v1.docx

'Abstract

Mobile-assisted language learning (MALL) has been the subject of several comprehensive studies in the past decade. Still, a relatively small number of research synthesis studies addressed the mainland Chinese environment of higher education. This study introduces a mobile educational platform for Android that combines Game-Based Learning (GBL) with Cuckoo Search Optimisation (CSO) to improve Chinese language learning. But according to current research, the GBL performs less when it follows a static learning path. To improve the GBL's learning path, the CSO technique is employed. The Client Mobile Learning System, Data Synchronisation Intelligence Agent, and Remote Management Server included the system. The corresponding design of this method has been maintained with regard to the various student, new word level, study, and memory stages. Both tests have controlled difficulty levels within a comparable range ensuring accurate testing. The efficacy of the suggested CSO is determined by a variety of cloze tests, the results which indicate that the delay times for counts of 1–5 words are 0.031, 0.036, 0.041, 0.053, and 0.069. It has been demonstrated that the suggested CSO-GBL can successfully enhance Chinese language learning performance, and the simulation confirms the system's viability and efficacy.

Keywords: Chinese language, Cuckoo Search Optimisation, Game-Based Learning, Mobile-assisted language learning, Remote Management Server

1. Introduction

The term "mobile internet" [1] has currently been in use for ten years already, and in that time, the technology landscape has changed significantly. Many forces have combined to create a diverse yet equitable competitive environment. These days, platforms may easily link to one another, and apps created for one platform can operate immediately on another. Platform distinctions are become increasingly blurry, and a new "mobile internet" is emerging at this time. A new area of study called "mobile learning [2]" blends digital learning with MC technology to give students access to knowledge and information whenever and wherever they desire. This allows for genuine autonomous learning, which leads to socialisation and lifelong learning. Since Chinese is the mother tongue in China [3], thus mastering it is essential to one's future growth. Additionally, a significant amount of Chinese vocabulary appears in Chinese learning materials like newspapers and intricate articles. A certain amount of grammar proficiency is required to comprehend something completely. As a result, Chinese learners will benefit greatly from an Android-based Chinese learning system that is easy to use and lets users utilise brief windows of time to pick up some basic Chinese. This work develops an embedded system of EDK using a 32 bit soft RISC processor [4] as a customised microprocessor. Recognise the real-time image input from CMOS cameras displayed on a DVI screen.The Chinese teaching system that is based on WC enables learners to actively learn knowledge. Additionally, the author bases the design of the personalised learning system on the game theory, By considering the individual online learning features and the personalised learning mode's design approach. Additionally, the performance of

the model is verified and analysed in the present research. This research aims to build a new mobile Chinese learning system using CSO [5] optimized GBL that completely considers learners' vocabulary acquisition and memory cycle in order to address this issue. The main contributions of this research is as follows,

- The GBL approach is introduced in this research to develop Chinese language learning system more engaging and effective for learners.
- In the GBL method to optimize the learning strategies effectively, a metaheuristic approach named Firefly optimization approach is proposed to dynamically adjust critical thinking.
- The test cases also conducted using number of input features to determine the potential of GBL approach for the development of Chinese language learning system.

The remaining of the paper is organized as follows: Section 2 presents the previous research done based on the development of hand gesture recognition system. The proposed methodology is briefly explained in section 3 whereas the experimental results are detailed in section 4. At last, the conclusion of the overall research is presented in section 5.

