Factors Influencing University Students' Intention to Engage in Mobile-assisted Language Learning through the Lens of Action Control Theory

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ABSTRACT: Mobile technology is regarded as a helpful tool facilitating language learning. However, the success of mobile technology largely depends on learners' acceptance. This study explored the factors that may affect students' intention formation regarding mobile-assisted language learning (MALL) in the context of higher education through the lens of action control theory. The study adopted mixed methods: an online survey of 557 students and individual interviews with 70 students. The findings indicated factors in each of the three dimensions (preoccupation, hesitation, and volatility) of action control theory that positively or negatively influenced the students' intention to use mobile technology for language learning. According to the findings, these influential factors may be related experiences in the preoccupation dimension, design and feature interference of MALL applications and teachers' teaching style influence in the hesitation dimension, and overall appraisal and performance impact and other novelty interference in the volatility dimension. Students' success in initiating and completing a MALL task depends on mainly depends on their acceptance of MALL, and this acceptance is affected by these factors in a positive or negative direction. The strengthening of the positive influence and the weakening of the negative influence caused by these factors should be paid attention to in the process of performing and engaging in a MALL task. Students' concerns regarding the use of mobile technology in language education are addressed with suggestions for future research and practice in light of the findings.

Keywords: Mobile technology, Language learning, Learning intention, Action control, Higher education

1. Introduction

Technology-enhanced learning, in particular with mobile devices (e.g., smartphones and tablets), is under the spotlight in higher education. The majority of mobile device users are college students aged 18–29 years (Pew, 2021; Poushter, 2016). Advancements in mobile technology have greatly supported language learning in higher education settings (Crompton & Burke, 2018; Hwang & Fu, 2019; Ke & Hsu, 2015; Kukulska-Hulme et al., 2017; Reinders & Pegrum, 2017) because such technology can be a tool conducive to fostering autonomous language learning anywhere and at any time (Reinders & Benson, 2017) and enhance learning outcomes, interaction, and positive perceptions (Golonka et al., 2014). Due to the benefits of mobile-assisted language learning (MALL), MALL technology has gradually been integrated into language curriculum; however, factors positively or negatively influencing the integration of MALL cannot be ignored (Chwo et al., 2016).

The success of implementing mobile technology for language learning depends on student acceptance (Hsieh et al., 2017). The previous studies adopted the technology acceptance model (TAM), the extended TAM (e.g., the General Extended Technology Acceptance Model for E-learning, Abdullah & Ward, 2016), self-determination theory of motivation (Nikou & Economides, 2017), and activity theory (Lin et al., 2020) to investigate factors influencing learners' intention to adopt mobile learning or MALL. Unlike the previous studies, the present study adopted action control theory (ACT; Kuhl, 1994a) to design survey items for each of the three dimensions (preoccupation, hesitation, and volatility) based on the context of MALL to investigate possible factors influencing learner intention transformation to accept or reject MALL. Limited research has focused on behavioural intention changes during MALL according to a meta-analysis conducted by Hwang and Fu (2019). The causes underlying behavioural intention change in MALL are poorly understood. In addition, in second language acquisition (SLA) research, ACT proposed by Kuhl (1994a), a prominent theory in mainstream psychology, has been adopted to investigate foreign language learner behaviour and motivation (Dörnyei & Ryan, 2015; Ellis & Shintani, 2014; Khany & Amiri, 2018; MacIntyre & Blackie, 2012; MacIntyre & Doucette, 2010). ACT focuses on continuums of two poles (state and action orientations) in three dimensions (preoccupation, hesitation, and volatility). These tendencies may affect whether an individual is able to initiate, focus, and follow up on a task (Jaramillo et al., 2007). ACT has high explanatory potential for outcome variables in the context of second language learning (Ellis & Shintani, 2014).

The current study adopted ACT to explore possible factors affecting behavioural intention changes in the course of MALL tasks in higher education settings. In view of this, the study aimed to explore what determinants could influence intention transformation when learners were engaging in MALL tasks in the three dimensions (preoccupation, hesitation, and volatility) of ACT and to deeply investigate learners' perception that the interference factors could influence their intention changes to adopt MALL in a positive or negative direction. The study contributes to the field of MALL use in higher education in the following respects. First, the investigation may broaden knowledge of the causes underlying behavioural intention change in MALL tasks. Second, the findings can provide a reference for higher education educators and developers of MALL systems to tailor tasks promoting positive change in student intention without interference from negative factors that severely hamper the completion of MALL tasks. Finally, to our knowledge, this is the first study to adopt a cross-sectional survey and individual interviews to examine the factors influencing student intention transformation in MALL tasks in higher education. In the following sections, previous studies related to this study in Background, research participants, designs, and analytical methods in Research Methodology, and research findings and discussion in Results and Discussion provide a comprehensive picture of this study.

This study investigated possible factors affecting learners' behavioural intention to accept MALL through the lens of ACT. We addressed two research questions:

- RQ1. What factors affect the behavioural intention of university students to use a mobile device for language learning through the lens of ACT?
- RQ2. What perceptions do students have regarding the factors affecting their MALL intention through the lens of ACT?

