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REPORT

Understanding Chinese University EFL Students' Mobile-Assisted Learning, Regional Differences and Academic Emotions

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ABSTRACT

Few studies have explored regional differences in the academic emotions of English-as-a-Foreign-Language (EFL) students when they engage in mobile-assisted learning. To fill this gap, this qualitative study, conducted at a Chinese university, focuses on eight EFL students from different regions of China and examines their academic emotions during their 21-day learning through mobile-assisted vocabulary applications. By mainly drawing on semi-structured interviews with eight students, the qualitative study showed regional differences in academic emotions during students' vocabulary learning through mobile applications. Students from underdeveloped cities experienced more positive emotions (such as pride, willingness, enjoyment, and admiration) than those from developed cities. Implications of the study include providing suggestions for caring for the emotional well-being of EFL students from diverse regions of China during their mobile-assisted learning.

KEYWORDS

English-as-a-Foreign-Language (EFL) learners, mobile vocabulary applications, regional differences, academic emotions, learning behavior

1 INTRODUCTION

Mobile-assisted language learning refers to language learning supported by portable devices and covers a large number of activities that allow learners to learn a language anywhere at any time [1]. Vocabulary learning is an aspect in which mobile-assisted language learning has become a highly discussed topic [2]. Indeed, sufficient vocabulary is the basis of reading, listening, and writing; vocabulary learning is crucial to the success of second language (L2) students [3] (e.g., English-as-a-Foreign-Language [EFL] and English-as-a-Second-Language [ESL] students). Studies [4, 5] have revealed that mobile-assisted vocabulary learning (e.g., learning words through mobile vocabulary applications) demonstrates diverse benefits in relation

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to L2 students' vocabulary learning, such as students' higher levels of engagement and their improved academic performance in English vocabulary learning.

Students experience academic emotions, namely emotions related to their academic learning [6]. Many studies [7, 8] have explored L2 students' academic emotions in the language learning process. For example, Li et al. [9] have revealed that L2 learners' anxiety (a negative academic emotion) levels in learning English are negatively related to their English proficiency and achievement, while their levels of enjoyment (a positive academic emotion) exhibit positive associations. Cho and Castañeda [10] have also explored L2 students' academic emotions in mobile-assisted language learning contexts. It was found that students' enjoyment in the Spanish learning process increased when they learned through mobile applications, and that they experienced a high level of motivation and engagement after a period of mobile learning. Further, Cheng and Chen [11] found that students with higher levels of anxiety were found to have poorer English learning achievement than those who experienced lower levels of anxiety in the mobile-assisted English learning process. Another study [12] focusing on mobile-assisted Korean language learning also revealed that students who experienced a higher level of enjoyment tended to achieve higher scores, while students' higher level of anxiety was linked to their lower performance on the same assessment. These studies underscore the significant impacts of emotions on mobile language learning and further call for explorations of factors that influence emotions while learners are engaged in mobile-assisted language learning [13, 14].

Regional factors tend to be influential on students' academic emotions, and scholars [15] have investigated the regional differences in students' academic emotions, particularly among L2 students. For example, Ramos Holguín and Aguirre Morales concluded that L2 students in rural or peripheral areas tend to have a negative self-image and lower levels of motivation and confidence than their urban counterparts, which contributes to language anxiety [16]. The gaps between rural and urban areas in terms of infrastructure, learning resources, faculty quality, and support from family are possible reasons for students' differences in academic emotions [15]. These findings reflect that the regional difference in L2 students' academic emotions is worth exploring [15, 16].

However, almost no research has been conducted to understand L2 students' academic emotions related to regional differences in mobile-based language learning (e.g., learning through mobile vocabulary applications). To fill this gap, this study was conducted to explore regional differences in EFL students' academic emotions during their learning with mobile vocabulary applications. The findings of this study may shed light on mobile-assisted vocabulary learning and teaching, offer an understanding of the educational disparities between students in different areas, and provide insights for enhancing students' emotional health in the mobile-assisted learning context.

2 LITERATURE REVIEW

2.1 Mobile-assisted language learning

Mobile-assisted language learning refers to language learning via mobile devices or media, which are flexible and accessible compared with traditional language learning methods [17]. With the features of portability, handy accessibility, and interactivity, mobile-assisted language learning is regarded as an important branch

of language learning and has received increasing attention in the field of L2 learning, with mobile-assisted vocabulary learning being one of the highly discussed topics [2, 18].

Much research [19–22] has explored the influence of using mobile applications on L2 students' vocabulary learning processes. For example, among 42 EFL college students with multicultural backgrounds, Rezaei et al. [23] conducted a quantitative study on the effectiveness of English vocabulary mobile applications using tests and questionnaires. It demonstrated that mobile vocabulary applications could enhance students' learning performance and class participation. In addition, a quasi-experimental study concluded that a mobile vocabulary application designed to facilitate vocabulary learning through games improved the English vocabulary learning performance and motivational level of 64 Arabic ESL students [21]. These studies showed that mobile vocabulary applications have become a handy tool for vocabulary learning, and investigating this topic may offer suggestions for L2 students' language learning [19–23].