2. Literature Survey

The acceptability of three different kinds of MDs such as monolingual, bilingualised, and bilingual by Chinese EFL learners is investigated by Danyang Zhang et al [6]. In all, 125 participants utilised mobile dictionaries in different English learning situations, mostly for vocabulary and reading comprehension. The questionnaire was derived from the Technology Acceptance Model and the mobile technology evaluation framework covered three primary topics such as behavioural intention to use, perceived utility, and perceived ease of use. Based on a comparison between the bilingual MD group and the bilingualized MD group, the study indicates that the latter group expressed more pleasure. Rustam Shadiev et al [7] suggested an informal mobile technology-based foreign language learning activity that went beyond regular classroom lectures. Participating in our learning exercise were undergraduate Chinese students. With a single group pretest-post-test design, we investigated whether our learning exercise might improve their language learning results. Lastly, by interviewing the participants and their teachers, we looked at whether our learning exercise may lessen the cultural characteristics that are part of Asian society. According to our findings, learning outcomes of participants increased throughout the learning exercise. The findings also revealed that the majority of participants thought the exercise had a great benefit.

Combining the technological acceptance model with the self-determination theory, Yang Chen and Shuang Zhao et al. [8] suggested a theoretical framework that is tested using survey data from 272 Chinese college students. The descriptive statistical and structural equation

modelling analysis produces the following conclusions: (1) students typically select these apps out of autonomous motivations rather than controlled motivations; (2) autonomous motivation favourably affects perceived usefulness and ease of use, whereas controlled motivation only shows positive effects on the former; (3) controlled motivation does not affect the autonomous motivation to adopt these apps; and (4) in line with the TAM frameworks. Xiaomeng Li [9] suggested an approach of study and research to investigate the impact of using the mobile-assisted language learning (MALL) application "IELTS Liulishuo" (speaking English fluently in the IELTS test) as a unit of analysis to enhance the English-speaking production of Chinese university students. And the research highlights the related constraints and workable solutions when assessing the advantages of mobile applications using the seven dimensional criteria. The study demonstrated the benefits of using a MALL oral English assessment application characterised by an automatic speech recognition (ASR) system on the improvement of complexity, accuracy, and fluency of English learners in Chinese colleges, despite certain technical and pedagogical issues challenging adoptions of MALL in some less developed regions of China.

Xiaojing Huang [10] suggested a novel sort of Android-based, vocabulary-learning personalised mobile EFL learning system. Its foundations are CSO and GBL. This method maintains the matching design considering the various student, new word level, study, and memory stages. According to the research, the test included 15 closed questions with a total score of 30 and 15 multiple choice questions both before and after. Both exams have their difficulty levels managed within a comparable range to guarantee correct testing. The vocabulary of the students increased dramatically in cloze examinations, even while their academic performance in multiple choice questions did not. The simulation confirms that the suggested approach is both feasible and effective in enhancing English learning performance.

3. Proposed Methodology

3.1. Design Principles of Computer Chinese Assisted Learning System

The main focus of this system's is to identify the main challenges that students face when learning Chinese. In accordance with these challenges, a new learning model is established to increase students' initiative in the computer Chinese learning procedure. The system also takes into account the learning habits and methods of the students. Lastly, the efficacy of the learning process is examined and confirmed using computer Chinese characteristics and computer terminology categorization. Following instruction, users can keep up the question bank, determine their results, and assess how much effective their learning . Figure 1 illustrates the system's design.
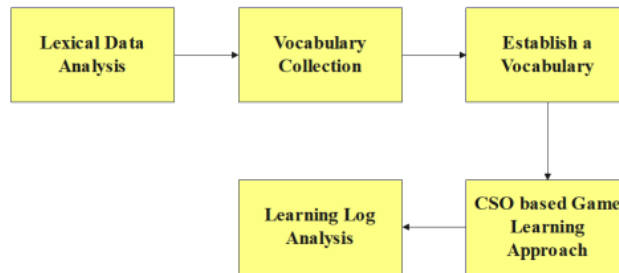
Figure 1: Block diagram of the proposed approach

(1) Game learning [11]: Vocabulary data is gathered into various groups and a vocabulary library is created for everyday learning questions based on the features of computer Chinese vocabulary. Students' initiative in learning is increased by game-based learning.

(2) Validation learning: The efficacy of the learning approach is confirmed by the validation of the learning system. Exercises are selected from the question bank based on the subject matter being studied, and learning feedback is combined together. The primary goal is to identify the learning status and eliminate redundant log weights from the learning procedure.

