highest academic qualification	Diploma	8	2.0
	Bachelor	300	78.2
	Master	72	18.8
	PhD	4	1.0
Game-based learning teaching experience	<1 years	33	8.6
	1-2 years	92	24.0
	3-5 years	143	37.2
	≥6 years	116	30.2
Subject taught	Chinese	35	9.1
	English	46	12.0
	Physics	39	10.2
	Chemistry	20	5.2
	Mathematics	101	26.3
	History	4	1.0
	Geography	9	2.3
	Biology	23	6.0
	Information technology	96	25.0
	Music	7	1.8
	Ethics and Law	3	0.8
	Art	1	0.3

3.2. The practices related to the implementation of game-based learning

When respondents were questioned about their experiences with playing games, the majority of teachers (82%) acknowledged engaging in games during their leisure hours. Interestingly, over half of the respondents (63%) mentioned that they did not play games on a daily basis, spending less than two hours per week on gaming activities. Among the reasons cited for playing games, boredom was the most prevalent, with 73% of teachers indicating that they turned to gaming for this reason. Additionally, a significant portion of teachers (39%) reported playing games for professional purposes, while some also mentioned playing games out of curiosity (22%). In the survey, it was found that while most respondents acknowledged the use of games in teaching, the frequency of their use was not particularly high, with 55.2% indicating infrequent use.

In the analysis of the question, "To what extent do you think game-based learning could be beneficial for teaching?" The researchers observed that the majority of respondents provided a positive response, with favorable and very favorable feedback accounting for 84.9%. This implies that game-based learning is more likely to be embraced by younger teachers, possibly due to their work pressures and willingness to adopt digital technologies [27].

When respondents were asked about the reasons for using game-based learning in teaching (with multiple choices allowed), the following responses were observed: 78.9% (303/384) of the participants expressed that their initiative was a significant driver for using game-based learning. The 65.1% (250/384) of participants cited those games were particularly suitable for achieving their intended learning outcomes. 55.7% (214/384) of participants employed games to facilitate a multifaceted teaching approach. The 31.8% (122/384) of participants reported that games were available within their respective educational institutions. Only 11.2% (43/384) of participants used games because they were part of the curriculum. In summary, it can be stated that in secondary education, the use of games is not systematically integrated but is largely driven by the individual initiatives of teachers [28].

3.3. The challenges encountered in implementing game-based learning

The survey on the difficulties and challenges encountered by teachers in implementing game-based learning revealed several noteworthy findings, and the responses are summarized in Table 3. Among these challenges, technology issues and limited instructional time per lesson emerged as the most prominent obstacles, each affecting 68% of the respondents. These factors were identified as the most significant barriers hindering teachers from effectively using games in the classroom [16], [29]. Following closely, 63.8% of respondents noted the difficulty of finding high-quality games that align with curriculum objectives as a significant challenge. Other challenges highlighted by most respondents included a lack of teacher training (60.9%). The need for more effective classroom management (55.5%). Lack of knowledge in the field of game-based learning (53.9%). Inadequate skills in the field of game-based learning (51.8%).

These findings highlight the complex nature of implementing game-based learning in the curriculum, including the challenges related to game selection, integration, and teacher readiness. Teachers may face difficulties due to a lack of confidence or interest in game-based learning, further emphasizing the need for professional development and technology support [27]. Overall, these results reaffirm the importance of developing a competency model for teachers engaged in game-based learning. The model would address these challenges and enhance the effectiveness of game-based learning in the classroom, ultimately improving educational outcomes and teacher preparedness.

Table 3. The challenges of implementing game-based learning in the classroom (Multiple selections per respondent)

The challenges of implementing game-based learning in the classroom	Frequencies (N=384)	Percentage (%)
Limited instructional time	261	68.0
Games lack curriculum fit	245	63.8
Lack supporting materials	169	44.0
Technology issues	261	68.0
Students' lack of content knowledge	159	41.4
Students' lack of game playing skills	101	26.3
Requires more classroom management	213	55.5
Lack of teacher training	234	60.9
Lack of infrastructure	113	29.4
Lack of policy and reference framework	178	46.4
Lack of financial support	69	18.0
Lack of knowledge in the field of game-based learning	207	53.9
Lack of skills in the field of game-based learning	199	51.8
No self-confidence in teaching activities	189	49.2
Lack of interest in the field of game-based learning	154	40.1

