Affective Support for Self-Regulation in Mobile-Assisted Language Learning

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ABSTRACT

Mobile-assisted language learning (MALL) research includes examination and development of second language learners' cognitive and metacognitive self-regulated learning skills, but the affective learning component of self-regulation in this context remains largely unexplored. Support for affective learning, which is defined by learners' beliefs, attitudes, and emotions, has been shown to influence learners' cognitive processes, performance, and engagement considerably, and is therefore critical to promote and foster throughout the learning process. This paper defines the importance of supporting affect in MALL, sets out a theoretical perspective on supporting affective self-regulation in MALL, and elaborates on what designers and teachers can do to facilitate affective development through the use of mobile technology, learning analytics, and artificial intelligence. It examines and further delineates the role of affective computing and the role of the teacher in fully harnessing the affective affordances of MALL.

KEYWORDS

Affect, Artificial Intelligence, Learner Autonomy, Learning Analytics, L2 Learning, Mobile App Design, Mobile-Assisted Language Learning, Self-Regulated Learning, Support

INTRODUCTION

Recent meta-analyses have shown that language learners' affective states have a significant impact on their performance (Dewaele, 2022) and engagement (Shen, 2021). Scholars also stress that positive emotions contribute to the development of self-regulation and autonomy (Oxford, 2017), which are essential for successful second and foreign language (L2) acquisition.

The psychological concept of self-regulation began to attract attention in language learning research two decades ago (Dörnyei, 2005; Oxford, 1999) in relation to earlier established work

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on language learning strategies and learner autonomy. Research on self-regulation has grown in prominence alongside – and in synergy with – the development of technology-supported learning platforms and environments that present opportunities for self-paced and student-directed learning, as well as a growing body of research on language learning on mobile devices (e.g., Hsu & Lin, 2021; Lin et al., 2020). As apps, digital resources and online communities for mobile assisted language learning (MALL) continue to expand, there is a growing sense among teachers and researchers that learners should be supported to expand their abilities, skills and strategies in order to take full advantage of the new opportunities for self-regulated mobile learning in and out of class. In doing so, they can be encouraged to learn regularly and reflectively, with greater self-awareness of how to progress and improve their language learning across formal and informal learning settings (Perry & Moses, 2019). Recently, Lai et al. (2022) examined L2 learners' use of mobile technology in self-directed learning. They stress that students utilise mobile-accessible apps (e.g., Duolingo) to create their own learning environment in which they predominantly do not receive support from facilitators (e.g., teachers), especially when "the whole process is self-initiated" (p.2). However, earlier research emphasises that students are generally bad at calibrating their own learning (Dunlosky & Lipko, 2007), including evaluating and regulating their abilities, strategies and motivations. They often need support to develop and grow their self-regulated learning (SRL) skills, strategies and knowledge (Viberg, Khalil, et al., 2020).

Since mobile technologies provide opportunities for L2 learners to engage in complex interactions involving a multitude of cognitive, meta-cognitive, and affective factors (Peng et al., 2021), self-regulation is a key ability. The lens of self-regulation (e.g., Zimmerman, 2000) is therefore a fitting one for the design and development of appropriate support mechanisms in MALL; even more so considering recent developments in the field of learning analytics for SRL (Viberg, Khalil, et al., 2020; Winne, 2017), and the establishment of the MALLAS framework (*Mobile-assisted language learning through learning analytics for self-regulated learning*). MALLAS is a conceptual framework that captures the dimensions of self-regulated language learning and learning analytics that are required to support MALL (Viberg, Wasson et al., 2020; further explained below).

In parallel with the MALL context, research on *affect* in the field of L2 acquisition has recently gained strong momentum (Shao et al., 2020). However, scholars stress that past research on affective states – that consist of moods, emotions, sentiments or attitudes (Frijda, 1994) – in L2 acquisition has largely focused on negative emotions, including language anxiety (Teimouri et al., 2019). It has left out or toned down the influence of positive emotions, attitudes and beliefs such as happiness, pride, joy, hope and admiration, among others (Shao et al., 2020). The different types of positive emotions have, similarly, been discussed by MALL researchers, oftentimes as the emotions that L2 learners experience when using mobile technology for L2 acquisition (e.g., Kukulska-Hulme & Viberg, 2018). Yet, they are rarely directly supported for the purpose of enhancing learners' opportunities for improved self-regulated *affective* learning. In parallel, teachers also tend to miss out on opportunities to support positive emotions or beliefs in this regard, or to provide the necessary assistance to foster affective learning (Huang, 2018).

This paper focuses on an under-researched and under-theorised aspect of self-regulation in MALL, namely its *affective* component. It defines the importance of supporting affect in MALL through appropriate design and use of mobile technology, learning analytics and artificial intelligence, grounded in the MALLAS framework (Viberg, Wasson et al., 2020). It also elaborates on how teachers can be supported in developing learners' affective learning skills and strategies as part of their self-regulation when using MALL apps.