2.2 Academic emotions

According to Pekrun et al. [6], academic emotions describe students' emotions experienced during academic activities, such as teaching, learning, daily homework assignments, exams, and other relevant settings. Pekrun et al. [6] also emphasized the diversity of academic emotions and divided them into positive emotions (e.g., joy and pride) and negative ones (e.g., anxiety and boredom).

Empirical studies [24–26] have explored L2 students' academic emotions in their language learning process. For instance, Shao [27] recruited 1021 freshmen studying at a foreign language university in Southeastern China and utilized questionnaires as well as an examination to evaluate EFL participants' academic emotions and English learning achievements. It was concluded that the positive emotions (enjoyment, hope, and pride) experienced by students helped improve their motivation, self-regulated learning, and, ultimately, their exam scores, while the negative emotions (hopelessness and boredom) had the opposite impacts. Furthermore, Méndez and Peña [28] used a qualitative approach to explore academic emotions in EFL students' language learning process. Twenty-four second-year EFL college students at a university in southern Mexico were recruited for this study, and they were required to describe their feelings about language learning experiences and participate in semi-structured interviews. The results of this study revealed that positive emotions enhanced the confidence of these EFL participants, which allowed them to realize language advancement, while negative emotions seemed to cause insecurity and undermine their confidence in English learning, hindering their further language achievement. Dovchin [29] enrolled 11 women of Mongolian background living in Australia who spoke English as a second language, and these participants were observed in various settings for two years with regard to their use of English. It was shown that all participants experienced some level of depression during their English learning process, which caused chronic mental and psychological pressure [29]. Furthermore, the sense of depression tended to disrupt the participants' learning processes as well as distract their attention from their study and thus had negative impacts on their academic performance [29].

Given the ample evidence of the influence of academic emotions on language achievement in the literature, it is worthwhile investigating their effects on the language proficiency of L2 students during mobile-assisted learning, which may provide insights for L2 teaching and learning.

2.3 Students' regional background: An influencing factor of academic emotions

Several scholars [30–33] have conducted research that explores the influence of multiple factors on students' academic emotions. Among these studies, the influence of regional differences on academic emotions has received growing attention. For example, in a general educational context, Cocorada [34] recruited 213 Romanian college students to investigate the influence of residence on students' academic emotions, using the Academic Emotions Questionnaire [35]. Cocorada found that participants from rural areas experienced significantly more negative emotions (shame, anxiety, and boredom) than students from urban areas. The study suggested that rural students experienced isolation and struggled to maintain their social relationships after entering university, which could be associated with their learning and contributed to their higher levels of negative emotions [34].

Focusing on L2 learning (especially EFL students), Xu [36] selected 900 EFL undergraduates in a Chinese college, including both urban and rural students. Using the Foreign Language Classroom Anxiety Scale developed by Horwitz [37], the study assessed the anxiety experienced by these students in the English learning process [36]. The researcher found a big gap between teacher quality and educational resources in rural and urban areas and demonstrated that rural students had fewer opportunities to practice their English and received less support from their families than their urban counterparts [36]. That is, rural undergraduates showed an apparently higher level of negative emotions, such as anxiety and depression, than their urban counterparts [36]. Wigati [38] explored the academic emotions of high school EFL students from different regions in Indonesia. Through classroom observations, questionnaires, and focus group interviews, it was concluded that urban students experienced higher levels of enjoyment, boredom, and anxiety in learning English than rural students, while rural students experienced more emotions of pride than their urban counterparts [38]. Moreover, students' motivation for learning was viewed as a main influential factor in the disparity between rural and urban students' academic emotions [38]. Compared with urban students, rural students lacked intrinsic motivation and learned English relatively passively, which caused their lower levels of enjoyment [38]. These studies (i.e., [36–38]) well documented that regional differences in the form of the quality of teachers, educational resources, families, and students' motivations for learning are closely associated with students' academic emotions.

Regional differences explored by these studies mainly involve three aspects: 1) internal, 2) external, and 3) previous experiences. The internal aspect concerns the individual (e.g., the motivation in [38–40]), whereas the external aspect is connected with the learning environment or facilities (e.g., the social relationship in [34]; access to mobile devices in [41]). Previous experiences are relevant to students' prior learning and life experiences (e.g., the instructional quality in high school in [36, 42]).

Thus, exploring the regional differences in L2 students' academic emotions for the educational disparities in these areas may reveal factors that are likely to influence students' learning process.

2.4 Academic emotions in the context of mobile-assisted learning

With the development of mobile devices and their applications in education, several scholars [43, 44] have also investigated students' academic emotions in mobile learning. For example, Yang et al. [45] enrolled six Chinese EFL college students and investigated their academic emotions in the mobile-assisted English learning

process during the 2019 pandemic. It was revealed that the participants experienced negative emotions, including anxiety and boredom, because of insufficient peer support and low online self-regulation ability. They also experienced positive emotions, such as enjoyment, relaxation, and hope, when they received positive feedback and engaged in interesting learning activities. Studies such as this scrutinize students' academic emotion patterns in relation to mobile-assisted learning and further reveal the significance of studying the possible factors that influence students' emotions. In doing so, research findings may be able to improve students' mental health and their experiences with mobile-assisted learning.

