

Matching Degree Between University Students' Digital Literacy and the Current Situation of Mobile Language Learning

<https://doi.org/10.3991/ijim.v17i14.41185>

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Abstract—Based on the current situation of university students' mobile phone language learning, this paper investigates whether university students' digital literacy can effectively support their mobile phone language learning, aiming at clarifying the matching between university students' digital literacy and the current situation of mobile phone language learning, and constructing corresponding application mechanisms. It is found that university students' existing digital literacy cannot effectively support their mobile language learning practices, which shows that the former has a significant impact on the application level of the latter. The two are significantly related in many elements, but the matching degree between many pairs of related elements is low and the deviation is large: the existing acquisition skill of digital literacy have a negative impact on the satisfaction and usefulness of mobile language learning; Low-level creative skill have a negative impact on the usefulness, convenience and satisfaction of mobile phone language learning. Therefore, measures such as promoting the development of general digital literacy to specialized digital literacy, adopting digital literacy promotion plan that integrate daily contact and training interventions, carrying out teaching activities based on low deviation matching, and using demographic characteristics to adjust digital literacy can improve the level of mobile language learning adoption.

Keywords—mobile learning, mobile language learning, digital literacy

1 Introduction

Mobile learning has become an important way for learners to get ubiquitous, flexible, interactive and multi-modal learning opportunities, so its position in digital learning has been further consolidated. Using daily mobile devices such as smart phones, tablets and media players for learning and mobile learning has become a universal demand among learners around the world. To this end, UNESCO (United Nations Educational, Scientific and Cultural Organization) held the first and second seminars aimed at promoting education through mobile technology in 2011 and 2012, respectively, and in 2017 clearly pointed out that mobile terminals and high-speed wireless networks will

change the global education landscape, encouraging learners in all countries to access educational resources globally through mobile learning. In this context, Mobile Assisted Language Learning (MALL), as a combination of mobile learning and language learning, has been more and more accepted and popularized, and has been widely used by contemporary university students in formal, informal or mixed foreign language learning. However, in terms of application mode, multimodal resource utilization, conceptualization, interaction level, and application effectiveness, MALL practice among university students is still at a low level, and there is a lack of understanding and coordination between education and development parties on the influencing factors. Analyzing the matching between the digital literacy of university students' application of mobile technology and the current situation of shopping malls can help to reveal the reasons for the lowest practical level of university students' shopping malls and build an effective mechanism for university students' shopping malls.

2 Literature review

MALL is not only one of the main ways for university students to learn foreign languages, but also an important part of digital campus construction in many universities. However, in the specific learning practice, this language learning mode still has some shortcomings. However, there are still some shortcomings in this mode of language learning in practice, and scholars have tried to explore the reasons for this situation from different perspectives.

2.1 MALL

In addition to the ubiquity, portability, and user-friendliness of mobile technology, mobile learning has the advantages of reducing learning anxiety, promoting personalized learning, increasing learner autonomy, enhancing learning confidence, and supporting more collaborative learning. As a result, language teachers have a more positive attitude toward mobile learning than teachers of other subjects, and mobile learning activities are mainly focused on language learning.

There are still many things that could be improved in MALL practice. Firstly, the current MALL learning activities for university students are of a single type, still dominated by "content-driven" learning activities [1], mainly focusing on vocabulary learning, word meaning search, word pronunciation, grammar correction, listening training, course content transfer, testing, video playback, etc. These are mostly "design" activities based on both "visual" and "auditory" mechanisms. These are mostly language learning activities based on both "visual" and "auditory" means, while "design-driven" learning activities that support interactive learning, discovery learning, and innovative learning are dominant. Secondly, due to the limitation of the technology level, the perceptual functions supported by mobile terminals are basically in separate application modes, which makes the existing MALL learning activities of university students less effective. This makes it difficult for university students' current MALL learning activities to generate perceptual interaction and form a linkage effect; finally, the acceptance

of MALL shows a large dispersion. Finally, the acceptance of MALL shows a large distribution. Lastly, the acceptance of MALL is widely scattered. The research found that most MALL learners are those who have not tried, give up after trying, or do not use it regularly, while not enough scholars are those who use it regularly and frequently [2]. The study found that most MALL learners are untried, tried and abandoned, or not regular users, but they need more regular and frequent users. In addition, a review of related studies shows that there still needs to be more quantitative research on MALL, among which experimental, short-term, and small-scale studies are the most common. Most of these studies have concluded that MALL can promote the improvement of foreign language skills, which is suspected to be technocentric. At the same time, most MALL studies aim to encourage learners' language skills or compare the advantages and disadvantages of mobile learning environments with those of other backgrounds. At the same time, most studies on MALL aim to promote learners' language skills or compare the advantages and disadvantages of mobile learning environments with other environments [3].

