Ceddi Journal of Education
Vol. 4 No. 2 December (2025)
https://doi.org/10.56134/cje.v4i2.151

ISSN:2830-0017(print)
ISSN:2830-0025(online)

Design and Evaluation of a Gamification-Based Mobile Application for Mandarin Vocabulary Learning for Beginners

Akbar Iskandar[1*], Riska Kherani[2], Muhammad Akbar Azis[3], Yutaka Matsuo[4]

[1]*Information Technology Education, Universitas Teknologi Akba Makassar, Makassar, Indonesia*
[2,3]*Informatics Engineering, Universitas Teknologi Akba Makassar, Makassar, Indonesia*
[4]*Department of Computer Science, University of Tokyo, Tokyo, Japan*

Abstract

Vocabulary learning is the main foundation in mastering foreign languages, including Mandarin, which has a high level of complexity in terms of hanzi, pinyin, and lexical meaning. In Indonesia, the need for Mandarin mastery continues to increase along with the development of economic and academic cooperation with China. However, the process of learning Mandarin vocabulary for beginners is still dominated by conventional approaches that are less adaptive to the characteristics of digital-era learners. The contribution of this research lies in the design of a mobile application that integrates hanzi exercises, flashcard games, and a digital dictionary into a structured gamification mechanism based on levels, scores, and time limits for HSK 1–4 vocabulary learning. This study uses a quantitative descriptive method with a software engineering approach. Evaluation was conducted through direct trials with eight beginner learners using a five-point Likert scale questionnaire instrument. Data analysis was carried out using descriptive statistics and instrument reliability testing. The results showed an overall average score of 4.36 with a Cronbach's Alpha value of 0.87, indicating high reliability. These findings indicate that the application has good levels of usability, engagement, and user acceptance, and demonstrates the potential to support learning motivation and the effectiveness of mobile-based Mandarin vocabulary learning at the beginner level.

Keywords: Mobile Learning; Gamification; Mandarin language; Vocabulary; Educational Applications.

Received: 5 June 2025 Revised: 12 October 2025 Accepted: 15 December 2025

Introduction

Mandarin is the most widely spoken language in the world and plays a strategic role in global communication, particularly in economics, education, and international diplomacy. Over the past two decades, Mandarin's position as an international language has strengthened as China's economic and geopolitical influence has grown (Chen, 2020; Erbaugh, 2022; Gil, 2021). This situation has a direct impact on the increasing demand for Mandarin language proficiency in various countries, including Indonesia. In Indonesia, the increasing need for Mandarin language proficiency is inseparable from the intensification of Indonesia's bilateral relations with China in the industrial, trade, and education sectors (Hidayadi et al., 2025; Oratmangun, 2022; Setijadi, 2016).

At the local level, these needs are contextual and real. In Morowali Regency, Central Sulawesi, interactions between local and Chinese foreign workers in the mining sector require basic Mandarin communication skills as a daily tool (Camba et al., 2020; Kadir & Suaib, 2020; Rahman et al., 2024). Meanwhile, in Makassar City, the interest of students to participate in scholarship programs and academic exchanges to China continues to increase, with the HSK (Hànyǔ Shuǐpíng Kǎoshì) exam as the main prerequisite (Darmanto et al., 2021; Junaeny, 2024). Despite this significant increase in demand, Mandarin Chinese learning approaches in Indonesia are still dominated by conventional methods, such as the use of textbooks, vocabulary memorization, and static written exercises. This approach is less aligned with the characteristics of digital generation learners who are accustomed to visual interaction, instant feedback, and the flexibility of technology-based learning. As a result, the process of learning Mandarin Chinese vocabulary, especially in the early stages, is often perceived as difficult, boring, and demotivating (Lê Ngọc et al., 2021; Mustarih et al., 2025; Ying et al., 2020; Ying, Rosalin, et al., 2021).