2. Background

2.1. Mobile-assisted language learning

Handheld mobile technologies are influencing how higher education students learn languages. Mobile devices now outnumber conventional desktops (Pegrum, 2014). Interest in using mobile devices such as smartphones and tablets for educational objectives (Duman et al., 2015) has gradually increased. Mobile learning is defined as learning involving the use of a mobile device (Crompton, 2013). In a special issue of *ReCALL* in 2008, Kukulska-Hulme and Shield introduced MALL as a developing field. In MALL, learners adopt mobile technology to engage in language learning tasks (Burston, 2015; Kukulska-Hulme et al., 2017; Shadiev et al., 2017).

In higher education environments, many researchers have highlighted the role of mobile technology in effective language learning. Mobile technology can enhance and improve language learning performance because of its key advantages, including ubiquity, adaptability to personal study habits, higher authenticity, easy accessibility of information, and continuity of study on different devices (Burston, 2015; Duman et al., 2015; Kukulska-Hulme et al., 2017; Loewen et al., 2019; Petersen & Sachs, 2016; Reinders & Pegrum, 2017). Students can obtain materials and study languages anytime and anywhere. Numerous studies have indicated that mobile technology could become a helpful tool for vocabulary learning (Chen & Chung, 2008; Chen et al., 2019; Kim, 2011; Lin & Lin, 2019; Ono et al., 2015; Stockwell, 2007; Wu & Huang, 2017), speaking and listening skills development (Hwang & Chen, 2013; Hwang et al., 2014; Nguyen et al., 2018), reading ability enhancement (Chen & Hsu, 2008; Hsu et al., 2013), grammar learning (Li & Hegelheimer, 2013; Wang & Smith, 2013), and writing skills improvement (Jiang & Zhang, 2020).

MALL researchers have identified drawbacks of mobile technology and factors affecting acceptance of the technology for language learning. Studies have indicated that small screen size, typing problems, connection problems, and privacy intrusion can negatively influence learning intention and outcomes (Lai & Zheng, 2018; Li & Hegelheimer, 2013; Thornton & Houser, 2005). In addition, not all students are willing to use mobile learning applications (Hsu, 2015; Kim et al., 2017; Stockwell, 2010). Successful adoption of mobile technology for language learning is dependent on student acceptance of such technology (Hsieh et al., 2017). Increasingly, studies have focused on investigation of learner intention to engage in MALL tasks with the adoption of the technology acceptance model (Chang & Hsu, 2011; Chang et al., 2013; Chen, 2018; Hoi, 2020; Nie et al., 2020). Because mobile technology as a major role can be conducive to language learning, the factors affecting students' intention to adopt such technology for language learning should be investigated.

2.2. Action control theory

ACT, proposed by Kuhl (1994a), is a prominent theory in mainstream psychology. According to the theory, individual differences play a central role in emotion regulation, cognition, and behaviour in fulfilling intentional action. Action control takes the effects of mediating processes into account because these processes influence intentions. In the theory, a continuum exists between action and state orientations. Action-oriented learners can pursue their intentions or goals and then use appropriate cognitive skills to successfully convert their intentions into actions. By contrast, state-oriented learners do not have the ability to transform their intentions into actions because of negative states (e.g., a fear of failure or hesitation to initiate an action; Diefendorff et al., 2000).

Apart from the general concept of action-state orientation, ACT has three components, namely preoccupation, hesitation, and volatility. Preoccupation is defined as the degree to which individuals manage interfering and unpleasant thoughts in a past, present, or future state. The opposing poles in the preoccupation component are preoccupation versus disengagement. At the disengagement pole, action-oriented individuals disentangle themselves from thoughts of alternative targets or unpleasant events that may hamper progress in a given task. By contrast, a state-oriented individual at the preoccupation pole cannot disentangle from unpleasant experiences such as past failures. Hesitation pertains to the degree to which individuals have trouble converting decisions into action and the hesitation between continuing an already initiated task and beginning a completely new one. The opposing poles in the hesitation component are hesitation versus initiative. Action-oriented individuals at the initiative pole easily initiate work on tasks. By contrast, a state-oriented individual at the hesitation pole may not have the behavioural capacity to launch actions. Volatility is defined as the degree to which individuals are distracted when performing an already initiated action. Action-oriented learners effectively sustain strong and sustained intention until the task is completed. However, a state-oriented learner is easily distracted from current tasks, which impairs their overall performance. They may struggle to appropriately initiate new and novel tasks.