In summary, there are still many things that could be improved in the research on MALL practices, and so far, little is known about its influencing factors. Studies exploring the deficiencies of MALL among university students still need to be improved. Based on this, this study examines the causes of the low level of MALL practice among university students from the perspective of matching university students' digital literacy degrees with their MALL status.

2.2 Digital literacy and the MALL connection

Digital literacy is the ability of citizens to acquire, process, understand, and create information or content in a digital environment [4]. Digital literacy is a necessary ability and character for citizens in modern society, an essential part of civic literacy and civic education, and a necessary condition for achieving media-empowered lifelong learning [5]. Digital literacy and language learning are symbiotic. Foreign language education in the information age promotes language learning through digital literacy. It leverages language learning and digital literacy integration to master new skills such as online literacy and communication [6]. As a result, students with lower language proficiency will face more significant challenges in improving digital literacy and using ICT in their learning [7]. The association between language learning and digital literacy determines that their digital literacy influences the intention and level of university students' implementation of MALL in applying mobile technology; conversely, language learning supported by mobile technology can also promote digital literacy.

In MALL practice, some university students must fully utilize their digital literacy learning potential. It was found that in the process of second language learning among university students, influenced by the single mode of MALL practice; the subjects applied only a tiny part of the learning functions of mobile terminal devices [8], such as email, short text messages, multimedia messages, audio and video playback, electronic dictionaries, learning systems, etc. The use of applications that can support interactive learning still needs to be improved, and the multimodal availability of mobile terminals still needs to be fully utilized. In addition, the existing digital literacy of university

students does not match their status as "digital natives." It was found that although the penetration rate of mobile devices in the subjects' hands was high, only a small number of them chose to learn foreign languages through podcasts, mainly because many of them were not familiar with how to download podcasts to their mobile devices [9].

In summary, there is no match between the current level of MALL practice among university students and their digital literacy learning application potential. MALL studies often focus on developing university students' language skills, ignoring the impact of university students' digital literacy on MALL effectiveness, resulting in a continued lack of current research exploring the match between the two.

3 Methodology

3.1 Research questions

This study analyzes the symbiotic issues of whether the current digital literacy status of university students is at a level that effectively supports their implementation of MALL and whether the current status of MALL among university students can promote their learning potential of digital literacy to the fullest, reveals the reasons that lead to the current low level of MALL practice among university students, and explores the paths to improve the level of MALL practice. The specific research questions are: first, what is the current situation of the components of digital literacy among university students and their MALL components; second, whether the differences in the demographic characteristics of university students are reflected in their digital literacy and the current situation of MALL; third, whether the components of digital literacy among university students match with the current status of their MALL components.

3.2 Research idea

Firstly, we researched the current situation of digital literacy and MALL components of university students; secondly, based on the above research data, we analyzed the differences between them in terms of demographic characteristics such as gender, age, place of origin, English level and monthly expenditure; secondly, we conducted a correlation analysis between the components of digital literacy and MALL components of university students; finally, we used the deviation analysis method to analyze the significant correlation between the elements of MALL and digital literacy. Finally, the deviation analysis was used to analyze the match between the two components.

Based on the results of the match analysis between the digital literacy of university students and the current situation of MALL, we make full use of the problems of the high match between the two sides and propose teaching suggestions on the design of learning activities, assessment of learning effectiveness, and implementation of teaching concepts that can improve the level of MALL practice of university students. To address the elements related to the low match between the two, suggestions are made for skills training, equipment application and management, and campus environment construction to enhance digital literacy to support university students' MALL practice

effectively; learning models or learning activity designs are proposed to enhance MALL practice, to give full play to the learning application potential of digital literacy.