In the following sections, we consider how MALL is moving into the informal domain and how this strengthens the need to understand and support self-regulation in contexts beyond the classroom, paying special attention to affective aspects of language learning. We also set out our theoretical perspective on supporting *affective self-regulation* in MALL. This informs our proposed designs for

affective MALL support and our considerations of the teacher role as an affective strategy guide and source of support across learning contexts outside the classroom.

MALL AND SELF-REGULATION

MALL is an approach that enables in-class and out-of-class learning, mostly used by those who need to practise and develop their language skills. It increasingly takes place outside of class, in environments where learners learn on their own or with friends, without a teacher. Learners create opportunities for themselves to develop a range of skills in this way, such as oral communication via videoconferencing or online game play. These opportunities have been found to make them less anxious when using the L2, compared to classroom settings where speaking practice is observed by the teacher (Peng et al., 2021). Furthermore, language researchers have shown that individual learner characteristics, including one's motivation (Lamb & Arisandy, 2020) and L2 anxiety (Lee et al., 2019) can be associated with different informal learning experiences, which lead to differences in learning performance (Lee & Dressman, 2018). In informal settings, personal affective resources have to be harnessed both to engage in learning and to manage one's attitude, motivation and emotions. Therefore, to benefit from the use of mobile technologies for language learning, especially outside of class, there is a critical need to self-regulate on the part of the learner (Lai et al., 2022; Viberg & Kukulska-Hulme, 2022; Zhang, & Liang, 2021).

Since learning a language requires sustained, frequent practice, there has been recent interest in how mobile applications and activities can be designed to engage language learners in the learning process and to increase their enjoyment, for example, through game-like or gamified learning on mobiles (Cho & Castañeda, 2019; Shortt et al., 2021; Wang & Han, 2021). Using these technologies to bridge informal and formal settings, and using their affordances as mentioned above, requires learners to open up to informal learning practices in more formal learning contexts. At the same time, it requires teachers to provide effective and tailored support.

McNess, Broadfoot and Osborn (2003) have reflected on what it means to be a 'good' teacher and found that it implies "not only a mix of professional knowledge and skills, but also an ability to empathise and build relationships with the learner" (p.244). These fundamental requirements may get lost in online and mobile settings. Huang (2018) discovered that "teachers have the least involvement in affective aspects of online learning" (p.14) and concluded that teacher training should include a focus on instructor-learner relationships and building a helpful virtual classroom atmosphere. These findings suggest that researchers, teachers, and designers are required to rethink the set-up and methods of language curricula and provide adequate answers to the question of how affect can be best understood and supported.

AFFECT IN LANGUAGE LEARNING

The affective learning process is an umbrella concept that includes learner motivations, intentions, emotions, interests, satisfactions, values, goals, and attitudes which, from an SRL perspective, can be individually and socially regulated (Gegenfurthner et al., 2021). These elements can be considered a key part of self-regulation that can assist learners in planning, monitoring and self-evaluating, and can create a sustainable affective learning experience (Vermunt, 1996).

Earlier research has demonstrated that human cognitive processes are influenced by emotions, including processes such as learning and memory (Phelps, 2004; Um et al., 2012), attention (Vuilleumier, 2005), and reasoning (Jung et al., 2014). That is, the cognitive and affective dimensions of self-regulated language learning are not mutually exclusive: both contribute to effective learning (Efklides, 2011; Peeters, 2018). Learning a new language can be highly stressful and can challenge learners' views of themselves, especially when communication in a target language is imperative rather than a choice (Arnold, 1998; Oxford, 2017). Their emotions, beliefs, and attitudes directly

influence their motivation, in addition to contextual factors (Gardner & Lambert, 1972; Oxford & Shearin, 1994) and learners' individual differences (Zafar & Meenakshi, 2012), including their level of self-regulation (Peeters & Mynard, 2021; Viberg & Andersson, 2019) as well as their self-initiated engagement with mobile learning activities (Peng et al., 2021). Interpersonal aspects of affect concern relations between students or between teachers and students. They might also include relations between learners and the target language and culture (Arnold, 2011).

All this makes the affective component of L2 learning "a complex and challenging phenomenon that must be understood and worked with, rather than ignored" (Oxford, 2017, p. 65). It is, therefore, remarkable that many studies in the field of computer-assisted language learning do not adequately capture "the affective and/or social aspects to interaction [...] that are vital to engagement" (Philp, 2016, p. 386).