ACT, borrowed by SLA researchers, has gradually earned a place in second language (L2) motivation research (Dörnyei, 2001; Dörnyei, 2005; Ellis & Shintani, 2014) and has been empirically corroborated (Khany & Amiri, 2018; MacIntyre & Blackie, 2012; MacIntyre & Doucette, 2010; MacIntyre et al., 2001). Khany and Amiri (2018) examined a proposed model in terms of ACT, motivational self-system of L2, and learners' motivated behaviour in the context of a foreign language. They reported that preoccupation, hesitation, and volatility had negative impacts on L2 learners' motivated behaviour and learning experience. Students' ideal L2 self was positively correlated with volatility, but a negative correlation existed between students' "ought-to" L2 self and hesitation. MacIntyre and Blackie (2012) assessed the contribution of ACT in predicting nonlinguistic outcomes by using the Gardnerian socioeducational model and Pintrich's expectancy-value model. They discovered that action control is highly related to nonlinguistic outcomes. Hesitation can predict willingness to communicate, language anxiety, perceived communication competence, and the intention to continue L2 learning. Preoccupation was a determinant of perceived communicational ability, willingness to communicate, and language anxiety, and volatility was a predictor of language anxiety.

Despite these findings, little research examined the latent contribution of ACT in mobile technology–enhanced language learning contexts in higher education settings (Hsu & Lin, 2022). Researchers have extended the technology acceptance model with other factors to investigate learner acceptance of MALL (Chen, 2018; Nie et al., 2020; Park et al., 2012). However, little is known regarding the factors affecting learner acceptance of MALL in the process of behavioural intention transformation in the three dimensions (preoccupation, hesitation, and volatility) of ACT. Accordingly, this study examined possible factors in the behavioural intention transformation of university students when they are performing MALL tasks, with a focus on their perception in each dimension of ACT.

3. Research methodology

3.1. Participants and sample size

As for cross-sectional survey, the participants in this study were 557 undergraduate students of six universities in Taiwan learning English as a foreign language. All of them voluntarily filled in the online questionnaire. Of all participants, 167 (30%) were males and 390 (70%) females. Most participants (500; 89.8%) were aged under 20 years, and 57 (10.2%) participants were aged 21–25 years. Given the focus of the study on MALL, the participants' English language learning experience with mobile devices was collected to ensure that all used mobile devices to learn English. In total, 155 (27.8%) participants had less than 1 year of experience learning

English with mobile devices, with the remaining participants (402; 72.2%) having learned English with mobile devices for more than a year.

As for interviews, in all, 70 undergraduate students (56 males and 14 females) of one university in Taiwan were recruited as interviewees; 65 (92.8%) were aged ≤ 20 years and 5 (7.1%) were aged 21–25 years. They all signed the consent form and agreed to participate in the interviews of the study. The mobile devices the participants used varied: 69 (98.5%) owned a smartphone, 15 (21.4%) had a laptop, and 3 (4.2%) owned a tablet. All the interviewees had experience learning English with mobile devices. Overall, 63 (90%) had less than 1 year of English language learning experience with mobile devices, and the remaining 7 (10%) had used a mobile device to learn English for 1–3 years.

3.2. Research design

The study adopted ACT to explore the factors university students perceived as affecting their behavioural intention to use mobile devices to learn English, in the three dimensions of preoccupation, hesitation, and volatility. Mixed methods were employed for data collection: a quantitative one (a cross-sectional survey) and a qualitative one (individual interviews). Dörnyei (2007) indicated that researchers commonly employ interviews and questionnaires for data collection. A survey following online convenience sampling can be used to collect data from numerous individuals at a single point in time (Fraenkel et al., 2012). Interviews enable researchers to investigate people's views in greater depth (Kvale, 1996; Kvale, 2003).

3.3. Data collection and analysis

The survey was designed in terms of ACT to explore possible factors affecting the behavioural intention transformation process when students engage in MALL tasks, among the three dimensions (preoccupation, hesitation, and volatility). Ten open-ended questions were designed for the semi-structured interviews. To ensure content validity, the survey items and interview questions were amended a few times based on the four experts' suggestions. The major revision suggestions from the four experts were summarised as follows. First, the tense of each survey item should be revised from the past tense to future tense. Second, the four survey items in the hesitation construct should be concise and clear, not wordy. Third, the previous English learning experience should be an interference factor, so it should be one of the survey items in the preoccupation construct. Fourth, teaching style may be a possible factor interfering learner intention to initiate a MALL task, so it should be added in the hesitation construct. Fifth, in the second survey item of the volatility construct, "successful" should be used to describe MALL performance to ensure that learners will have intention to continue using mobile devices for their English learning when they have good learning performance in a MALL task. Sixth, the interview question design should be based on the ten survey items to gain an in-depth understanding of related specific events influencing the learners' intention to use mobile devices for their English learning in the three ACT dimensions. Finally, for each interview question, it should be necessary to invite interviewees to share previous related experiences and to explain whether the shared experience may positively or negatively influence their intention to use MALL in each of the three ACT dimensions. The four experts had more than 15 years of English language teaching experience. The items of the scale and interview questions were translated into Mandarin. We invited two qualified participants to fill out the Mandarin version of the questionnaire and to review the interview questions to ensure that all the items in both instruments were understandable. According to their suggestions, the items were revised to achieve the desired level of readability. The two participants who supported the pretesting process were excluded from formal sampling.