However, to the best of our knowledge, no research has explored regional differences in students' academic emotions when they learn language through mobile devices, particularly regarding vocabulary learning.

To fill this gap, the current study adopts mobile vocabulary applications, one of the most representative mobile language learning tools [2], and investigates the regional differences in university EFL students' academic emotions when they learn through mobile vocabulary applications. The study is guided by the following questions:

1. What do EFL students' positive and negative academic emotions look like in the process?
2. How do regional differences play out in EFL students' academic emotions in the process?

The study may also provide suggestions for students in different regions on how to better utilize mobile devices for L2 learning by recognizing and regulating their academic emotions. The study is also hoped to help educators understand students' mental health when students from different regions are exposed to mobile-assisted language learning.

3 METHODOLOGY

This study aimed to understand the academic emotions of EFL students from different areas during their learning process with vocabulary applications, explore the differences, and understand the relationship between regional factors and their academic emotions. A qualitative study approach, which excels in revealing such situated complexities [29], was therefore adopted to observe and compare students' emotions aroused during the process of vocabulary learning on mobile devices.

3.1 Research context

This study was conducted at a top-rated university in China. At the university, English is one of the most famous flagship majors. The English major education curriculum emphasizes both the basic knowledge and professional skills of students. The English majors at this university came from different areas in China, offering a cohort of richly diverse and sufficient participants for the study.

In particular, according to the arrangement of this university, English major students needed to pass the Test for English Majors-Band 4 (TEM-4) in the second semester of their sophomore year, which is a national English proficiency test for Chinese English majors. The test examines students' English listening, writing, reading, and speaking proficiency, and contains various question types, such as dictation, multiple-choice questions, cloze, and composition [46]. Thus, building vocabulary is a crucial task for students during their preparation process [47]. As such, English

major students need to learn these words for the test, and most mobile vocabulary applications have set vocabulary lists for TEM-4, which makes it appropriate to focus on their vocabulary learning through mobile devices.

3.2 Participants

The eight participants in this study, whose profiles are detailed in Table 1, were all first-year English major undergraduates at this college. Chinese was their first language, and they spoke English as a foreign language. These eight participants were recruited through volunteer sampling because the authors did not have access to a large-scale sampling of the first-year group. To this end, the first author posted a recruitment advertisement on WeChat (a social media platform similar to Twitter) to attract participants in a relatively efficient way. The advertisement also displayed the requirements, research procedures, and token of appreciation for the participants. One of the requirements was that the participants had not learned TEM-4 words before the test, which can prevent the previous vocabulary knowledge from influencing the result of this study to a large extent.

Given that the research focuses on exploring regional differences in EFL students' learning processes with mobile vocabulary applications, the participants were divided into two groups according to their hometowns (refer to Table 1).

Table 1. The profile of the pseudonymized participants

Group	Participants	Regions	Gender	Age	Previous Experience with English	Initial Mobile Phone Ownership	The Initial Use of Mobile Vocabulary Applications
Group 1	Shen	A first-tier city in Zhejiang province	Female	19	Her previous education was mainly test-oriented. Her school invited foreign teachers to teach students online and provided students with opportunities to receive English training from some educational organizations.	Middle school	Middle school
	Bi	A second-tier city in Heilongjiang province	Female	19	She attended the best local high school.English teaching did not emphasize test-taking skills. Teachers encouraged students to watch English movies. Her mother was strict with her English study and signed her up for several extracurricular English lessons for her.	Middle school	High school
	Liu	A fourth-tier city in Shanxi province	Male	19	He experienced intense competition in examinations. Teachers did not emphasize the value of listening and speaking ability. He read English newspapers every week. School held multiple English competitions and activities.	Middle school	Elementary school
	Bai		Female	18	Teachers focused on writing ability rather than speaking. She had reading lessons once a week. Sometimes teachers played some English movies in class. She had taken part in some extracurricular English activities.	High school	Middle school

(Continued)

Table 1. The profile of the pseudonymized participants *(Continued)*

Group	Participants	Regions	Gender	Age	Previous Experience with English	Initial Mobile Phone Ownership	The Initial Use of Mobile Vocabulary Applications
Group 2	Du	A fifth-tier city in Jiangxi province	Female	18	Previous education experiences mainly focused on tests. Teachers did not pay much attention to oral English. She had been learning vocabulary by rote.	High school	Middle school
	Jiang	A fifth-tier city in Jilin province	Female	18	Previous education experiences mainly focused on test-taking skills. She had attended a few English extracurricular activities or competitions.	After the college entrance examination	Middle school
	Mi	A fifth-tier city in Xinjiang province	Female	20	She did not have English lessons in high school. She had learned English in a preparatory course for one year before starting college.	After the college entrance examination	University
	Qiu	A sixth-tier city in Jiangxi province	Female	19	Previous education experiences mainly focused on tests. She had never joined in an extracurricular English class. She had reading lessons once a week in high school.	After the college entrance examination	After the college entrance examination

Group 1 included students from developed areas in first-, second-, and fourth-tier cities, while Group 2 consisted of students from relatively underdeveloped areas in fifth- and sixth-tier cities. The division of cities in this study was based on the Chinese classifying standard of city level [48], because different city levels may represent different financial, technological, and educational development.