3.4. The requirements necessary for the development of a competency model

The needs analysis regarding the training received by teachers indicates some significant findings. Many respondents, 335 (87.2%), reported that their training can be categorized under the theme of "Learning by doing." This suggests that many teachers acquire their knowledge of game-based learning through practical experience rather than structured training. Overall, the data shows that a relatively low percentage of teachers have received formal training specifically related to game-based learning. This finding aligns with the high percentage of teachers who identified "Lack of teacher training" as one of the key challenges they encounter when implementing game-based learning. It emphasizes the need for more structured and comprehensive training opportunities for teachers in this field [28].

Furthermore, a total of 376 respondents (97.9%) expressed a clear need for a competency model to enhance the competencies required by teachers in the field of game-based learning. This response underscores the demand for structured guidance and support in this area. In terms of self-assessment, the needs analysis of 384 teachers revealed that 311 respondents (81%) rated their competence in the field of game-based learning as negative (poor and fair), indicating space for improvement. Only 73 respondents (19%) considered their competence level in this field to be good and above.

Moreover, respondents unanimously agreed on the importance of knowing their level of competence, with a 100% positive response (rating it as important and very important). These findings strongly reinforce the significance of developing a competency model for teachers implementing game-based learning. They highlight the perceived need for improved competencies in this domain and emphasize the importance of a structured framework to guide teachers in enhancing their skills and knowledge in game-based learning [30].

A need analysis is a crucial step in understanding and addressing the challenges and requirements of teachers implementing game-based learning game-based learning pedagogy [31]. This study exemplifies the significance of conducting such an analysis to gain insights into the specific needs and difficulties faced by

teachers in this domain. The needs analysis conducted in this study has highlighted several important points. Firstly, teachers identified several significant challenges hindering the adoption of game-based learning. The most significant barriers included technology issues and limited instructional time [16], [29]. Additionally, concerns about the game's lack of curriculum fit, the lack of formal teacher training in game-based learning, and the need for improved classroom management were notable challenges [32], [33]. The needs analysis reveals that while teachers see the value of game-based learning, they face various obstacles in its effective implementation [15]. Understanding these challenges is essential for providing effective support. The identification of these pedagogical challenges underscores the necessity of a comprehensive approach to addressing the specific needs of game-based learning teachers.

Secondly, the study emphasizes the critical role of a competency model for game-based learning teachers. The model can serve as a framework for guiding teachers in identifying the essential competencies they need to possess and master for successful game-based learning implementation. This competency model is pivotal in ensuring that teachers are well-equipped to integrate game-based learning into their teaching practices effectively. The model can help teachers enhance their competencies and address the challenges they encounter, ultimately improving the integration of game-based learning into their pedagogy. The results of the needs analysis study provide valuable insights into the requirements for developing a competency model for teachers engaged in game-based learning. The majority of teachers showed a positive attitude towards the use of games in education, which is consistent with previous research [9]. They acknowledged that games are valuable educational tools that can occasionally yield various benefits, ultimately leading to improved learning outcomes for students [3]. Despite their positive outlook, a relatively small number of teachers reported regularly incorporating games into their classroom teaching. This indicates a gap between teachers' perceptions of the value of game-based learning and their actual implementation practices.

Moreover, a competency model can help in assessing and measuring teachers' current levels of competency in game-based learning. This assessment can be instrumental in identifying areas where teachers may need additional training or support. By providing a structured framework for evaluating and enhancing teacher competencies, the model can facilitate targeted professional development and continuous improvement in game-based learning pedagogy [27].

Based on the findings from the needs analysis survey of game-based learning teachers, several key implications can be drawn. Teacher training programs should be redesigned to offer more comprehensive opportunities for teachers to learn and critically analyze instructional strategies that utilize games [34]. This includes not only the technical aspects of game technology but also pedagogical strategies for effective game-based teaching. Teachers require a diverse range of competencies to be adequately prepared for the integration of games into educational contexts. These competencies should encompass both technical skills related to game technology and pedagogical skills to maximize the educational benefits of games [27]. It is crucial to equip future educators with the knowledge and skills necessary to identify and implement the most effective strategies for integrating game-based learning into various curricula [34]. This preparation should be an integral part of teacher education programs. The study emphasizes the importance of ongoing professional development opportunities for teachers to continually acquire and refine their knowledge and skills in game-based learning. Such opportunities should be made readily available throughout teachers' careers.