The survey comprised two sections: (1) a scale for possible factors affecting behavioural intention to continue using mobile devices to learn English, and (2) demographic information. According to Table 1, the ten scale items were designed in accordance with ACT (Kuhl, 1994a), the Action Control Scale (ACS-90, Kuhl, 1994b), and the technology acceptance model (Davis, 1989). The first three items focused on preoccupation; the following four items were related to hesitation; and the final three items measured volatility. A 7-point Likert scale (1 = strongly disagree, 7 = strongly agree) was adopted. The ten opened-ended questions of the interviews were based on the ten items of the scale.

In the survey, 557 valid questionnaires were collected. The reliability and validity of the measured items were investigated, and Pearson correlation analysis was used to assess the relationships among the three constructs. Descriptive statistics are used to summarise and present quantitative data. Qualitative data from the interviews were analysed in three stages: description, analysis, and interpretation (Wolcott, 1994). As noted by Wolcott (1994, p. 12), description can "address what is going on here and single out some things as worthy of note and

relegates others to the background;" analysis addresses "the identification of essential features and the systematic description of interrelationships among them;" and interpretation addresses "processual questions of meanings and contexts." In data analysis, recurring themes can provide in-depth information.

4. Results

4.1. Descriptive statistical analysis of the items in each construct

As presented in Table 1, among all measured items, the total average for the hesitation construct (mean [*M*] = 5.99, standard deviation [*SD*] = 1.10) was highest, followed by preoccupation (*M* = 5.64, *SD* = 1.18), and volatility (*M* = 5.51, *SD* = 1.16).

Table 1. Descriptive statistics of measured items of three ACT constructs

Construct	Measured items	*M*	*SD*	Rank
Preoccupation	1. Previous experiences of English learning through mobile devices will influence if I am willing to use mobile devices to learn English.	5.77	1.06	1
	2. Previous experiences of using mobile devices will influence if I am willing to use mobile devices to learn English.	5.59	1.24	2
	3. Previous experiences of English learning will influence if I am willing to use mobile devices to learn English.	5.55	1.24	3
Average		**5.64**	**1.18**	**-**
Hesitation	1. The interface of MALL will influence my decision on if I will use mobile devices to learn English.	5.78	1.20	3
	2. The content of MALL will influence my decision on if I will use mobile devices to learn English.	6.19	0.98	2
	3. Teachers' teaching styles will influence my decision on if I will use mobile devices to learn English.	5.74	1.29	4
	4. Convenience and usefulness of mobile devices will influence my decision on if I will use mobile devices to learn English.	6.25	0.94	1
Average		**5.99**	**1.10**	**-**
Volatility	1. My appraisal of the whole MALL procedure will influence if I am willing to continue using mobile devices to learn English.	5.95	1.04	2
	2. Successful MALL performance will influence if I am willing to continue using mobile devices to learn English.	6.15	0.94	1
	3. Other, novel things will not influence if I am willing to continue using mobile devices to learn English.	4.42	1.51	3
Average		**5.51**	**1.16**	**-**

4.2. Factor analysis

Factor analysis is a statistical method used to describe variability among observed, correlated variables in terms of a potentially lower number of unobserved variables called factors. Varimax rotation was used to examine the construct characteristics or degree of concept. The Kaiser–Meyer–Olkin (KMO) test for sampling adequacy was used for the evaluation of size. KMO values range between 0 and 1. A high KMO value denotes several common factors between items and thus indicates suitability for factor analysis. When the KMO value is lower than 0.5, conducting a factor analysis is not recommended (Kaiser, 1974). Among the constructs, the KMO value was highest for hesitation (0.750), followed by preoccupation (0.696) and volatility (0.526; Table 2). Thus, all values were higher than the threshold value (0.5).

Table 2. KMO value of each construct

Construct	KMO value
Preoccupation	0.696
Hesitation	0.750
Volatility	0.526

4.3. Reliability and validity analysis

4.3.1. Reliability analysis

For reliability analysis (Table 3) to determine whether items had a suitable level of internal consistency, the criteria of composite reliability (CR) and Cronbach's α of at least 0.6 (Fornell & Larcker, 1981) were adopted. Latent variable values that are highly correlated indicate that the consistency of the construct reflected by the items is high. In the results, the CR of the latent variables for all constructs ranged between 0.73 and 0.80, and Cronbach's α ranged between 0.811 and 0.863, showing that the latent variables had good reliability.

4.3.2. Validity analysis

A validity analysis evaluates the correctness of a questionnaire, which is often reflected by three indicators, namely content validity, convergent validity, and discriminant validity. Again, the questionnaire items were based on relevant literature and were discussed and reviewed by four experts. Therefore, the questionnaire can be considered to have content validity. For favourable convergent validity, individual factor loadings must reach 0.5 or higher and range between 0 and 1. For favourable discriminant validity, the square root of the average variance extracted (AVE) of one construct must be larger than the correlation coefficient of the other (Fornell & Booksten, 1982; Fornell & Larcker, 1981). The convergent validity analysis revealed that individual factor loadings were all greater than 0.5, and the AVE of the latent variables ranged between 0.47 and 0.52 (Table 3). The AVE of each construct should be higher than 0.5, but we accepted 0.4 because, according to Fornell and Larcker (1981), if AVE is less than 0.5 but CR is higher than 0.6, the convergent validity of the construct is adequate. The CR of each construct was higher than 0.7; thus, an AVE between 0.4 and 0.5 was acceptable. The square roots of the AVE of the latent variables were 0.688–0.724 (Table 4). These values were acceptable (Fornell & Larcker, 1981).