*Corresponding author.
E-mail address: akbar.iskandar@gmail.com (Akbar Iskandar)

(Nation & Nation, 2001) emphasizes that vocabulary mastery plays a fundamental role in foreign language learning because it forms the foundation for the four language skills: listening, speaking, reading, and writing. In the context of Mandarin, the challenge of vocabulary mastery becomes even more complex because learners must simultaneously understand the relationship between the visual form of Chinese characters, the phonological representation of pinyin, and lexical meaning. This complexity often creates a high cognitive load for beginning learners, especially when the learning strategies used are not able to facilitate the processes of repetition, association, and memory reinforcement effectively. Without adequate vocabulary mastery, learners will experience significant obstacles in understanding and using the language functionally (Huang & Chiu, 2015). Therefore, effective, contextual, and adaptive vocabulary learning strategies are an urgent need in Mandarin language education, especially in the early stages of learning.

The development of mobile technology opens up new opportunities in designing more flexible and personalized learning experiences (John, 2025; Spaho et al., 2025). Mobile learning allows learners to access materials anytime and anywhere and supports continuous, independent learning at their own pace. However, the mere presence of technology does not automatically guarantee effective learning. A pedagogical approach is needed that optimizes user interaction, increases cognitive engagement, and maintains long-term learning motivation. One approach widely studied in the literature on technology-based education is gamification (Aguiar-Castillo et al., 2021; Christopoulos & Mystakidis, 2023; Mohamad et al., 2018; Saleem et al., 2022). Gamification is defined as the application of game elements in non-game contexts with the aim of increasing user engagement, motivation and experience (Deterding et al., 2011; Prasad, 2021; Rivera & Garden, 2021)(Mayrhofer et al., 2025). In the context of language learning, gamification has been proven to encourage active engagement (Dahri et al., 2025), strengthen vocabulary retention, and increase interest in learning through challenge mechanisms, direct feedback, and reward systems (Cheng et al., 2025; Mun et al., 2022)(Chandra & Deli, 2023; Heryadi & Muliamin, 2016).

However, most Mandarin learning apps currently available still focus on a global context and have not fully considered the local needs of Indonesian learners, particularly at the basic HSK 1–4 levels. Furthermore, the integration of gamification elements in existing apps is often partial and has not been systematically designed to align with vocabulary learning objectives. Based on these gaps, this study aims to design and evaluate a contextually designed gamification-based Mandarin vocabulary learning mobile app and evaluate it through a quantitative approach. The contribution of this study lies in the development of an app that systematically integrates hanzi exercises, flashcard games, and a digital dictionary into a structured gamification mechanism for HSK 1–4 levels, with a focus on the beginner user experience as a basis for developing more adaptive and relevant mobile-based Mandarin learning.

Method

This study used a quantitative descriptive approach with a software engineering framework (software design and evaluation study) that focused on the design and initial evaluation of a gamification-based Mandarin vocabulary learning mobile application. This approach was chosen because the research objective was not directed at testing causal relationships, but rather to assess the level of usability, engagement, and user acceptance of the application developed at the prototype stage. The study was conducted in Makassar City involving beginner Mandarin learners as target users, considering their characteristics relevant to the learning objectives of the basic level of HSK 1–4.

The research subjects consisted of eight beginner Mandarin Chinese learners who had attended non-formal courses and had never taken the HSK exam. The limited number of respondents was deemed adequate for formative evaluation in the early stages of application development, as is common in technology-based learning system development research. All respondents were asked to use the application in a single self-study session that included vocabulary exploration, Chinese character reading practice, flashcard games, and the use of a digital dictionary. Data collection was conducted through a combination of observation, literature review, and user testing. Initial observations were conducted on several existing Mandarin Chinese learning applications, such as Duolingo and ChineseSkill, to identify feature characteristics, user interaction patterns, and remaining limitations. The literature review was used to establish a conceptual foundation related to vocabulary learning, mobile learning, and gamification. Furthermore, the primary research data was obtained through user testing, which generated quantitative data regarding user perceptions and experiences during application use.