(3) Extraction of learning features: The goal of this procedure is to identify the learning features of students by analysing test results and learning logs, reflecting students' weak areas of learning through question creation error rates, and understanding the learning procedure of students from the learning logs.

(4) Feature matching: The learning system must offer learning recommendations based on the unique qualities of each learner, ensuring that every student experiences the delight of learning to the fullest extent possible, attending to their feelings, increasing their commitment to learning, and boosting the desire for learning.

3.2.1. Evaluation of Chinese Vocabulary Learning Ability

In this work, an item characteristic function is constructed using a basic Android system variable, and it is utilised to simulate word difficulty in order to evaluate students' proficiency with Chinese vocabulary. The calculating formula is as follows:

According to equation (1), if the the difficult parameter of the word ($\square$) and learner's vocabulary capacity ($\square$) are the same, then the probability ($\square\square$) is equal to 0.5. It shows that students must have a larger vocabulary to recognise the jth word. Frequently, Maximum likelihood estimation and Bayesian estimation are utilised in Android to assess trainees' proficiency. The MLE software is straightforward and easy to use, but idepending on whether students answer exam questions correctly or incorrectly using the acuquired vocabulary, it produce various assessments of their vocabulary ability. The MLE approach frequently overstates students' vocabulary

proficiency even in cases where test results are entirely accurate. Conversely, the maximum probability estimator typically understates the learner's vocabulary skills when the test response is entirely inaccurate. While Bayesian estimating techniques address the issue of divergent estimation in maximum likelihood estimation, they are more difficult and less efficient than maximum likelihood estimation techniques. For determining the vocabulary abilities of the learners, this study essentially relied prior data on the distribution of vocabulary abilities. Thus, the following formula is used for determining learners' language acquisition ability utilising the Bayesian estimating approach:

3.2.2 Chinese Vocabulary and Test Table Recommendations

The two most widely used methods in Android are Bayesian as well as Maximum Information Algorithm. Maximum Data Method is a strategy in which each word and its related word deliver diverse information to learners. Learners are recommended to use terms with extensive content[16]. Due to the difficulty of Bayes method compared with the minimum method, we offer relevant terms using minimal method. The maximum data function is established below.

Among them, Ij (θ) It is the jth vocabulary at the lowest degree of its ability θ information value at the level of bj is the difficulty parameter of the jth word. Word counsellors offer the most helpful terms to learners. For learners with strong preference ability, the greater the information function value, the higher the importance of recommendation.

3.2.3. Cuckoo Search Optimization

The Cuckoo Search Algorithm (CSA) is a bio-inspired metaheuristic optimisation algorithm that mimics the behaviour of cuckoo birds [12]. This bird has a great reproduction technique in addition to producing a terrific sound. The Cuckoo deposited its eggs in other people's nests by emptying them in order to start a new nest. The three forms of brood parasitism seen in the CSA are intraspecific brood parasitism, collaborative breeding, and nest acquisition. Here is an explanation of the fundamental CSA regulations. Each cuckoo bird carries a single egg, and the best nest is passed down to the following generation. The local solution, or good eggs, are found in the nest and are used for procreation.   flights, which are air recommendations that are evaluated to obtain the best outcome globally.

The type of the matter N determines the dimension of a matter that has to be optimised. There are birds in the nest m, there are iterations in progress t, and there is a maximum amount of iterations T. There is a specified location vector X_i for the nest $(1 \leq i \leq m)$ is defined a $X_i = \{X_{i1}, X_{i2}, \dots X_{iN}\}$. A bird in CSO often glances at its journey in its N-dimensional nest. The optimisation process relies on stochastic walks and $Levy$ flight for seek, and it involves effectively replacing the prior worst solution with a new one. Consequently, equation (7) expresses the nesting route and location update of the CS in the following manner:

$$X_i^{t+1} = X_i^t + \alpha \oplus Levy(\lambda) \qquad (7)$$

Whereas, X_i^t and X_i^{t+1} denotes the position vectors of the bird's nest at and iterations; X_i denotes the current state and α denotes the step or transition size. $\oplus$ symbolises a random seeming route and point-point multiplication. Following is the connection with time. Equation (8) gives the following expression for the dispensation.