4.3.3. Correlation analysis

The mean and standard deviation for hesitation were 5.99 and 1.10; those for preoccupation were 5.64 and 1.18; and those for volatility were 5.51 and 1.16. According to Table 4, preoccupation (r (555) = 0.540, $p < .01$) and hesitation (r (555) = 0.577, $p < .01$) were positively correlated with volatility. The variable preoccupation (r (555) = 0.534, $p < .01$) was positively correlated with hesitation. Generally, researchers believe that a correlation coefficient of < 0.3, 0.3–0.7, and > 0 indicates a low, moderate, and high correlation, respectively. Therefore, the three variables were moderately correlated (Hwang, 2018).

Table 3. Reliability indices and factor loadings for each construct

Construct	Measured item	Factor loading	AVE	CR	Alpha
Preoccupation	P1	0.613	0.47	0.73	0.811
	P2	0.668			0.818
	P3	0.772			0.863
Hesitation	H1	0.696	0.51	0.80	0.814
	H2	0.771			0.815
	H3	0.511			0.818
	H4	0.836			0.822
Volatility	V1	0.759	0.52	0.77	0.813
	V2	0.732			0.836
	V3	0.679			0.816

Table 4. Discriminant validity and correlation

	Preoccupation	Hesitation	Volatility
Preoccupation	0.688		
Hesitation	0.534**	0.714	
Volatility	0.540**	0.577**	0.724

Note. $^{**}p < .01$.

4.4. Student perceptions of factors affecting MALL, in the ACT dimensions

To address the second research question, 70 interview transcripts were analysed. The steps (description, analysis, and interpretation) proposed by Wolcott (1994) were adopted to analyse the qualitative data of the interview transcripts. First, we found out the whole picture of the interview transcripts and then selected the noteworthy parts related to factors influencing learner intention changes in each of the three ACT dimensions. Secondly, we identified essential features (e.g., interference from previous experiences and application design and feature impact) and systematically analyse the interrelationship among these features. Finally, we interpreted the correlations between the features and the three dimensions (preoccupation, hesitation, and volatility) of ACT and summarised the recurring themes, offering in-depth information. The major themes that emerged from the data were as follows: related experiences in the preoccupation dimension; design and feature interference of MALL applications in the hesitation dimension; teaching style influence in the hesitation dimension; overall appraisal and performance impact in the volatility dimension; and other novelty interference in the volatility dimension.

4.4.1. Related experience in the preoccupation dimension

With preoccupation defined as interfering and unpleasant thoughts hindering individuals to initiate an act (Kuhl, 1994a), students with a positive previous experience can detach themselves from such thoughts to initiate a task, whereas those with a negative previous experience may lack such an ability. This phenomenon was noticeable in mobile-assisted English language learning. Most participants mentioned that positive experiences in mobile-assisted English language learning, using mobile devices, and English language learning may enhance their willingness to initiate a MALL task, whereas some stated that they were unable to disentangle negative experience to conduct such a task. Participant 3 reported a positive experience as follows:

I've had a good experience in adopting Quizlet to improve my English vocabulary learning. Its merits such as user-friendly interface, various learning activities, and quiz games could effectively improve my vocabulary scores. I can learn English vocabulary wherever and whenever I want. I'll initiate similar mobile-assisted learning tasks in the future because of such positive experiences.

However, Participant 15 discussed a negative experience in mobile device use for English language learning:

I don't initiate a new mobile-assisted learning task because I've had a negative English learning experience with mobile devices. My high school English teacher assigned English tasks which we needed to complete on a mobile English learning application, Duolingo. Although it was an interesting way to learn English, it made my eyes strain and some pop-up advertisements frequently interrupted my flow and learning attention. In the future, these two reasons may demotivate me to initiate such tasks.

Most participants reported that the ubiquity of mobile devices can help them easily commence English language learning tasks ("I can use my smartphone anytime and anywhere; this ubiquity can help me break the ice on mobile-assisted language learning tasks" #7). However, a few students firmly believed that their smartphone was for communication purposes rather than for English language learning ("I will not use my smartphone to engage in any English learning tasks because my smartphone is used for contacting my friends and families, rather than for English learning" #23).