The evaluation instrument used was a five-point Likert-scale questionnaire, with a value range of 1 (strongly disagree) to 5 (strongly agree). This questionnaire covered five main indicators: user interface appearance, ease of navigation, vocabulary completeness, exercise design and gamification elements, and digital dictionary features. These indicators were developed based on the principles of usability and user experience in mobile-based learning applications, and were evaluated conceptually to ensure their suitability with the learning objectives and the characteristics of novice users. Data obtained from the questionnaire were analyzed using descriptive statistics to determine the average value and standard deviation for each aspect assessed. In addition, an internal reliability test was conducted using Cronbach's Alpha to assess the consistency of the evaluation instrument. Inferential analysis was not used in this study due to the limited sample size, so the analysis results focused on mapping user perception tendencies and initial evaluation of the quality of the developed application.

Figure 1 shows the use case diagram depicting user interaction with a gamification-based Mandarin learning application system. The application prototype was designed with user interface (UI) and user experience (UX) principles in mind. Testing was conducted with real users to obtain initial feedback before further development. This step is expected to ensure the developed application not only meets user expectations but also makes a positive contribution to Mandarin learning for the research subjects.

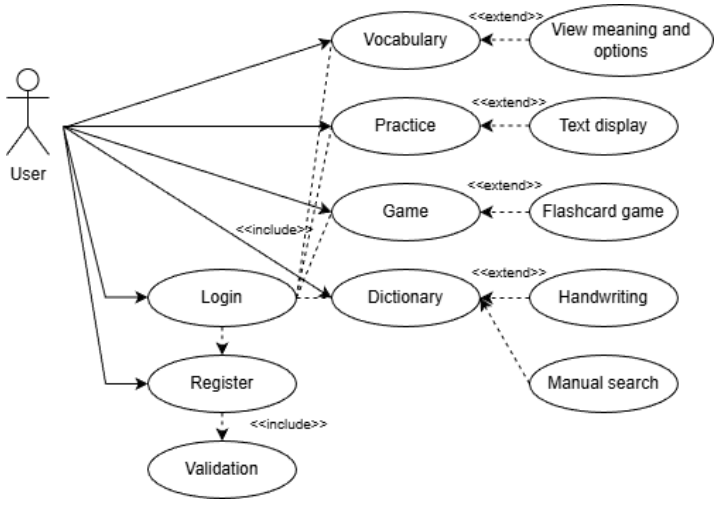

Figure 1. Use case diagram

The evaluation in this study focused on the usability and user experience aspects, so that the results obtained represent user perceptions of the quality of the application, not direct measurements of improvements in learning outcomes.

Results and Discussion

Result

This section presents the results of a quantitative evaluation of a gamification-based Mandarin vocabulary learning mobile application. The evaluation was conducted through a user trial involving eight beginner learners, focusing on perceptions of the interface, navigation, vocabulary comprehensiveness, gamification-based exercise design, and digital dictionary features. A summary of the application's trial characteristics is presented in Table 1, while the results of quantitative user assessments of each evaluation aspect are shown in Table 2.

Table 1. Evaluation with application trial

Evaluation	Information
Types of trials	Direct user testing
Number of respondents	8 students from one of the course locations in Makassar
Aspects tested	UI View Menu Navigation

Evaluation	Information
	Completeness of vocabulary data
	Training design satisfaction
	Written Dictionary Features
Evaluation methods	Likert scale questionnaire and usage observation

Table 1 shows that the evaluation method was conducted through direct user testing involving eight respondents from Mandarin language courses in Makassar. Aspects tested included user interface appearance, menu navigation, vocabulary completeness, satisfaction with the exercise design, and digital dictionary functionality.

Table 2. Application trial results

Rated aspect	Average Score (1–5)	Information
UI View	4.6	Liked for its bright colors
Menu Navigation	4.2	Easy to use
Completeness of vocabulary data	3.8	Need to add vocabulary
Training design satisfaction	4.5	Can't wait to try the app out first hand
Written Dictionary Features	4.7	Unique and very helpful

The quantitative test results presented in Table 2 show that all evaluation aspects obtained an average score above the midpoint of the Likert scale (3.0). The interface display obtained an average score of 4.6, indicating that the application's visual design was considered attractive and comfortable to use. Menu navigation obtained a score of 4.2, indicating that the menu structure was considered easy to understand by users. The vocabulary completeness aspect obtained a relatively lower score of 3.8, indicating that although the content was considered adequate, users still expected vocabulary additions. The gamification-based exercise design obtained a score of 4.5, while the digital dictionary feature obtained the highest score of 4.7, indicating that this feature was considered very helpful in the vocabulary learning process. Meanwhile, Figures 2 and 3 generally display the interactive interface in the application.