Besides, to exclude the impact of irrelevant variables as much as possible, the participants' language scores were also collected (refer to Table 2). The test involved was their last semester's intensive reading examination, a comprehensive English test that mainly emphasized students' grasp of vocabulary in terms of denotation, connotation, and grammar usage. It could be seen that there was no distinct regional disparity between these two groups of students before the study. Although their scores were different from each other, the differences might result from individual factors, rather than the impacts of regional factors. Thus, participants' previous vocabulary level was not likely to be an influential factor in the results of this study.

Table 2. Participants' intensive reading scores

Group	Participants	Scores (out of 100)
Group 1	Shen	94
	Bi	82
	Liu	77
	Bai	88
Group 2	Du	75
	Jiang	91
	Mi	60
	Qiu	83

Also, it could be noticed that most students felt anxious and stressed when they started their college life, but they strove to adjust to the new environment and the different learning style in university. As Shen (from a first tier city) said, "*I feel the teaching and learning mode at university is quite different from that in high school and is challenging for me, but after a semester's adjustment my anxiety is not as intense as before*." Bai (from a fourth tier city) also mentioned, "*I think university study has a high requirement on the depth of thinking. At the beginning, I thought my ability in this aspect was relatively poor, but now I have adapted to it step by step*." In Group 2, Qiu (from a fifth tier city) said, "*At first, my thinking mode and learning methods were still the same as in high school, but now I am learning to change and to focus on the improvement of my ability rather than the scores and tests*." Mi (from a sixth tier city) also said, "*At the beginning of last semester, I felt that the lessons were really hard for me and I was very anxious, but gradually I got over it and saw my own progress*." Their words show that they were in similar situations and had almost the same attitudes toward future study in university. This means that the previous emotional state of participants was not likely to influence the results of this study.

3.3 The study

Materials. Regarding the learning tool employed in this study, the researchers of the study chose a Chinese mobile vocabulary application called "Bubei" (a vocabulary application developed by a Chinese company) for its multiple review methods, interesting illustrative examples from TV series or films, relevant collocations, helpful dictations, and individual records of users' learning data; these features are not commonly available in other vocabulary software. The core idea of this vocabulary application, developed by a company located in Beijing in 2014, is to learn words in authentic contexts rather than by rote [49]. Currently, it has become one of the top four most downloaded English vocabulary applications in China, with users mostly in their 20s [50]. In this study, participants were told to use "Bubei" to learn TEM-4 words based on their learning habits for 21 days.

Users checked in every day when they opened the software and got virtual gold coins, which could be used to exchange learning materials, including online dictionaries and lessons. When users clicked "Learn," they began to learn new words. They were first presented with the automatic pronunciation of the word and were supposed to choose the correct meaning of the word from four different choices, which could help users distinguish between similar words. If users' choice was wrong, the application would show the correct meaning of this word as well as a similar word that users had mistaken for. After choosing, users could further learn about the relative knowledge of this word and understand its meaning in context. Users could choose to spell the word if needed, and could delete the word if they were already familiar with it. Further, users could review learned words by clicking "Review." This presented them with opportunities to recall the meaning of the word. After that, they needed to spell these words with the assistance of their Chinese meanings; if they needed to listen to the pronunciation, they could click the "bulb" at the bottom of the screen. If users made mistakes in spelling, they were supposed to repeat the spelling until they spelled every word correctly.

In addition, the application also recorded users' learning statistics, such as the number of words users learn, users' learning time, and their frequency of use, which could manifest participants' usage habits with this application. This record was the source of the quantitative data in this study.

Procedure. The study consisted of three main phases (see Table 3). The eight participants were divided into two groups according to their hometowns; then, all participants were asked to learn the same vocabulary list of TEM-4 words using "Bubei" for 21 days. It should be noted that during the autonomous learning process, participants were required to study according to their habits and in a relatively natural way in order to minimize the interference of the study. Further, the researchers did not give any instructions during that process for the same reason. Students were asked to avoid clocking in during the learning process, in case the function affected their motivation. At the end of the 21 days, each student was interviewed for about 30 minutes about their learning process with "Bubei" as well as their previous experiences with other similar applications.

Table 3. Study procedures for the two groups

Phase	Group 1	Group 2
Phase 1: Classification of participants	Classification: Students were grouped according to the city level of their hometowns.	
Phase 2: Learning TEM-4 words through the application for 21 days	Students were asked to learn TEM-4 vocabulary according to their own pace and habits.	
Phase 3: Individual interviews	30-minute interviews	

3.4 Data collection and analysis

All participants engaged in a semi-structured individual interview that lasted 30 minutes. In the interview, the students were asked several questions about their use of vocabulary applications and their feelings during the learning process. Both the questions and the participants' answers were in Chinese (the participants' first language). The participants were also asked about their previous experiences with using other vocabulary applications, which were discussed during the interview to fully learn about their usage of vocabulary applications and feelings. The contents of the interviews were transcribed and analyzed by the first author, and were also double-checked by the second author. The results were also confirmed by the participants. In addition, during the 21-day learning, the first author also wrote field notes of the participants' learning behavior.