Most interviewees expressed that their previous English language learning in a fixed place (e.g., classroom or cram school) caused them to resort to mobile technology because it helped them learn English anytime and anywhere (e.g., "Learning English in class or cram school did not help me effectively learn English, so I'm grateful for mobile technology which can help me learn English anytime and anywhere" #39). However, a few students reported that they preferred to learn English with teachers in person because they could obtain immediate feedback from teachers if they had questions. MALL tasks cannot offer this immediate interaction (e.g., "In past face-to-face English learning, I could immediately ask teachers questions and obtain answers in class; however, I can't ask questions and get answers immediately on MALL applications" #49). As stated earlier, students may become paralysed in the learning process because of related negative experiences or they can detach themselves from extraneous thoughts regarding unrelated goals by using positive related experiences.

4.4.2. Design and feature interference of MALL applications in the hesitation dimension

Hesitation denotes an inability to convert decisions into actions (Kuhl, 1994a). In this dimension, the perceived design and features of MALL applications may interfere with a learner's determination on whether to continue

an initiated MALL task. After learners commence a MALL task, they experience the design and features of MALL application, causing hesitation between continuing the initiated task and starting a new task. Most participants reported that an intuitive and user-friendly interface design and diverse MALL features made them firmly continue initiated MALL tasks:

When I initiated a MALL task in the past, the intuitive and user-friendly interface, various and interesting learning activities, and learning anytime and anywhere could keep me engaged in the initiated task without being tempted and disturbed by other new things. (#5)

By contrast, a complex interface design, repetitive activities, and content that is too difficult or monotonous may cause learners to hesitate regarding whether to remain engaged in an initiated MALL task:

In the past, after conducting a vocabulary learning task on Quizlet for several weeks, I stopped to look for new ones because it was too boring to use repetitive vocabulary learning activities like the flash cards and match activity. (#43)

I've used the Voice of America application to enhance my listening, but I gave up using it because of its complex and unintuitive interface. (#8)

4.4.3. Teaching style influence in the hesitation dimension

Teaching style may be a primary factor influencing continual MALL. More than 90% of the participants stated that if a teacher had a vivid, interesting teaching style, they would remain engaged in MALL tasks rather than abandoning them in favour of a novel task (e.g., "One of the English teachers I had before had a vivid and interesting teaching style. She guided us to learn English words on Kahoot. I kept learning English via Kahoot because of her teaching style, not Kahoot" #54). Interviewees also indicated that traditional and demanding teaching styles could demotivate them, as indicated by the following response:

I've used mobile devices to learn English, but later I stopped using this method because of my demanding English teacher. I knew this method could be beneficial for my English learning. However, I didn't like my teacher's teaching style, so I didn't continue using her recommended mobile learning application, Quizlet. (#2)

4.4.4. Overall appraisal and performance impact in the volatility dimension

Volatility refers to the degree to which individuals are distracted when conducting a task. In this dimension, some factors may effectively sustain learners' focus on a MALL task; others may easily distract learners from a MALL task and impair their overall performance. Most participants stated that if their overall appraisal of and performance in a MALL task was positive, they could remain focused until its completion (e.g., "In the past, while I was doing an English learning task on Kahoot in class, I decided that this was the most effective way to improve my English learning performance, so I tried my best to complete it" #33). Some participants abandoned a MALL task and found other, novel activities when they appraised the MALL task as dull and not improving their learning performance (e.g., "When I was a high school student, I found it so boring to complete repetitive activities on Quizlet for many days, so I started browsing Instagram and Facebook and didn't finish the task assigned by my teacher" #68).

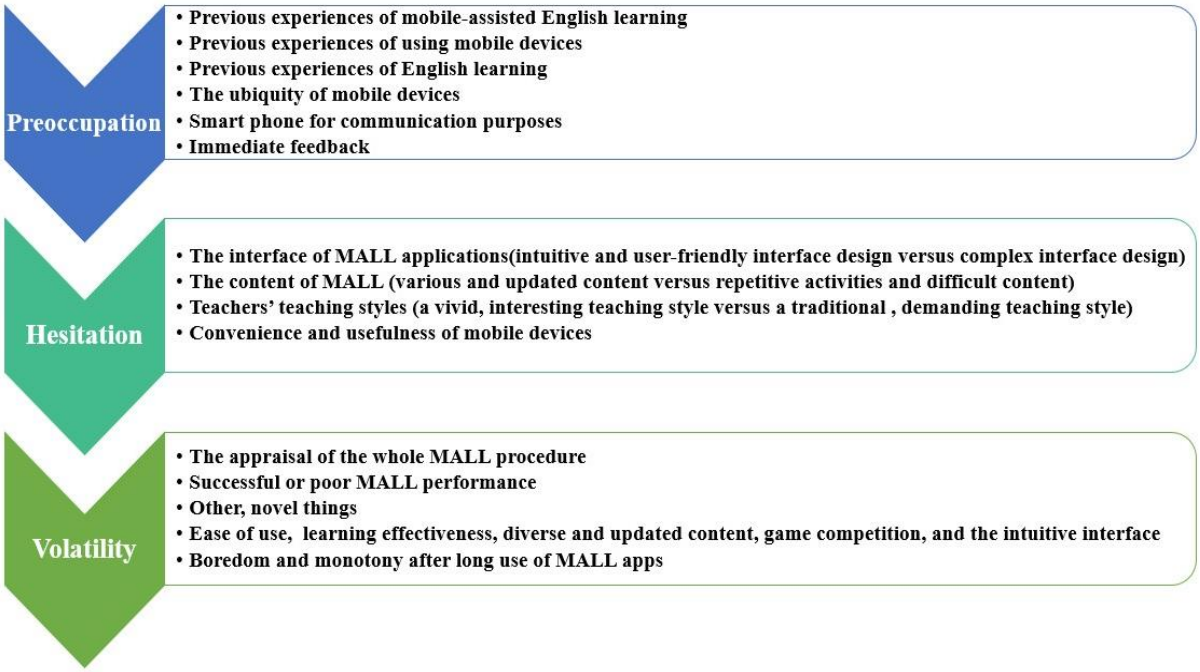
4.4.5. Other novelty interference in the volatility dimension