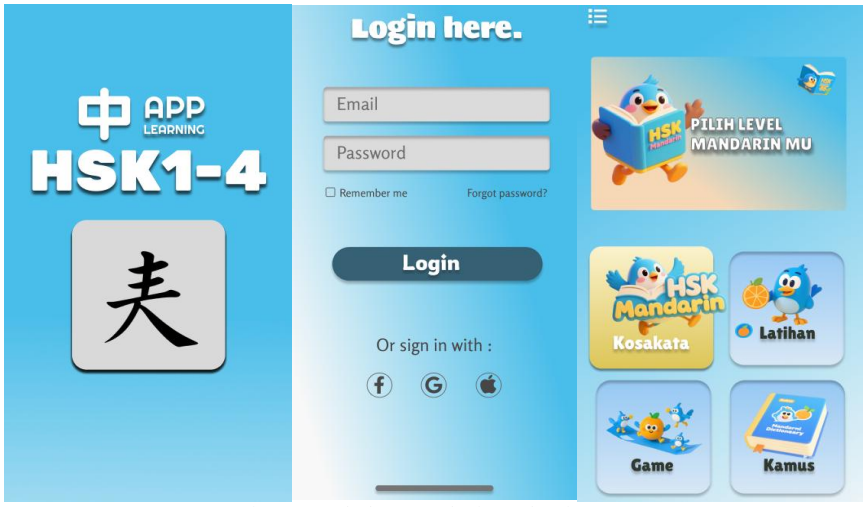

Figure 2. Splash screen, login, and main page

Figure 2 shows the initial flow of the app, starting from the splash screen and moving to the authentication page. After logging in, users are directed to the main homepage, which contains vocabulary modules, exercises, games, and a digital dictionary. Figure 3 shows the HSK level selection screen and a vocabulary pop-up that provides Chinese characters, pinyin, and meanings for instant feedback.

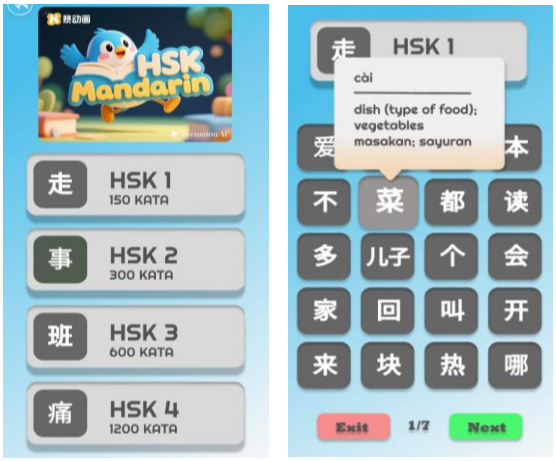

Figure 3. Select level page and artikata pop-up

The application's strengths are evident in elements such as effective gamification in engaging users and the dictionary's flexibility, which accepts various input methods, including handwriting and pinyin. However, the study also identified several shortcomings, including the lack of an audio pronunciation feature that could enhance learners' pronunciation comprehension, limited practice materials, and the lack of a learning progress tracking system that could help users monitor their progress. Overall, however, the aggregate mean score of 4.36 and Cronbach's Alpha reliability score of 0.87 indicate that the evaluation instrument and application developed have a high level of consistency and user acceptance.