The practical contribution of this research provides actionable insights for educators and policymakers by integrating the specific context of game-based learning. These insights inform the development of targeted professional development programs and training models aimed at enhancing teacher readiness and effectiveness in implementing game-based learning. Consequently, this research contributes to a deeper understanding of the competencies required in modern educational settings [34].

In summary, the implications and contributions of this research underscore the importance of a strategic approach in developing teacher competencies for game-based learning. By focusing on comprehensive training, continuous professional development, and the establishment of a competency model, teachers can be better prepared to leverage game-based learning. This preparation ultimately improves educational outcomes and creates dynamic learning experiences for students. The overall results of the needs analysis emphasize the critical need to develop a competency model tailored to game-based learning teachers. These competencies are closely tied to the quality of teaching and impact the learning outcomes of students. Equipping teachers with the necessary knowledge and skills enhances the educational experience and outcomes for students in the context of game-based learning [28]. Through proper training, educators can effectively integrate game-based learning into their teaching strategies, creating more engaging and interactive learning environments. The development and implementation of a structured competency model will not only address the current challenges faced by teachers but also foster a more effective and engaging learning environment for students.

4. CONCLUSION

In conclusion, the results of this needs analysis underscore the critical necessity for a competency model tailored for teachers implementing game-based learning in Chinese secondary schools. The findings reveal that teachers face numerous challenges, such as technological issues, curriculum alignment, and the need for adequate training. The majority of teachers currently acquire their knowledge through practical experience rather than structured training, and there is a clear demand for more formalized training opportunities. The response to a competency model and the significant self-assessment indicating room for improvement highlight the urgency of providing teachers with structured guidance and support. By addressing these needs, the development of a competency model can enhance the effectiveness of game-based learning.

The implications of this research are significant for future efforts in teacher development and education policy. The identified need for a competency model suggests that educators require a structured framework to help them acquire the skills and knowledge necessary for game-based learning. This study lays the groundwork for designing such a model, which could serve as a valuable tool for guiding teacher training and professional development. The next step of this research is to design and develop a comprehensive competency model. This model will outline the specific knowledge, skills, and abilities that teachers need to effectively implement game-based learning in their classrooms. By clearly defining these competencies, the model will serve as a framework for teacher training programs, ensuring that educators are well-prepared to use game-based learning techniques.

REFERENCES

[1] R. Pinedo, N. García-Martín, D. Rascón, C. Caballero-San José, and M. Cañas, "Reasoning and learning with board game-based learning: A case study," *Current Psychology*, vol. 41, no. 3, pp. 1603–1617, Mar. 2022, doi: 10.1007/s12144-021-01744-1.

[2] R. W. Mee Mee *et al*., "Role of gamification in classroom teaching: Pre-service teachers' view," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 9, no. 3, pp. 684–690, Sep. 2020, doi: 10.11591/ijere.v9i3.20622.

[3] S. Sundaram and R. Ramesh, "Effectiveness of joyful game-based blended learning method in learning chemistry during COVID-19," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 11, no. 4, pp. 2140–2146, Dec. 2022, doi: 10.11591/ijere.v11i4.22427.

[4] D. Chytas, M. Piagkou, and K. Natsis, "Outcomes of the implementation of game-based anatomy teaching approaches: An overview," *Morphologie*, vol. 106, no. 352, pp. 8–14, Feb. 2022, doi: 10.1016/j.morpho.2021.02.001.

[5] L. Deng, S. Wu, Y. Chen, and Z. Peng, "Digital game-based learning in a Shanghai primary-school mathematics class: A case study," *Journal of Computer Assisted Learning*, vol. 36, no. 5, pp. 709–717, Oct. 2020, doi: 10.1111/jcal.12438.

[6] L. López-Faican and J. Jaen, "EmoFindAR: Evaluation of a mobile multiplayer augmented reality game for primary school children," *Computers and Education*, vol. 149, p. 103814, May 2020, doi: 10.1016/j.compedu.2020.103814.