$$Levy(\lambda) \sim \mu = t^{-\lambda}(1 - < \lambda \le 3)$$
(8)

Equation (9) uses the step size data from the current optimum solution to determine the step size factor, which is represented as follows:

$$\alpha = \alpha_0(X_i^t - X_{best}) \qquad (9)$$

When the present best solution is stable α_0 and essentially maintained. Equation (10) expresses the estimated stochastic numbers for the required calculation as follows;

$$Levy(\lambda) \sim \frac{\varphi\mu}{|v|^{\frac{1}{\overline{\beta}}}} \qquad (10)$$

The typical normal distribution is μ and v. The CSO uses the Lagrange range multiplier function to integrate equations (7) to (10), which results in a new solution that is stated as follows in equation (11) during $Levy$ flight.

$$X_i^{t+1} = X_i^t + r\left(X_j^t - X_k^t\right) \qquad (12)$$

Where, r – homogeneous scattered stochastic value in the range between [0,1] interval and X_j^t and X_k^t – two stochastic solutions of the t-th iteration.

4. Experimental Results

4.1. Quantitative and Qualtitative Analysis

4.1.1. Analysis of the delay of the i-th letter prompt data

The online vocabulary retrieval, online examination, and online video learning modules are the two primary functional modules of the Android Chinese learning system that demand fast data transfer speeds. An analysis of latencies to rapidly display information in five words whenever the letter I is input. The horizontal line between them indicates the word count, while the vertical line indicates the time in seconds.

Table 1: Analysis of the delay of the i-th letter prompt data

Words Count	Delay
1	0.031
2	0.036
3	0.041
4	0.053
5	0.069

4.2.2. Analysis of Student Pre Test and Post Test Scores

The outcomes of training performance during the pre-test as well as post-test periods are compared in Table 2. There are 5 multiple-choice questions in each of the pre- and post-tests, with a maximum score of 10 points. The two tests' difficulty levels are kept within a comparable range to guarantee accurate testing.

Table 2: Comparison Results of Student Pre Test and Post Test Scores using CSO-GBL

Words Count	Pre-test	Post-test
1	19	22
2	22	22
3	24	22
4	21	28
5	19	23

Table 2 demonstrates that learners' vocabulary skills in cloze examinations have greatly increased. For the word count 1, the student's pretest score is 19 and after training eith CSO-GBL approach the post test score is 22. It clearly demonstrates the suprior performacne of CSO-GBL.

4.3. Discussion

The obtained results shows that the proposed CSO-GBL approach performs better when tested with different word counts. This achievement is achieved by the use of CSO approach to optimize the GBL for exploring the static way of Chinese learning for the learners. For the word count 1, the student's pretest score is 19 and after training eith CSO-GBL approach the post test score is 22. It clearly demonstrates the suprior performacne of CSO-GBL.From the above tables, it clealry states that the proposed CSL-GCL performs better in post test scores but compared to pre-test the fact that their academic performance in multiple-choice questions did not much improve significantly.

5. Conclusion

Over the last ten years, a number of thorough research have examined MALL. Relatively few research synthesis studies, however, focused on the mainland Chinese higher education

context. This study introduces a mobile educational platform for Android that combines CSO-GBL to improve Chinese language learning. But according to current research, the GBL performs less when it follows a static learning path. To improve the GBL's learning path, the CSO technique is employed. The efficacy of the suggested CSO is determined by a variety of cloze tests, the results which indicate that the delay times for counts of 1–5 words are 0.031, 0.036, 0.041, 0.053, and 0.069. Future work will be focused on integrating advanced DL approaches to enhance the potential of learning system.