Most the participants indicated that ease of use, favourable English language learning effectiveness, diverse and updated content, and game competitions could prevent them from being attracted by other, novel things and complete the initiated MALL task (e.g., "I enjoyed quiz games on Socrative because I wanted to beat my classmates. This way I could also enhance my English ability. The activity made me complete the assigned task" #41). Participant 26 noted, "updated content on Kahoot could sustain my interest in learning English on this app to achieve the final goal and complete the task." Participant 13 said, "I didn't have difficulty navigating when I did the Quizlet vocabulary learning task. The user-friendly interface motivated me to complete the task." However, some interviewees mentioned that boredom and monotony after long use of MALL apps might prompt them to find other novelties (e.g., "After working on a MALL task for a long time, I felt a sense of boredom, which made me want to abandon the current task and find other, novel activities to do" #9).

4.5. A summary of factors influencing learner intention changes in the three ACT dimensions

According to results from the survey and interview, we summarised factors influencing learner intention changes in the three ACT dimensions (preoccupation, hesitation, and volatility) in Figure 1. In the preoccupation dimension, previous experiences of mobile-assisted English learning, using mobile devices, and English learning, the ubiquity of mobile devices, smart phone for communication purposes, and immediate feedback may be factors influencing learner intention to disentangle from alternative targets or negative thoughts. In the hesitation dimension, the interface of MALL applications (intuitive and user-friendly interface design versus complex interface design), the content of MALL (various and updated content versus repetitive activities and difficult content), teachers' teaching styles (a vivid, interesting teaching style versus a traditional, demanding teaching style), and convenience and usefulness of mobile devices may influence learner intention to initiate a MALL task. In the volatility dimensions, the appraisal of the whole MALL procedure, successful or poor MALL performance, other, novel things, ease of use, learning effectiveness, diverse and updated content, game competition, the intuitive interface, and boredom and monotony after long use of MALL apps may be factors influencing learners' sustaining intention until a MALL task is completed. We considered the factors in the three ACT dimensions may positively or negatively influence a learner's intention changes from removing negative states, initiating a MALL task, to sustaining their intention until the MALL task is completed.

Figure 1. A summary of factors influencing learner intention changes in the three ACT dimensions



5. Discussion

MALL research in higher education rarely explores factors affecting learners' intention to use MALL from the perspective of psychological traits (Yu, 2020). This study examined factors affecting the behavioural intention to engage in language learning with mobile devices in higher education through the lens of ACT (Kuhl, 1994a). The results of the survey indicated that the three dimensions (preoccupation, hesitation, and volatility) were evident in higher education settings because of their strong, significant correlational relationships. Preoccupation was positively correlated with hesitation, and preoccupation and hesitation were highly correlated with volatility. Each of the three may influence the decision to initiate a MALL task and then sustain focus until its completion.

Previous experiences in three aspects (i.e., MALL, the use of mobile devices, and English learning) may interrupt the focus required for engaging in MALL tasks in the preoccupation dimension (Khany & Amiri, 2018). Positive experiences in these areas help learners disentangle themselves from alternatives and initiate a MALL task because they perceive benefits in MALL, mobile devices, and English language learning. Negative experiences in these areas may result in learners becoming "obsessed" with negative states and feeling afraid of initiating a new MALL task, which conforms to the findings of Khany and Amiri (2018) and Kuhl (1994a).

Several elements (i.e., interface design, content, teaching styles, and convenience and usefulness) may affect hesitation. The results extend the conclusions of previous studies, suggesting that these elements may have a positive or negative influence on hesitation to trigger an action to initiate a MALL task after a decision has been made (Diefendorff et al., 2000; MacIntyre & Blackie, 2012; MacIntyre & Doucette, 2010). On the basis of our findings, we draw the following conclusions. First, an intuitive and user-friendly interface can help learners escape from the vacillation between continuing the initiated MALL task and starting a new activity. Conversely, a complex interface design makes learners consider ending the initiated task and find a new activity to engage in. Second, diverse, interesting MALL content can accelerate the speed of decision making and help learners bypass the hesitation phase to start a MALL task. By contrast, tedious and repetitive MALL content deepens the intensity of hesitation, which in turn encourages learners to engage in a completely new activity. Finally, the perceived ease of use and usefulness of MALL can result in continued MALL use. One possible reason is that learners perceive that little effort is required to complete the MALL task and that their language learning performance has improved, which increases their willingness to continue in the task. If learners do not detect these two benefits, they are likely to abandon the initiated task at the hesitation stage.