Discussion

The results of the study indicate that the gamification-based Mandarin vocabulary learning mobile application has a high level of user acceptance, particularly in terms of interface display, exercise design, and digital dictionary features. The high average scores for interface and navigation aspects indicate that the applied UI/UX design principles are able to support ease of use, which is an important factor in mobile-based learning. Ease of navigation allows novice users to focus on the learning material without being distracted by the application's technical complexity. This finding is in line with previous research which states that gamification-based learning applications tend to increase user engagement through intuitive and user-oriented learning experiences (Fedro, 2021; Huang & Chiu, 2015). High scores on gamification-based training designs indicate that game elements, such as challenges, scoring, and immediate feedback, play a role in encouraging users to actively interact with the learning material.

The digital dictionary feature that received the highest score indicates that the flexibility of vocabulary search through Chinese characters and Pinyin is a key need for beginning learners, especially in the context of Mandarin, which has a non-alphabetical writing system. Quick access to vocabulary allows users to simultaneously associate the visual form of Chinese characters with pronunciation and meaning, thus supporting the memory strengthening process. This finding is consistent with research findings (Ying, Susilo, et al., 2021). Which emphasizes the importance of interactive dictionary support in Mandarin vocabulary learning. Conversely, the relatively lower vocabulary completeness scores indicate that content limitations remain a major challenge and indicate the need for gradual material enrichment according to HSK levels. Overall, these findings confirm that a gamification approach to Mandarin vocabulary learning contributes to a more engaging learning experience and supports user engagement.

From an educational app development perspective, the results of this study indicate that a balance between interface design, gamification mechanisms, and content depth is a key factor in the success of mobile-based learning apps. Although this study did not directly measure improvements in learning outcomes, positive user responses to the gamification elements and exercise design suggest potential for increased learning motivation. Therefore, this app can be viewed as a relevant vocabulary learning support tool for beginner learners in the context of technology-based Mandarin language learning.

Conclusions and Suggestions

Conclusions

The conclusion of this study indicates that a gamification-based Mandarin vocabulary learning mobile application has good usability and user acceptance, especially among beginner learners at HSK 1–4 levels. The results of the user perception-based evaluation indicate that the attractive interface design, intuitive navigation, and interactive features such as game-based exercises and a digital dictionary can support a positive learning experience. Although this study did not directly measure improvements in learning outcomes, the findings indicate that the gamification approach has the potential to support engagement and motivation in mobile-based Mandarin vocabulary learning. Thus, the developed application can be seen as a learning support medium that is relevant and adaptive to the characteristics of learners in the digital era.

Suggestions

Future research could consider developing audio pronunciation features for each vocabulary word to support users' understanding of Mandarin phonological aspects. Furthermore, expanding vocabulary content and diversifying game-based exercises, including those that accommodate Mandarin cultural contexts, could potentially enhance the depth and relevance of learning. Future research is also recommended to integrate a learning progress tracking system that allows users to continuously monitor their progress and more comprehensively evaluate the impact of such features on users' motivation and learning experience.

References

Aguiar-Castillo, L., Clavijo-Rodriguez, A., Hernández-López, L., De Saa-Pérez, P., & Pérez-Jiménez, R. (2021). Gamification and deep learning approaches in higher education. *Journal of Hospitality, Leisure, Sport \& Tourism Education*, *29*, 100290.

Camba, A., Tritto, A., & Silaban, M. (2020). From the postwar era to intensified Chinese intervention: Variegated extractive regimes in the Philippines and Indonesia. *The Extractive Industries and Society*, *7*(3), 1054–1065. https://doi.org/https://doi.org/10.1016/j.exis.2020.07.008

Chandra, T., & Deli, D. (2023). Education gamification and student motivation: A case study of Chinese language education. *IJIE (Indonesian Journal of Informatics Education)*, *7*(2), 85–95. https://doi.org/https://doi.org/10.20961/ijie.v7i2.80108

Chen, C.-Y. (2020). *The acquisition of Mandarin by heritage speakers and second language learners*. https://doi.org/https://doi.org/10.1075/lald.63.12che

Cheng, J., Lu, C., & Xiao, Q. (2025). Effects of gamification on EFL learning: a quasi-experimental study of reading proficiency and language enjoyment among Chinese undergraduates. *Frontiers in Psychology*, *16*, 1448916. https://doi.org/https://doi.org/10.3389/fpsyg.2025.1448916