The study primarily adopted qualitative thematic analysis. The participants' interviews were first transcribed and analyzed through inductive thematic analysis. The transcripts were read multiple times. Based on previous relevant literature [36, 38], these transcripts were also deductively coded. The codes utilized in this study to locate expressions about academic emotions were mainly developed according to the categories proposed by Pekrun et al. [6]. However, since the types of academic emotions defined by Pekrun et al. [6] are relatively general and limited, other expressions of academic emotions that occurred in previous research such as [51] were also used to code the text.

Through inductive analysis, several preliminary categories were developed, such as self-recognition of learning achievement, attitudes toward the design of this vocabulary application, and the conflict between course load and mobile vocabulary learning. These categories summarized the factors that might influence participants' academic emotions, and participants from different regions tended to perform differently in these aspects. After a deductive analysis, these categories were combined

into larger themes, including the external factors (factors that are irrelevant to the participants themselves), internal factors (participants' inner perceptions and thoughts), and previous learning experiences.

After sorting and coding the information for each group, the researchers compared the data from these two groups to survey the regional differences between students' academic emotions during their learning process with vocabulary applications. Field notes recorded during the 21 days were also referenced to further refine the codes and categories.

Apart from the qualitative data drawn from the thematic analysis, the number of emotion words and relevant expressions mentioned by each participant was also provided as supplementary quantitative data (see Table 4).

Table 4. The number of emotion words in the interview transcription

Group	Participants	Relevant to Internal Factors		Relevant to External Factors		Relevant to Previous Experiences	
		Positive	Negative	Positive	Negative	Positive	Negative
Group 1	Shen	0	8	4	5	5	4
	Bi	2	10	3	11	7	2
	Liu	5	11	5	4	4	5
	Bai	2	5	5	6	7	4
Group 2	Du	2	6	7	3	2	7
	Jiang	5	3	6	3	1	4
	Mi	9	3	8	1	0	6
	Qiu	4	3	13	2	1	8

4 FINDINGS

The EFL students from different areas presented various academic emotions during their learning processes using the mobile vocabulary application. Students from fifth- and sixth-tier cities (i.e., underdeveloped areas) experienced more positive academic emotions (such as pride, willingness, enjoyment, and admiration) than those who came from first-, second-, and fourth-tier cities (i.e., developed areas). The regional differences in participants' self-recognition of learning achievements, motivation types, and experiences with the design of this app might explain the disparities in positive academic emotions. However, students from underdeveloped areas were also more likely to experience anxiety due to their high self-expectations resulting from intrinsic motivation. Furthermore, students from developed areas tended to be more confident than students from underdeveloped areas, since the education they received in high schools was of higher quality.

4.1 Regional differences: Academic emotions and internal factors in relation to ongoing learning

Regarding internal factors (e.g., self-recognition and learning goals) related to their ongoing learning, students from fifth- and sixth-tier cities reported that they

mostly experienced positive academic emotions (e.g., joy of success and willingness to use the app) in the vocabulary learning process, although to varying degrees and mixed with occasional occurrence of negative emotions (i.e., anxiety). By contrast, students from developed areas, possibly due to a lack of positive influences at the internal level, mostly exuded neutral or negative emotions.

One positive academic emotion demonstrated by those from underdeveloped areas (fifth- and sixth-tier cities) was pride. For example, Mi said, "*When I came across a word that I had just learned with the app and could clearly recall its meaning, I would feel quite proud of myself. It generated a sense of achievement in my heart*." Qiu also said, "*Sometimes I might find a familiar word when I was watching American or British movies, and it turned out to be a word I had learned through this vocabulary application, which was more than amazing*." Such a positive academic emotion seemed mainly related to this group of students' self-recognition of learning achievements in this mobile-mediated learning context. As Mi said, "*I learned a word I did not know before*." Similarly, Qiu said, "*It was an amazing feeling. Words that you did not know or could not remember very well before suddenly became quite familiar [through the use of the application]. At that moment, I felt very proud that my efforts had paid off*."

However, students from developed areas (i.e., first-, second-, and fourth-tier cities) rarely mentioned pride or the joy of success in relation to such self-recognition. Moreover, they experienced what seemed to be disappointment. For instance, Bai noted, "*I could hardly use the words I learned in writing or speaking*." Shen also mentioned, "*I always failed to apply them and could not even remember their meaning the next time I encountered them*." For them, for a lack of self-recognition in their learning through the application, they did not experience pride as the other group of students did. Instead, they experienced disappointment. The difference might be because students from developed areas might value the application only as an additional supplement to their vocabulary learning and did not invest themselves in learning through the application. Bi, who also expressed the same emotion, pointed out, "*I was confused about why I could not remember the words I had just learned and use them proficiently. It was quite disappointing*."