3.3 Design of the research scale

The research scale, "Survey on Digital Literacy and Mobile Language Learning among university students," consists of three parts: personal information, a survey on digital literacy, and a survey on mobile language learning.

In the first part, "personal information" covers gender, place of origin, school, grade, major, monthly expenses, whether or not they are class officers, mobile device ownership and English proficiency, etc. The aim is to capture the demographic information and factors affecting their MALL behavior.

The second part, "Digital Literacy Survey," was designed to investigate the current digital literacy of the subjects in terms of mobile technology.

Digital literacy often combines three cognitive skills: acquisition, comprehension, and creation in a digital environment [10]. Hsieh [11] added the element of "online social skills" to the traditional digital literacy framework, which was widely accepted. This new element consists of online social skills and content-sharing skills. The digital literacy framework was thus extended to cover acquisition, comprehension, creation, and online socialization (Figure 1). The "State of Digital Literacy Survey" section of this research instrument is based on this digital literacy framework's four elements (factors). The third part, "Mobile Language Learning Survey," was designed to investigate the current situation of the participants in using mobile technology for foreign language learning [12]. Since there is no fixed structure for this part, the questions were created first, and then the factors were generated after the structural validity analysis.

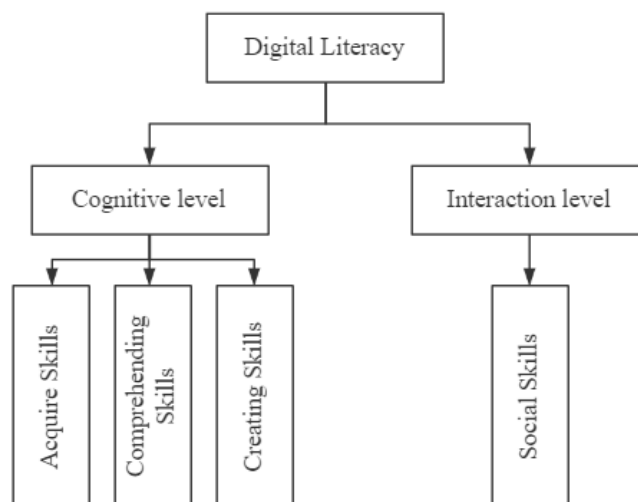


Fig. 1. Digital Literacy Framework for University Students

The question items for the second and third parts were created based on three sources: first, the question items used in the relevant studies [13] were referred to and adapted to the purpose of this study; second, two focus interview groups were formed and guided to output their actual experiences in MALL practice, and the interviews were coded and analyzed thematically afterward, from which some of the question items were produced; third, the members of the subject group were selected according to the university students' Thirdly, members of the group brainstormed based on the mobile technology application practice and MALL learning practice of university students, to produce some of the questions. When the first draft of the scale was generated, the second part contained 30 items, including six acquisition skills, nine comprehension skills, nine creation skills, and six online social skills; the third part included 58 items. The items in these two sections were standardized into a five-point Likert scale format: 5 for most robust or most consistent with the person, 4 for stronger or most consistent with the person, 3 for unable to say, 2 for weaker or less compatible with the person, and 1 for most fragile or least consistent with the person.

3.4 Research scale testing

The first stage of the test was to implement content validity and face validity tests for the second and third parts of the scale. The content validity was to test the extent to which the actual content of the scale matched the expected range, and the face validity was to test whether the subjects would perceive the items as what the researcher wanted to test. After the first stage of testing, the questions in the two sections were reduced from 30 and 58 in the first draft to 28 and 49, respectively. On the research instrument Questionnaire Star, the first-stage tested scale was prepared as a validation draft, and 141 students from first- and second-year college English classes of different majors were invited to take the test. The scale was tested in the second stage based on the data obtained: only the "individual" test was accepted in the second part because the four elements (factors) were identified. ---The third part of the scale was subjected to a structural validity test for the output factors. The output factors were named by thematic analysis, and finally, the reorganized third part was tested for reliability.

The results of the reliability test showed that the Cronbach's alpha coefficients of all four elements of the second part reached 0.817 and above, the Cronbach's alpha coefficients of the question items of the four elements reached 0.732 and above, the correlation among the question items of the four elements reached 0.196 ($P = 0.026$, $P < 0.05$). The Pearson's correlation coefficient among the four elements reached 0.487 ($P = 0.000$, $P < 0.01$) and above, and the Pearson's correlation coefficient among the four elements reached 0.487 ($P = 0.000$, $P < 0.01$). The above analysis results indicated that the second part of the scale had good reliability and was suitable for formal research.