In the volatility dimension, learner appraisal of MALL, learning performance, and other novelties may affect their willingness to continue engaging in MALL. For volatile learners, negative appraisal of an initiated MALL task and poor MALL performance discourage them from remaining focused until they complete the task. Conversely, positive appraisal of and performance in MALL play a crucial role in sustaining learner motivation (Harmer, 2007; Khany & Amiri, 2018) until the task is completed. Moreover, when learners perceive that MALL is beneficial, they are less likely to be attracted by other novelties and are more focused on task completion.

5.1. Implications for pedagogical practice

A unique contribution of this study is that it is one of the first attempts to explore the factors that intervene in the intention transformation of university students to initiate a MALL task and continue engaging in the task until it is completed in the three dimensions (preoccupation, hesitation, and volatility) of ACT. The results have pedagogical implications. First, considering positive and negative experiences in three areas (i.e., MALL, mobile device use, and English language learning), instructors may wish to share positive experiences in these areas to help address negative states and accelerate the initiation of a MALL task (Teo et al., 2019).

Second, instructors and developers of MALL applications ought to select intuitive and accessible interfaces and diverse, interesting content. In particular, continually updated content and interactive learning with students from other schools can help students continue attending to an initiated MALL task and avoid their engaging in another task. Third, operation orientation, technical guidance, and immediate assistance need to be offered to students to facilitate their use of MALL applications (Unal & Uzun, 2021).

Fourth, familiarising teachers with mobile technology and MALL applications could alter their teaching beliefs and styles. Mobile-assisted language teaching seminars featuring teachers with experience in MALL can be held. Finally, we suggest that instructors and developers of MALL applications design a variety of small, interesting, and achievable activities to enhance students' sense of learning achievement and remove repetitiveness and predictability from activities. This approach prevents students from turning to novel activities, thus enabling them to concentrate on completing the MALL task.

5.2. Limitations

The study has some limitations. First, the data were collected from several universities in Taiwan. To increase the generalizability of the findings, a similar study would have to be conducted with students of universities in different countries. Second, the study adopted the three variables (preoccupation, hesitation, and volatility) of ACT. Future studies should integrate the variables with other models such as the general extended technology acceptance model for e-learning (GETAMEL, Abdullah & Ward, 2016). Third, the study only focused on the factors influencing learner intention changes in the three ACT dimensions in the context of MALL. However, in future research, other researchers should apply this research and consider carrying out similar studies to investigate what factors may positively and negatively influence the intention transformation process in other contexts (e.g., business marketing, artificial intelligence development, and medicine and society). Finally, a cross-sectional survey on what influences intention transformation in the three dimensions (preoccupation, hesitation, and volatility) was conducted. Future research can explore whether similar effects in the three dimensions of ACT still interfere with the change of student intentions when they are engaged in English language learning on a specific MALL application.

6. Conclusions

Previous experiences in mobile-assisted English learning, mobile device use, and English learning may affect whether university students successfully overcome other thoughts or negative states to initiate a MALL task in the preoccupation dimension. Interface design, content, ease of use, and usefulness of MALL in addition to instructor teaching styles may determine whether a student remains engaged in the initiated MALL task or whether they abandon it to engage in other tasks in the hesitation dimension. The final appraisal, learning performance, and the attraction of other novelties influence whether students remain focused until the initiated MALL task is completed in the volatility dimension. All in all, successful acceptance and completion of MALL tasks depend mainly on student intention (Venkatesh et al., 2003); thus, the determinants affecting intention transformation in the three dimensions of ACT should be investigated to assist students in smoothly completing MALL tasks and to enhance the possibility of mobile device use for language learning in higher education.

The research findings revealed that the factors intervening the three dimensions (preoccupation, hesitation, and volatility) of ACT provide a new research direction for the future MALL and technology-enhanced language learning contexts. Future research is necessarily conducted to obtain deeper understanding of these interference factors or to investigate new interference factors influencing learners' acceptance of the technology for their language learning. In the study, we also developed a scale regarding factors interfering each of the three ACT dimensions in the MALL context to identify what factors might positively and negatively influence learners' intention to accept mobile technology for language learning. Future research can further examine or investigate pedagogical strategies or application function designs to strengthen learners' positive experiences and weaken their negative experiences caused by these interference factors to remove their negative states and other thoughts, and then maintain their learning intention until a MALL task is completed. In addition, many studies have been centered on the effect of mobile technology on vocabulary, listening, speaking, writing, and grammar. However, studies on the interference factors influencing learner intention to accept mobile technology for their language learning through the lens of ACT are still limited.

Conflict of interest

The authors declare that they have no conflicts of interest to this work.

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