References

1. Cui, Yuhuan, Zezhong Ma, Liya Wang, Aimin Yang, Qiumei Liu, Shanshan Kong, and Huifang Wang. "A survey on big data-enabled innovative online education systems during the COVID-19 pandemic." *Journal of Innovation & Knowledge* 8, no. 1 (2023): 100295.

2. Alam, Ashraf, and Atasi Mohanty. "Learning on the Move: A Pedagogical Framework for State-of-the-Art Mobile Learning." In *International Conference on Data Management, Analytics & Innovation*, pp. 735-748. Singapore: Springer Nature Singapore, 2023.

3. Chen, Juan. "Effectiveness of blended learning to develop learner autonomy in a Chinese university translation course." *Education and Information Technologies* 27, no. 9 (2022): 12337-12361.

4. Titare, Prashant S.,. "MPSoC design and implementation using microblaze soft core processor architecture for faster execution of arithmetic application." *International Journal of High Performance Systems Architecture* 11, no. 3 (2023): 156-168.

5. Imran, Muhammad, Sangeen Khan, Helmut Hlavacs, Fakhri Alam Khan, and Sajid Anwar. "Intrusion detection in networks using cuckoo search optimization." *Soft Computing* 26, no. 20 (2022): 10651-10663.

6. Zhang, Danyang, Sara Hennessy, and Pascual Pérez-Paredes. "An investigation of Chinese EFL learners' acceptance of mobile dictionaries in English language learning." *Computer Assisted Language Learning* (2023): 1-25.

7. Shadiev, Rustam, Xun Wang, Yuliya Halubitskaya, and Yueh-Min Huang. "Enhancing foreign language learning outcomes and mitigating cultural attributes inherent in Asian culture in a mobile-assisted language learning environment." *Sustainability* 14, no. 14 (2022): 8428.

8. Chen, Yang, and Shuang Zhao. "Understanding Chinese EFL learners' acceptance of gamified vocabulary learning apps: an integration of self-determination theory and technology acceptance model." *Sustainability* 14, no. 18 (2022): 11288.

9. Li, Xiaomeng. "The Effectiveness of Mobile-assisted Language Learning (MALL) Applications on the Spoken English Assessments in China's Universities." In *2021 International*

Conference on Social Development and Media Communication (SDMC 2021), pp. 751-756. Atlantis Press, 2022.

10. Huang, Xiaojing. "Design and Application of English Assisted Learning System Based on Mobile Learning Platform." *Procedia Computer Science* 228 (2023): 231-240.

11. Pratiwi, Damar Isti, Sri Wuli Fitriati, Issy Yuliasri, and Budi Waluyo. "Flipped classroom with gamified technology and paper-based method for teaching vocabulary." *Asian-Pacific Journal of Second and Foreign Language Education* 9, no. 1 (2024): 1.

12. Abdel-Basset, Mohamed, Reda Mohamed, Mohammed Jameel, and Mohamed Abouhawwash. "Nutcracker optimizer: A novel nature-inspired metaheuristic algorithm for global optimization and engineering design problems." *Knowledge-Based Systems* 262 (2023): 110248.

v1.docx

28%

SIMILARITY INDEX

PRIMARY SOURCES

1	Xiaojing Huang. "Design and Application of English Assisted Learning System Based on Mobile Learning Platform", Procedia Computer Science, 2023 Crossref	305 words — 9%
2	www.mdpi.com Internet	148 words — 5%
3	download.atlantis-press.com Internet	85 words — 3%
4	discovery.researcher.life Internet	49 words — 1%
5	Aravind B. R., Bhuvaneswari G., S. Suman Rajest. "chapter 1 ICT-Based Digital Technology for Testing and Evaluation of English Language Teaching", IGI Global, 2023 Crossref	34 words — 1%
6	Danyang Zhang, Pascual Pérez-Paredes. "Chinese EFL learners' use of mobile dictionaries in reading comprehension tasks", System, 2024 Crossref	31 words — 1%
7	Ashraf Alam, Atasi Mohanty. "Educational technology: Exploring the convergence of technology and pedagogy through mobility, interactivity, AI, and learning tools", Cogent Engineering, 2023 Crossref	28 words — 1%