The results of the structural validity test showed that the KMO value of the third part reached 0.913, and Bartlett's spherical test reached a significant level of 0.000, indicating that the sample size met the requirements and the data were suitable for factor analysis. Four factors were output from the rotated factor matrix, 40 question items were assigned to them, and nine question items that could not be transferred to the factors

were deleted. After thematic analysis, the four factors were named perceived usefulness, learning mode, perceived satisfaction, and perceived ease:

Perceived usefulness is the extent to which the subjects think MALL can improve their foreign language learning.

Learning mode is the specific learning behavior of the topics in implementing MALL.

Perceived satisfaction is the extent to which the subjects think they are satisfied with improving their foreign language learning after implementing MALL.

Perceived ease is the extent to which the topics believe they can improve their foreign language teaching after implementing MALL.

Perceived ease is the extent to which the subjects think they can improve their foreign language learning after implementing MALL.

The perceived ease of use is the degree to which the subjects think that using mobile technology in foreign language learning can reduce their physical and mental work and the degree to which they can master the use of related mobile hardware and software.

The reliability test results on the "Current state of mobile language learning" section, which was analyzed for structural validity, showed that the overall Cronbach's alpha coefficient of the team reached 0.961. The Cronbach's alpha coefficients of the four elements were 0.934 (0.928-0.932 for the question items), 0.91 (0.900 for the question items), and 0.941 (0.900 for the question items). 0.923 (0.910-0.915 for the question items) and 0.828 (0.767-0.814 for the question items), all of which are higher than the acceptable value of 0.70. The Pearson correlation coefficients between the four elements reached 0.601 ($P = 0.000$, $P < 0.01$) and above.

4 Discussion

Based on the data obtained from the formal research, we analyze the current situation and group differences of each element of digital literacy and MALL among university students, as well as the correlation and matching degree between them, respectively.

4.1 Current situation of digital literacy and MALL

The descriptive data in Table 1 show that the overall mean value of MALL and the mean value of most elements are higher than that of digital literacy, indicating that the existing digital literacy of university students may not be able to support the practice of MALL effectively, and the two are in a mismatch state.

From the element data, creation skills, and network social skills are the weakest and strongest digital literacy elements, respectively, indicating that university student's ability to use mobile terminals and various APPs to implement the output, publish, and produce multiple learning contents for learning, or to integrate various multimedia resources not directly used for learning into learning resources is the weakest digital literacy skill in their application of mobile technology. In contrast, university students' ability to apply The most vital digital literacy skill is the ability to communicate, exchange and discuss with others through mobile terminals and various APPs.

Learning mode was the weakest among the four MALL elements, and perceived satisfaction was the strongest. This finding indicates that university students recognize and are satisfied with MALL for foreign language learning, as evidenced by their satisfaction with this learning mode in terms of accessing foreign language learning resources, promoting foreign language skill development, and enhancing the diversity and interactivity of foreign language learning activities; the lowest score for learning mode indicates that university students still have deficiencies in the variety and interactivity of MALL activities[14].

Table 1. Descriptive Statistics of Digital Literacy and MALL Status of university students

Dimension	Variable	Min	Max	Std	Dev	Variance
Digital literacy	Gain	1	5	3.228	0.884	0.701
	Comprehend	1	5	3.400	0.840	0.634
	Create	1	5	3.110	0.814	0.665
	Socializing online	1	5	3.534	0.784	0.617
	Overall digital literacy	1	5	3.318	0.831	0.654
MALL	Usefulness	1	5	3.760	0.679	0.465
	Learning mode	1	5	3.584	0.710	0.506
	Satisfaction	2	5	3.846	0.596	0.358
	Simplicity	2	5	3.623	0.704	0.499
	Overall MALL	1	5	3.703	0.672	0.457