The willingness to keep learning through the application was another type of positive emotion experienced by participants from underdeveloped areas (fifth- and sixth-tier cities). For instance, Mi said, "*I often set learning goals [in regard to learning vocabulary through this app] for myself, which could make me feel energetic and I was willing to keep learning my vocabulary*." Jiang said, "*In my opinion, learning more words [through the application] was quite useful and attractive, which can improve my overall English proficiency, so I wanted to keep learning*." This kind of positive emotion (i.e., willingness) related to the use of the application appeared to be related to the participants' inner motivation and learning objectives. In other words, their engagement in the application seemed to be motivated by their own demands, and they learned words to improve their language skills. As Jiang said, "*For me, learning vocabulary is not for certain tests, and I just feel it is time to build up my vocabulary [through the application]*."

By contrast, students from first-, second-, and fourth-tier cities did not mention willingness to learn with the mobile vocabulary application. Instead, they tended to feel indifferent in the process. For example, Shen said, "*Sometimes I was unwilling to learn the vocabulary*." Bai said, "*I did not feel any significant emotional changes during the learning process*." Such negative emotions were likely to be caused by their lack of internal motivation to use the application. It might be that they were not much invested in themselves or considered the application an innovative method for vocabulary learning but a supplementary aid to their academic learning activities

(e.g., preparing for the examination). As Shen mentioned, "*The biggest reason I started learning English words via vocabulary applications was to cope with examinations, and [on the application] I only memorize words required by English tests. When the external motivations disappeared, I would stop learning words*."

Although the students from the underdeveloped areas (fifth- and sixth-tier cities) demonstrated positive emotions in general, especially in relation to internal factors (i.e., self-recognition of their academic development and internal motivation in learning), they also occasionally projected anxiety. For instance, Jiang noted, "*I will not give up memorizing words because I feel bored or lose motivation, but I sometimes blame myself for not learning enough words*." Qiu also said, "*When I failed to complete my daily task, I felt more than anxious, and it was a terrible feeling*." It looked like they tended to put pressure on themselves to achieve their goals, which may have contributed to their anxiety. Such negative emotions seemed to occur when they felt that they did not complete their academic tasks well or could not assess their academic progress. In other words, these internal factors put the students on a seesaw in which their positive emotions occurred in most cases and lasted for a long time, with the negative emotions emerging intermittently.

The negative emotion, anxiety, was not obvious in the students from the developed areas, who were somewhat neutral in this regard. As Bai noted, "*I sometimes memorized words mainly because I had more leisure time. So, I did not set too strict requirements for myself and did not experience much pressure*." As a group of students who were hardly influenced by those internal factors, their negative emotions of anxiety were also not as strong as those from underdeveloped areas. Understandably, students' anxiety about their use of the mobile application was related more to the extent to which they completed academic learning in relation to internal motivation or perceived progress. Such an extent was weak in the student group from developed areas but strong in the student group from underdeveloped areas.

In summary, considering the regional differences in internal factors, students in Group 2 (from fifth- and sixth-tier cities) were able to recognize their achievements and were largely internally motivated during the learning process, whereas the participants in Group 1 (from first-, second-, and fourth-tier cities) rarely recognized their progress and were externally motivated. Thus, students in Group 2 experienced positive emotions, such as pride and willingness, as well as a negative emotion, anxiety, whereas Group 1 students mainly felt disappointment or indifference.

4.2 Regional differences: Academic emotions and external factors in relation to ongoing learning

Regarding external factors (i.e., the design of the application), participants in Group 2 (from fifth- and sixth-tier cities) primarily reported positive emotions, such as enjoyment and admiration, with the other group demonstrating negative emotions. The two groups both experienced negative emotions in relation to the course load when they used the mobile vocabulary application.

The academic emotions of the two groups differed concerning their practical experiences with the design of this mobile vocabulary application. For example, Jiang, who was from an underdeveloped area and experienced enjoyment and admiration, said, "*This application rendered learning words a process similar to playing games*." Thus, students from underdeveloped areas had positive experiences with the function of the application and felt intrigued by the function/design of the application. Jiang enjoyed learning through the application and shared, "*It seemed*

interesting to me to memorize words [through the application]." Participants reported positive emotions, along with their admiration of the settings and functions of this application.

However, most students in the developed areas seemed to have antipathy toward the function and design of this application. Shen, who felt antipathetic to the process, noted, "*I was resistant to using it*." For this group of students, they might be more critical of the learning methods than the other group and might have their own preferred way of learning vocabulary during their past education. As Shen mentioned, "*I think we should learn words imperceptibly through reading. But when I used the vocabulary application to memorize words, I thought it was utilitarian. I do not like this way*."

Nonetheless, Bai from a fourth-tier city reported a sense of enjoyment and admiration similar to that of students in Group 2. Bai said, "*I think this application was pretty helpful, and I loved listening to the pronunciation of words. The spelling test and the review function of this app also enforced my memory of newly learned words*." Interested in the various functions of "Bubei," Bai expressed her admiration for its design. Bai's distinct emotional experience in this regard could be explained by her personal focus on the mobile vocabulary learning process. Compared with the other participants in Group 1, Bai paid much attention to the diverse functions of this app and recognized their values, while others hardly cared about its design and functions. As Liu, another student in Group 1, who came from a fourth-tier city, said, "*I seldom listened to the pronunciation of words [provided by the app] ... I have no obvious impression of this aspect [the lexical knowledge presented in this application]*."