8   Ahmed F. Mohamed, Amal Saba, Mohamed K. Hassan, Hamdy.M. Youssef et al. "Boosted Nutcracker optimizer and Chaos Game Optimization with Cross Vision Transformer for medical image classification", Egyptian Informatics Journal, 2024
Crossref

27 words — 1%

9   Ibrahim Riyadh Alrikabi, Murtadha A. Alazzawi, Ahmed Al-Khaleefa, Buraq T. Sh. Al-Mosawi, Hassanain Raheem Kareem, Ali Alsalamy. "Intrusion Detection in Networks using Honey Badger Algorithm with improved Adaptive Neuro-Fuzzy Inference System", 2023 Al-Sadiq International Conference on Communication and Information Technology (AICCIT), 2023
Crossref

22 words — 1%

10   Meng Qin, Nawazish Mirza, Chi-Wei Su, Muhammad Umar. "Is there irrational prosperity in China's digital economy?", Global Finance Journal, 2023
Crossref

21 words — 1%

11   sfleducation.springeropen.com
Internet

21 words — 1%

12   Emerson D. Peteros. "Impact of pre-service teachers' self-regulation and self-efficacy on their mathematics performance in blended learning", Journal of Education and Learning (EduLearn), 2024
Crossref

20 words — 1%

13   Ling-ling Li, Ze-Yao Cen, Ming-Lang Tseng, Qiang Shen, Mohd Helmi Ali. "Improving short-term wind power prediction using hybrid improved cuckoo search arithmetic - support vector regression machine", Journal of Cleaner Production, 2020
Crossref

17 words — 1%

14   Charlie Prétot, Nicolas Lamaison. "Methodology for Fifth Generation District Heating and Cooling Network Simulation", International Sustainable Energy Conference - Proceedings, 2024
Crossref

15 words — < 1%

15   Partho Ghose, Selina Sharmin, Loveleen Gaur, Zhongming Zhao. "Grid-Search Integrated Optimized Support Vector Machine Model for Breast Cancer Detection", 2022 IEEE International Conference on Bioinformatics and Biomedicine (BIBM), 2022
Crossref

13 words — < 1%

16   up-rid.up.ac.pa
Internet

12 words — < 1%

17   ouci.dntb.gov.ua
Internet

11 words — < 1%

18   proceeding.unnes.ac.id
Internet

11 words — < 1%

19   www.scilit.net
Internet

11 words — < 1%

20   Alejandra Gomez-España, Jorge L. Lopez-Morales, Belinda Español-Sanchez, Pilar García-Orduña et al. " Iridium-(κ -NSi) catalyzed dehydrogenation of formic acid: effect of auxiliary ligands on the catalytic performance ", Dalton Transactions, 2023
Crossref

9 words — < 1%

21   Sadiq M. Sait, Feras Chikh Oughali, Abdalrahman M. Arafeh. "Engineering a Memetic Algorithm from Discrete Cuckoo Search and Tabu Search for Cell Assignment of

8 words — < 1%

Hybrid Nanoscale CMOL Circuits", Journal of Circuits, Systems and Computers, 2016

Crossref

22   dspace.univ-ouargla.dz
      Internet   8 words — < 1%

23   www.researchgate.net
      Internet   8 words — < 1%

24   Danyang Zhang, Sara Hennessy, Pascual Pérez-
      Paredes. "An investigation of Chinese EFL learners'   7 words — < 1%
      acceptance of mobile dictionaries in English language
      learning", Computer Assisted Language Learning, 2023

      Crossref

EXCLUDE QUOTES   OFF   EXCLUDE SOURCES   OFF
EXCLUDE BIBLIOGRAPHY   OFF   EXCLUDE MATCHES   OFF