Christopoulos, A., & Mystakidis, S. (2023). Gamification in education. *Encyclopedia*, *3*(4), 1223–1243. https://doi.org/https://doi.org/10.3390/encyclopedia3040089

Dahri, N. A., Yahaya, N., Al-Rahmi, W. M., Almuqren, L., Almgren, A. S., Alshimai, A., & Al-Adwan, A. S. (2025). The Effect of AI Gamification on Students' Engagement and Academic Achievement: SEM Analysis Perspectives. *IEEE Access*. https://doi.org/10.1109/ACCESS.2025.3560567

Darmanto, Y. H., Hermawan, B., & Sulistyowati, E. (2021). Study and Application of HSK Exam Simulation Media. *STRUKTURAL 2020: Proceedings of the 2nd International Seminar on Translation Studies, Applied Linguistics, Literature and Cultural Studies, STRUKTURAL 2020, 30 December 2020, Semarang, Indonesia*, 94. https://doi.org/https://doi.org/10.4108/eai.30-12-2020.2311281

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness: defining" gamification". *Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments*, 9–15. https://doi.org/https://doi.org/10.1145/2181037.2181040

Erbaugh, M. S. (2022). The acquisition of Mandarin. In *The crosslinguistic study of language acquisition* (pp. 373–455). Psychology Press. https://doi.org/https://doi.org/10.4324/9781315808208-9

Fedro, W. I. (2021). Mandarin language learning with gamification method. *International Journal*, *10*(5). https://doi.org/https://doi.org/10.30534/ijatcse/2021/171052021

Gil, J. (2021). *Rise of Chinese as a Global Language*. Springer. https://doi.org/https://doi.org/10.1007/978-3-030-76171-4

Heryadi, Y., & Muliamin, K. (2016). Gamification of M-learning Mandarin as second language. *2016 1st International Conference on Game, Game Art, and Gamification (ICGGAG)*, 1–4. https://doi.org/https://doi.org/10.1109/ICGGAG.2016.8052645

Hidayadi, T., Zuhdi, M. L., & Yasin, H. R. (2025). Economic and strategic policies in indonesia-china cooperation: advancing foreign language education as a tool for cultural and economic diplomacy. *Jurnal Konseling Dan Pendidikan*, *13*(1), 582–592. https://doi.org/https://doi.org/10.29210/1147300

Huang, Y.-M., & Chiu, P.-S. (2015). The effectiveness of a meaningful learning-based evaluation model for context-aware mobile learning. *British Journal of Educational Technology*, *46*(2), 437–447. https://doi.org/https://doi.org/10.1111/bjet.12147

John, A. (2025). Revolutionizing STEAM education: Harnessing the power of AI and digital technology to deliver personalized learning experiences. In *Integrating Personalized Learning Methods Into STEAM Education* (pp. 143–168). IGI Global Scientific Publishing. https://doi.org/10.4018/979-8-3693-7718-5.ch007

Junaeny, A. (2024). HSK Test Anxiety Of Chinese Language Learners In University Students. *Jurnal Cakrawala Mandarin*, *8*(2), 9–18. https://doi.org/https://doi.org/10.36279/apsmi.v8i2.311

Kadir, A., & Suaib, E. (2020). Mining in Southeast Sulawesi and Central Sulawesi: shadow economy and environmental damage regional autonomy era in Indonesia. *International Conference on Social Studies and Environmental Issues (ICOSSEI 2019)*, 20–27. https://doi.org/https://doi.org/10.2991/assehr.k.200214.004

Lê Ngọc, H., Khai, X. T., Phuong, N. H., Long, U. P., Nam, T. T., & Ngan, N. T. (2021). Flashcard Design for Helping Students in Learning Chinese Vocabulary. *Journal of World Englishes and Educational Practices*, *3*(10), 10–23. https://doi.org/https://doi.org/10.32996/jweep.2021.3.10.2

Mayrhofer, J., Weinhandl, R., Baldinger, S., Bleckenwegner, V., & Riegler, V. (2025). Current state of gamification design in secondary mathematics education: a systematic literature review. *International Journal of Mathematical Education in Science and Technology*, 1–23. https://doi.org/10.1080/0020739X.2025.2555333

Mohamad, S. N. M., Sazali, N. S. S., & Salleh, M. A. M. (2018). Gamification approach in education to increase learning engagement. *International Journal of Humanities, Arts and Social Sciences*, *4*(1), 22–32.