4.2 Group differences in the status of digital literacy and the status of MALL

The data in Table 2 show that in terms of the current state of digital literacy, all elements differed significantly in three subject characteristics: birthplace, foreign language level, and monthly expenditure, indicating that university students' home, foreign language level, and monthly spending may all influence the frequency of their exposure to and application of mobile digital technology, which in turn affects their digital literacy. In addition, there were significant differences in comprehension skills by gender. Regarding the current status of MALL, there were significant group differences in the three elements of usefulness, satisfaction, and simplicity, as shown by the fact that gender, place of origin, and foreign language level influenced subjects' evaluation of the efficacy of MALL. Area of origin, foreign language level, and monthly expenditure affected subjects' assessment of the simplicity of MALL. Notably, all elements of MALL differ significantly in terms of foreign language level, indicating that a new learning model based on modern technology can improve the foreign language learning level of university students. That is, the way this learning model is implemented, the degree of satisfaction of university students with it, and the degree of effort they need to use it are significantly correlated with their foreign language proficiency. In addition, age had no significant effect on digital literacy and MALL status.

Combining the data in Table 2, It can be judged that the subject characteristics of gender, age, English proficiency, place of origin, and monthly expenditure have significantly more significant effects on university students' digital literacy than on their MALL practices.

Table 2. Descriptive Statistics of Digital Literacy and MALL Status of university students

Dimension	Variables	Sex		Grade		Place of origin		Foreign language level		Monthly expenses	
		F	Sig.	F	Sig.	F	Sig.	F	Sig.	F	Sig.
Digital literacy	Gain	1.184	0.277	1.965	0.162	13.778	0.000	10.173	0.000	17.927	0.000
	Comprehend	13.76	0.000	0.783	0.377	9.343	0.000	6.113	0.000	8.374	0.000
	Create	2.684	0.102	0.344	0.558	9.398	0.000	9.686	0.000	9.609	0.000
	Socializing online	0.165	0.684	0.073	0.787	6.127	0.000	6.479	0.000	5.356	0.000
MALL	Usefulness	11.80	0.001	0.214	0.644	2.544	0.040	5.124	0.001	1.994	0.095
	Learning mode	0.126	0.723	0.228	0.633	1.892	0.111	3.360	0.010	1.309	0.266
	Satisfaction	10.345	0.001	0.001	0.975	2.746	0.028	4.466	0.002	2.109	0.079
	Simplicity	2.663	0.104	0.001	0.982	4.334	0.002	8.285	0.000	4.292	0.002

4.3 Matching degree of digital literacy and MALL

In this study, we analyzed the correlation between digital literacy and MALL, extracted the components whose correlation coefficients reached a significant level, and then analyzed their matching degree by deviation analysis. Then, we analyzed their matching degree by the deviation analysis method.

The results of Spearman's correlation analysis show that there is a significant correlation between all digital literacy elements and MALL elements, and the significant levels all reach 0.01 level (two-tailed), indicating that there is a mutually reinforcing and mutually constraining relationship between the current situation of digital literacy of university students and their current situation of MALL, which can be matching degree analysis, as shown in Table 3.

Table 3. Spearman's correlation analysis between digital literacy and the components of MALL among university students (n=346)

Factors	Relevance test	Usefulness	Learning mode	Satisfaction	Satisfaction
Gain	Correlation coefficient Sig. (two-tailed)	0.249** 0.000	0.253** 0.000	0.298** 0.000	0.363** 0.000
Comprehend	Correlation coefficient Sig. (two-tailed)	0.245** 0.000	0.276** 0.000	0.261** 0.000	0.340** 0.000
Create	Correlation coefficient Sig. (two-tailed)	0.265** 0.000	0.311** 0.000	0.225** 0.000	0.325** 0.000
Socializing online	Correlation coefficient Sig. (two-tailed)	0.324** 0.000	0.315** 0.000	0.325** 0.000	0.357** 0.000

5 Discussion

The shift from general to specialized digital literacy promotes the coordinated development of digital literacy and MALL. The current state of digital literacy among university students is that creative skills are the weakest, and online social skills are the strongest. Given the soft creative skills, on the one hand, students need to enhance their general digital skills and have the skills to use multiple terminals such as smartphones, tablets, and media players (including the skills to use standard tools based on these terminals), especially the tools that support the integration of multiple terminals; on the other hand, university students also need to learn the use of various implements with specialized purposes, to have the skills to use both general-purpose and On the other hand, students also need to know the use of tools with technical applications to have the skills to create using both general-purpose and specialized tools.