Regarding the course load, students from the two groups (except for Liu, who came from a fourth-tier city) mentioned that they sometimes felt stressed during the learning process when they had a busy schedule. For example, Bi from the developed area (a second-tier city) noted, "*When I had to cope with my exams and homework, I was overwhelmed by the academic load and was unwilling to learn words*." Qiu from an underdeveloped area (a sixth-tier city) also said, "*Sometimes the quizzes in class were driving me crazy, and I felt too stressed to keep learning words through the application*." Such stress was understandable. Given that the application was used as supplementary learning rather than mandatory learning. When they had a mobile study load conflicting with their academic learning related to their mandatory courses, the participants' willingness to learn vocabulary through the application was mitigated.

Nevertheless, the course load did not exert a negative influence on Liu. Liu, the only student who did not report this kind of stress, said, "*Although I also faced the exams and homework, I made myself a study plan that was not too strict, so I did not experience obvious stress*." It is possible that the course load was not a common factor that influenced the students; instead, it may have expanded individual students' ability to handle their study schedules.

Concerning the regional differences in external factors, some participants from fifth- and sixth-tier cities (as well as Bai from a fourth-tier city) admired the design of this mobile vocabulary application, while others (from first-, second-, and fourth-tier cities) did not. As such, students recognizing the advantages of "Bubei" experienced enjoyment during the learning process, and other participants felt a sense of antipathy. Furthermore, the study load in university seemed to be an influential factor in participants' emotions, despite the fact that there was no regional difference in this aspect. Most students (except Liu, who came from a fourth-tier city) reported that they experienced stress when facing the conflict between the study load and the learning of words with the application.

4.3 Regional differences: Academic emotions and influencing factors in relation to previous education

In relation to factors pertaining to their previous education, students in Group 2 who came from underdeveloped areas (i.e., fifth- and sixth-tier cities) felt frustrated and were not confident during their learning through the application. By contrast, students in Group 1 (from first-, second-, and fourth-tier cities) were more confident in the learning process.

One factor was their English proficiency carried over from their previous education. For instance, Qiu from a sixth-tier city said, "*The difference (in English language proficiency) between my classmates and me imposed a sense of self-doubt on me. Sometimes, I notice my academic capacity and communicative ability are inferior to some of my classmates, which makes me frustrated [when learning through the application].*" Bi from a second-tier city said, "*I was confident about my English proficiency, [so is the use of the application].*" The students felt different in the new context where there was a gap in English proficiency. Those (i.e., Group 1 from the developed areas) who had a good accumulation of English competency felt confident in learning, including the use of the mobile application. Those from the underdeveloped areas (Group 2) felt less confident in their English competency in the new context, and such low confidence was also reflected in their use of the mobile application.

The difference in students' degrees of confidence in this regard was also aggravated by different educational experiences before they entered college. Qiu from a sixth-tier city said, "*Some of my classmates have well-educated parents, but I was brought up by my grandparents because my parents work in distant cities. I think the education I had received before mainly emphasized how to score high on exams.*" Different from Qiu, Bi, from the second-tier city, mentioned, "*My mother was very strict with my English study, and she had signed me up for several English cram classes to improve my ability when I was in high school*" and "*My English teacher in high school usually played Western films to expand our horizons, rather than merely focusing on examinations.*" Students from developed areas had received diverse types of educational support, including that from the school and family; the education they had received also emphasized quality rather than being examination-focused. As such, they felt more confident in terms of their learning at university, including the use of the application. As Qiu, who came from a sixth-tier city, further noted, "*Their knowledge of foreign countries is abundant. I feel that they [those from developed areas] have already expanded their perspectives a lot ... [so I feel a lack of confidence in learning].*"

Except for the participants' past learning experiences, Qiu, a student from a sixth-tier city, also mentioned that her previous use of technological devices influenced her emotional patterns. She noted, "*Some of my classmates owned their mobile phones at an early age, but I did not have my own phone until I graduated from high school. Thus, they are adept at using their mobile phones to find all kinds of resources that facilitate their English learning. There is a large gap between them and me [in terms of using mobile phones to learn English], which sometimes overwhelmed me.*" Her words showed that the technological differences made her feel frustrated to some degree.

Understandably, the more past experiences with technological use the students had, the more confident they would feel about the current technological use, such as their use of the vocabulary application in the current study. However, other students in Group 2 (from fifth- and sixth-tier cities) did not mention the obvious frustration caused by the disparities in terms of previous technological use experiences. Thus, Qiu's sense of frustration related to her past use of technological devices might have resulted from her personal family background and upbringing.

Similarly, Bai (Group 1, from a fourth-tier city) felt enjoyment and admiration when experiencing the functions of this app. She mentioned, "*The simple and beautiful interface, as well as the various functions of this app, attracted me a lot.*" This was different from the perceptions of students from developed areas, and this disparity might be related to her personal focus on the learning process. Further, Liu (Group 1, from a fourth-tier city) has not been negatively influenced by the course load since he set a relatively easy mobile vocabulary learning task for himself. As he noted, "*I think my daily study goal was pretty easy to accomplish, and thus it did not conflict with my course load.*" Bai's, Liu's, and Qiu's experiences point out that individual differences may influence students' academic emotions in addition to regional differences.