[7] P. Kaimara and I. Deliyannis, "Why should i play this game? The role of motivation in smart pedagogy," in *Didactics of Smart Pedagogy: Smart Pedagogy for Technology Enhanced Learning*, Cham: Springer International Publishing, 2018, pp. 113–137. doi: 10.1007/978-3-030-01551-0_6.

[8] E. Danniels and A. Pyle, "Promoting inclusion in play for students with developmental disabilities: kindergarten teachers' perspectives," *International Journal of Inclusive Education*, vol. 28, no. 5, pp. 457–474, Apr. 2024, doi: 10.1080/13603116.2021.1941316.

[9] A. Alam, "A digital game based learning approach for effective curriculum transaction for teaching-learning of artificial intelligence and machine learning," in *International Conference on Sustainable Computing and Data Communication Systems, ICSCDS 2022 - Proceedings*, IEEE, Apr. 2022, pp. 69–74. doi: 10.1109/ICSCDS53736.2022.9760932.

[10] C. Girard, J. Ecalle, and A. Magnan, "Serious games as new educational tools: How effective are they? A meta-analysis of recent studies," *Journal of Computer Assisted Learning*, vol. 29, no. 3, pp. 207–219, Jun. 2013, doi: 10.1111/j.1365-2729.2012.00489.x.

[11] D. Zou, Y. Huang, and H. Xie, "Digital game-based vocabulary learning: where are we and where are we going?" *Computer Assisted Language Learning*, vol. 34, no. 5–6, pp. 751–777, Jul. 2021, doi: 10.1080/09588221.2019.1640745.

[12] A. Sánchez-Mena, J. Martí-Parreño, and J. Aldás-Manzano, "Teachers' intention to use educational video games: The moderating role of gender and age," *Innovations in Education and Teaching International*, vol. 56, no. 3, pp. 318–329, May 2019, doi: 10.1080/14703297.2018.1433547.

[13] P. Mertala, "Digital technologies in early childhood education–a frame analysis of preservice teachers' perceptions," *Early Child Development and Care*, vol. 189, no. 8, pp. 1228–1241, Jul. 2019, doi: 10.1080/03004430.2017.1372756.

[14] K. Mutch-Jones, D. C. Boulden, S. Gasca, T. Lord, E. Wiebe, and F. Reichsman, "Co-teaching with an immersive digital game: supporting teacher-game instructional partnerships," *Educational Technology Research and Development*, vol. 69, no. 3, pp. 1453–1475, Jun. 2021, doi: 10.1007/s11423-021-10000-z.

[15] L. Pan *et al*., "How to implement game-based learning in a smart classroom? A model based on a systematic literature review and Delphi method," *Frontiers in Psychology*, vol. 12, Dec. 2021, doi: 10.3389/fpsyg.2021.749837.

[16] D. H. Shin and K. mi Chung, "The effects of input modality and story-based knowledge on users' game experience," *Computers in Human Behavior*, vol. 68, pp. 180–189, Mar. 2017, doi: 10.1016/j.chb.2016.11.030.

[17] M. Ranieri, J. E. Raffaghelli, and I. Bruni, "Game-based student response system: Revisiting its potentials and criticalities in large-size classes," *Active Learning in Higher Education*, vol. 22, no. 2, pp. 129–142, Jul. 2021, doi: 10.1177/1469787418812667.

[18] W. Watson and S. Yang, "Games in schools: Teachers' perceptions of barriers to game-based learning," *Journal of Interactive Learning Research*, vol. 27, no. 2, pp. 153–170, 2016, [Online]. Available: https://www.learntechlib.org/p/151749/

[19] A. Foster and M. Shah, "Principles for advancing game-based learning in teacher education," *Journal of Digital Learning in Teacher Education*, vol. 36, no. 2, pp. 84–95, Apr. 2020, doi: 10.1080/21532974.2019.1695553.

[20] A. Otterborn, K. Schönborn, and M. Hultén, "Surveying preschool teachers' use of digital tablets: general and technology education related findings," *International Journal of Technology and Design Education*, vol. 29, no. 4, pp. 717–737, Sep. 2019, doi: 10.1007/s10798-018-9469-9.