Combining Exposure and Training to Find a sustainable path to digital literacy The current state of digital literacy among university students is highly correlated with the current state of their MALL. Still, the overall mean value of the MALL and most of its components are higher than the mean value of digital literacy, and there needs to be a match between the two levels of development. The current state of digital literacy of university students may need help to effectively support their MALL practice effectively, and improving digital literacy becomes the focus of improving the match between this symbiosis. Contemporary university students are exposed to mobile technology anytime and anywhere in their daily lives, but this is only the basic but not the only condition to make them qualified digital citizens. Digital literacy encompasses two levels, namely, mastering basic digital technology operations and using an understanding of digital technology to solve problems and think critically. University students can easily reach the first level, but the second level requires long-term training and practice. Mere exposure to digital technologies will not make them truly digitally literate; to achieve adequate support for mobile learning purposes, there must be a shift from enhancing digital technology application skills to improving digital literacy. Therefore, besides natural exposure to mobile technology in daily life, providing relevant teaching or training for university students is necessary.

The negative function of high deviation matching is circumvented, and teaching and learning activities based on low deviation matching are actively constructed. The study found a significant correlation between digital literacy and MALL elements, indicating a de facto correlation. In contrast, the overall level of existing digital literacy is lower than that of MALL practices, indicating an imbalance in their development. Among them, "access-satisfaction," "access-usefulness," "creation-usefulness," "Create-satisfaction," and "Create-convenience" are the five pairs with the highest deviation from each other, which inferred that university students need more digital literacy to Digital literacy training that promotes the acquisition and creation of skills. Since mobile terminals and wireless networks are widely available in China, and the cost of applications is decreasing, improving access skills should focus on access to information and content rather than mobile technology or mobile services. To enhance the creative abilities of university students, in addition to designing assignments or activities for students with creative output, training on special-purpose software applications can be conducted for

them, supplemented by interactive learning group activities such as discussion, collaboration, and cooperation to produce a scaffolding effect, thus promoting the further enhancement of creative skills of university students.

Leverage the moderating effect of demographic characteristics on digital literacy to enhance MALL practices. Demographic factors impact both digital literacy and MALL practice, and the effects on the former are more significant than that on the latter. Theoretically, individuals with higher socioeconomic status and more experience with information and communication technology (ICT) are likely to have higher online social skills. Individuals with higher online social skills are more feasible to master multiple social interaction information technologies. This study found that monthly expenditures were highly correlated with all four elements of subjects' digital literacy skills, further indicating that socioeconomic status significantly impacted subjects' digital literacy skills. The issues in this study were from different parts of the country. Their monthly expenditures varied widely, which may affect the quantity and quality of their access to mobile technologies and mobile services and even their motivation to receive digital skills training [15]. Although contemporary university students do not have direct subjective socioeconomic status, they can accept and master nascent digital technologies more quickly as Internet natives who have been exposed to mobile technologies and have a richer experience in using them since childhood.

6 Conclusion

Digital literacy is one of the skills necessary for university students to adapt to contemporary university learning life and a guarantee for the transformation of university students' learning mode from a single learning mode based on traditional learning spaces such as classrooms, libraries, and computer rooms to a hybrid learning mode integrating mobile and non-mobile elements. Digital literacy is a constantly updated conceptual framework that always absorbs new digital skills based on the application of new technologies, making its connotation richer and its coverage and application domain broader. MALL also presents recent changes with the application of new technologies and the establishment of new learning concepts. The progress and popularity of technology and the renewal and acceptance of the idea make people have higher expectations of the matching degree of digital literacy and MALL. The development of digital literacy education in colleges and universities in China is relatively short and exists.

The shortage of valuable and professional teaching materials and contents and the inadequacy of relevant curricula have led many colleges and universities to fail to use digital literacy education to meet the needs of their teaching development. Therefore, colleges and universities should pay enough attention to digital literacy education of university students, which is not only an essential part of comprehensive literacy of university students in the 21st century, but also an essential prerequisite for the development of information technology teaching in colleges and universities, and an essential guarantee for recalibrating the digital literacy of university students to match with MALL.

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Article submitted 2023-04-06. Resubmitted 2023-05-30. Final acceptance 2023-06-04. Final version published as submitted by the authors.