Mun, P. N., Alias, N., & Dewitt, D. (2022). Effectiveness of a gamification application in learning mandarin as a second language. *Malaysian Journal of Learning and Instruction (MJLI)*, *19*(2), 183–211. https://doi.org/https://doi.org/10.32890/mjli2022.19.2.7

Mustarih, N., Nahnu, A., Noni, N. N., & Rahman, S. K. (2025). Analysis Of The Application Of Teaching Methods In Teaching Mandarin Vocabulary At University Level. *Klasikal: Journal Of Education, Language Teaching And Science*, *7*(1), 455–467. https://doi.org/https://doi.org/10.52208/klasikal.v7i1.1294

Nation, I. S. P., & Nation, I. S. P. (2001). *Learning vocabulary in another language* (Vol. 10). Cambridge university press Cambridge. https://doi.org/https://doi.org/10.1017/CBO9781139524759

Oratmangun, D. (2022). Indonesia--China strategic partnership transformation: building cooperation, synergy, and solidarity. In *China and the World in a Changing Context: Perspectives from Ambassadors to China* (pp. 167–174). Springer. https://doi.org/https://doi.org/10.1007/978-981-16-8086-1_21

Prasad, K. D. V. (2021). Gamification and its applications. *Journal of Business Strategy, Finance and Management*, *2*(2). https://doi.org/https://doi.org/10.12944/JBSFM.03.01-02.02

Rahman, S. K., Kadar, A. S., Wahyuningsih, S., & Mustarih, N. (2024). Career Opportunities For Mandarin Interpreters In Central Sulawesi's Mining Sector. *Klasikal: Journal Of Education, Language Teaching and Science*, *6*(3), 1074–1080. https://doi.org/https://doi.org/10.52208/klasikal.v6i3.1364

Rivera, E. S., & Garden, C. L. P. (2021). Gamification for student engagement: a framework. *Journal of Further and Higher Education*, *45*(7), 999–1012. https://doi.org/10.1080/0309877X.2021.1875201

Saleem, A. N., Noori, N. M., & Ozdamli, F. (2022). Gamification applications in E-learning: A literature review. *Technology, Knowledge and Learning*, *27*(1), 139–159. https://doi.org/10.1007/s10758-020-09487-x

Setijadi, C. (2016). 'A Beautiful Bridge': Chinese Indonesian Associations, Social Capital and Strategic Identification in a New Era of China--Indonesia Relations. *Journal of Contemporary China*, *25*(102), 822–835. https://doi.org/https://doi.org/10.1080/10670564.2016.1184895

Spaho, E., Çiço, B., & Shabani, I. (2025). IoT Integration Approaches into Personalized Online Learning: Systematic Review. *Computers*, *14*(2), 63. https://doi.org/10.3390/computers14020063

Ying, Y., Rosalin, K., & others. (2021). Mandarin M-Comic Application Design in Supporting Mandarin Vocabulary Learning. *Journal of Physics: Conference Series*, *1764*(1), 12089. https://doi.org/https://doi.org/10.1088/1742-6596/1764/1/012089

Ying, Y., Ruomei, F., & Susilo, P. M. (2020). Smart word aplication design for learning Mandarin-Indonesia vocabulary. *Journal of Physics: Conference Series*, *1477*(4), 42015. https://doi.org/https://doi.org/10.1088/1742-6596/1477/4/042015

Ying, Y., Susilo, P. M., Mei, F. R., & Rahardjanti, T. (2021). The role of the mandamonic games in supporting mandarin learning at elementry school. *Journal of Physics: Conference Series*, *1764*(1), 12107. https://doi.org/https://doi.org/10.1088/1742-6596/1764/1/012107