Taken together, it can be seen that the regional divergence in previous education experiences (specifically referring to language proficiency and educational support received before entering university) rendered the participants in Group 2 (from fifth- and sixth-tier cities) frustrated and not confident when they learned vocabulary with "Bubei".

5 DISCUSSION AND IMPLICATIONS

The case study yielded several findings. Concerning their academic emotions, the students from fifth- and sixth-tier cities (i.e., underdeveloped areas) were more likely to experience positive emotions such as pride and willingness, while students from first-, second-, and fourth-tier cities (i.e., developed areas) tended to feel antipathy or disappointment. This echoes some previous studies on the differences between rural and urban students' academic emotions in English learning. For example, as Lamb [52] noted, students from rural areas tend to have more motivation to learn English than urban students. Thus, rural students have positive attitudes and are hopeful about their future learning. However, the current study was conducted at a Chinese EFL university and focused on a specific field: mobile-assisted vocabulary learning. In this sense, the findings contribute to the literature on students' emotions by highlighting regional differences in a new context, which has not been explored in previous research. Indeed, previous scholars have barely studied students' academic emotions in their mobile-assisted language learning process, let alone focused on regional differences. Thus, the findings of this study are new to a large extent. Existing research on English vocabulary applications has mainly focused on their impact on English learning [2]. In this situation, this study augmented our understanding of the regional differences that may exist in students' academic emotions during the learning process with vocabulary applications.

Further, the regional differences in academic emotions might be explained by internal and external factors, such as students' self-recognition of learning achievement, motivation, and their experiences with the design of this app. This lends support to prior studies on the impact of influential factors on students' academic emotions. For example, Taj et al. [53] mentioned that factors such as workload and self-aspiration could impact students' academic emotions. Nevertheless, the current study focused specifically on the influences of various regional differences on EFL students' academic emotions and explored this topic in mobile-assisted learning. In this regard, the findings add to previous research by investigating different types of regional factors and their impacts on academic emotions in a mobile-assisted language learning context.

Regional differences in previous educational experiences were also found to influence students' academic emotions. To illustrate, students from first-, second-,

and fourth-tier cities received more and better educational resources in high school, contributing to the negative emotions (frustration and lack of confidence) experienced by students from fifth- and sixth-tier cities. This finding is similar to several previous studies, such as [36] on the influence of educational disparities on EFL students. That is, rural students received fewer educational resources than their urban counterparts, and the quality of their teachers cannot be compared with that of urban schools. However, the current study focused on a mobile-assisted learning context. Thus, this study complements previous research by specifically exploring the impact of regional factors on students' academic emotions in a new situation.

The implications of the study include the following aspects. First, although different in type and degree, all students in the research showed negative emotions. Thus, students need to attend to their subjective well-being when they learn language through mobile applications. As Wortha et al. [54] suggested, negative emotions are negatively related to learning outcomes in mobile learning contexts. For instance, students need to observe their emotional changes in the mobile learning process, find the root causes, and actively try to solve their concerns.

Second, participants mentioned that they had noticed regional disparities in educational quality and technological resources, which calls on Chinese administrators to implement measures to mitigate such differences. Li and Xiao [55] noted that the government should foster a balance of educational and informational resources between regional areas. To illustrate, administrators could increase educational input in less developed areas and accelerate the reform of rigid teaching modes in some areas in order to let students develop comprehensive English skills.

Third, some students had unpleasant experiences with the design of this app, thereby appealing to the designers of mobile-assisted learning applications to improve the settings and functions of apps to provide users with a better mobile-assisted learning environment. We suggest developing mobile language learning applications that incorporate the regulation of users' emotions to maximize learning outcomes.

6 CONCLUSION

Through a case study, we found that EFL students from different areas presented various academic emotions during their learning processes with mobile vocabulary applications. Students from underdeveloped areas experienced more positive emotions (such as pride, willingness, enjoyment, and admiration) than those from developed areas. However, students from developed cities were more confident in their mobile vocabulary learning process. These disparities in academic emotions may be explained by diverse types of regional differences (e.g., self-recognition of learning achievement).

The limitations of the study also merit our attention. One is that the study was conducted through a qualitative study approach, and the sample size was small; the research findings should be treated cautiously. However, the field explored in the current study is relatively new, and the research is not about seeking a generalized understanding. Another limitation is that, since volunteer sampling was adopted in this study, the gender ratio was not balanced among participants, and most participants were female. Nevertheless, neither in this study nor in previous research had different genders influenced the learning process with mobile phones; thus, the interfering impact of the gender ratio might be trivial. The last point is that the data collected in this study about participants' previous motivational level and

language proficiency was limited. Nonetheless, the main focus of this study is participants' academic emotions produced in the process of mobile vocabulary learning and the regional differences. Hence, the discussion of students' prior motivation and language level does not need to be that detailed. However, a quantitative analysis of students' motivation level prior to the study may offer a more precise understanding of it.

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