[21] I. Tabroni, A. Irpani, D. Ahmadiah, A. A. R., G. Sulaiman, and Ichsan, "Implementation and strengthening of the schools pasca the COVID-19 Pandemic," *Multicultural Education*, vol. 8, no. 1, pp. 16–31, 2021.
[22] N. Azizah, Mumpuniarti, S. Rudiyati, and D. Evans, "Elementary teachers' pedagogical competencies in supporting students with learning difficulties," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 13, no. 2, pp. 723–730, Apr. 2024, doi: 10.11591/ijere.v13i2.26345.
[23] S. Dhawan, "Online Learning: a panacea in the time of COVID-19 crisis," *Journal of Educational Technology Systems*, vol. 49, no. 1, pp. 5–22, Sep. 2020, doi: 10.1177/0047239520934018.
[24] F. Fahmi, B. W. Pratolo, and A. Abbas, "The core aspects of teacher's book content: an analysis on teacher's needs," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 11, no. 3, pp. 1575–1584, Sep. 2022, doi: 10.11591/ijere.v11i3.22370.
[25] R. V. Krejcie and D. W. Morgan, "Determining sample size for research activities," *Educational and Psychological Measurement*, vol. 30, no. 3, pp. 607–610, Sep. 1970, doi: 10.1177/001316447003000308.
[26] L. Frazer and M. Lawley, *Questionnaire design & administration: a practical guide*. New York: John Wiley & Sons, Inc, 2000.
[27] S. Chen, S. Zhang, G. Y. Qi, and J. Yang, "Games literacy for teacher education: towards the implementation of game-based learning," *Educational Technology and Society*, vol. 23, no. 2, pp. 77–92, 2020.
[28] J. B. Hauge *et al.*, "Current competencies of game facilitators and their potential optimization in higher education: multimethod study," *JMIR Serious Games*, vol. 9, no. 2, p. e25481, May 2021, doi: 10.2196/25481.
[29] H. Hu and R. A. Sperling, "Pre-service teachers' perceptions of adopting digital games in education: a mixed methods investigation," *Teaching and Teacher Education*, vol. 120, p. 103876, Dec. 2022, doi: 10.1016/j.tate.2022.103876.
[30] Y. Allsop and J. Jesse, "Teachers' experience and reflections on game-based learning in the primary classroom: views from England and Italy," *International Journal of Game-Based Learning*, vol. 5, no. 1, pp. 1–17, Jan. 2015, doi: 10.4018/ijgbl.2015010101.
[31] R. Reviere, S. Berkowitz, C. C. Carter, and C. Ferguson, *Needs assessment: a creative and practical guide for social scientists*. Washington D. C.: Taylor & Francis, 1996.
[32] P. Kaimara, E. Fokides, A. Oikonomou, and I. Deliyannis, "Potential barriers to the implementation of digital game-based learning in the classroom: pre-service teachers' views," *Technology, Knowledge and Learning*, vol. 26, no. 4, pp. 825–844, Dec. 2021, doi: 10.1007/s10758-021-09512-7.
[33] M. Hayak and O. Avidov-Ungar, "The integration of digital game-based learning into the instruction: Teachers' perceptions at different career stages," *TechTrends*, vol. 64, no. 6, pp. 887–898, Nov. 2020, doi: 10.1007/s11528-020-00503-6.
[34] T. Nousiainen, M. Kangas, J. Rikala, and M. Vesisenaho, "Teacher competencies in game-based pedagogy," *Teaching and Teacher Education*, vol. 74, pp. 85–97, Aug. 2018, doi: 10.1016/j.tate.2018.04.012.

BIOGRAPHIES OF AUTHORS

Jiang Jinchuan is a Ph.D. Candidate, School of Educational Studies, Universiti Sains Malaysia, Pulau Pinang, Malaysia. She holds a bachelor's degree in computer science & technology and a master's degree in computer technology. She is currently pursuing her doctoral studies in educational technology at Universiti Sains Malaysia (USM). Her research interests focus on educational technology and game-based learning. She can be contacted at email: jinchuan@student.usm.my.

Azidah Abu Ziden is an expert in educational technology with a special focus on learning management systems, instructional design, and Web 2.0. She currently serves as an Associate Professor at Universiti Sains Malaysia (USM). Also, she holds a bachelor's degree in graphics design and multimedia from Lancashire University, United Kingdom (UK), a master's degree in educational technology from Universiti Teknologi Malaysia (UTM), and a Ph.D. degree in Higher Education (instructional design) from University of Canterbury, New Zealand. She can be contacted at email: azidah@usm.my.