AFFECTIVE LEARNING IN MALL

Research on affect in MALL is often oriented towards improving MALL designs (formal and informal learning activities and mobile applications), but there is also some investigation of affective states and experiences while using MALL (e.g., Wu et al., 2022). Overall, these investigations demonstrate the affordances of mobile technologies-in-use for enhancing learners' affective learning experiences. Kukulska-Hulme and Viberg (2018) showed that the use of mobile devices for collaborative language learning leads to learners' enhanced motivation, increased enjoyment, and decreased language learning anxiety. These results highlight the various affordances of mobile technologies to support language learners in their affective language learning experiences across formal and informal learning settings. In other research on affect in MALL, the goal has been to understand learners' affective states in relation to personal traits and contextual factors. Liu et al. (2021) have researched the role of personal traits such as perfectionism that may be associated with burnout, among mobile learners of English in China, taking into account a stress-inducing examination-oriented learning culture to which the learners were exposed.

The two commonly examined affective states in MALL studies are *learner anxiety* and *self-confidence.* Research on language anxiety generally emphasises that this frequently found emotion has several negative correlates, including worsened cognitive processing and achievement, negative attitudes towards the language, decisions to drop language studies, a decreased willingness to communicate, diminished self-confidence and a lack of personality in communication (Oxford, 2017). In the MALL context, scholars have shown that L2 learning anxiety can be mitigated through, for example, the use of a mobile video recording tool (Le & Nguen, 2021), and the inclusion of mobile-assisted oral peer feedback (Ebadijalal & Yousofi, 2021). The findings of the latter study, in particular, illustrate that mobile-assisted oral feedback can also enhance EFL learners' self-directed performance, self-confidence and willingness to communicate. Earlier, Xu et al. (2017) demonstrated that the use of mobile-assisted (teacher) feedback enables EFL learners to gain more confidence in speaking English and to engage more actively in language learning activities outside the classroom. Others explored the impact of WhatsApp on enhancing Saudi EFL students' language skills and found that the use of this app reduced their language learning anxiety (Ali & Bin-Hady, 2019). Although there is some evidence in terms of MALL effectively supporting L2 learners' affective experiences, the existing support is rarely specifically aimed at supporting the L2 learners' development of affective SRL skills for language learning.

Yet, despite the importance of enabling affective learning experiences in and for language learning, scholars underline that "most of the emotional self-descriptions [reported emotions] of L2 learners have not been adequately addressed through research" (Oxford, 2011, p.67-69), and consequently, are rarely supported (Wu et al., 2022).

Researchers have also found that L2 English learners' technology-assisted SRL strategies mediate the association between English language self-efficacy, foreign language enjoyment, and learning

performance (An et al., 2021). The results showed that learners who had higher levels of self-efficacy, were more versed in the use of SRL strategies. At the same time, those who enjoyed learning the language were also more likely to self-regulate more, which, in turn, improved learning outcomes. Further, the authors suggest that training or instruction aimed at promoting the use of educational technology among students needs to pay attention to developing their strategic awareness of how to regulate their motivation. This will help optimise the effectiveness of their technology use in learning the target language (An et al., 2021).

With regard to support for emotion regulation in MALL settings, Viberg, Ma and Mavroudi (2020) have offered a prototype of the Affective Learning SRL (ATLAS) mobile app, grounded in Zimmerman's SRL model (Zimmerman, 2000). The app has been evaluated among L2 learners in the context of Japanese higher education. The results show that the students found the app to be useful for an increased awareness of the SRL process when learning English. They reported a perceived increased sense of engagement in, and motivation for, self-regulated language learning across formal and informal settings. The students also reported that they would like to perform affective learning activities (i.e., through the use of 'emojis' as a reflective practice) during each task phase of the SRL process (plan, monitor and reflect; Zimmerman, 2008). Whereas the ATLAS app was offered to support individual learning practices, scholars have recently shown that emotion regulation is also critical for success in collaborative learning. Wu et al. (2022) introduced an innovative affective mobile language tutoring system (AMLTS) to support Japanese language learning. To investigate the effect on emotion, the AMLTS offered a virtual emotion agent that could interact with users and record emotional events, learning assessments, and the results of the interaction into a database. The results showed that the AMLTS' design significantly improved learner engagement and performance (Wu et al., 2022). Zhang et al. (2021) explored how language learners' enjoyment and emotion regulation manifest themselves in online collaborative learning, facilitated by a social media app. The findings show the learners used different types of regulation (self-, co- and socially shared regulation) at both individual and group levels. Participants used words and emojis to realise emotion regulation in collaborative MALL. Also, researchers examined the use of video dubbing mobile technologies as a new type of language learning practice (Jao et al., 2022). In that study, L2 learners tried to mimic emotions via their voices, and human raters tended to focus on the emotion production aspect when evaluating dubbing performance.

THEORETICAL LENS FOR SUPPORTING AFFECTIVE SRL IN MALL

In this paper, we argue that the development of theoretically grounded support mechanisms for fostering L2 learners' affective learning strategies and skills in the context of MALL can be grounded in the Strategic Self-Regulation (S2R) model suggested by Oxford (2017), and based on Zimmerman's (2000) task-performance (i.e., plan, monitor and self-evaluate) model of SRL. The S2R model includes *metastrategies*, *strategies* and *tactics* (support mechanisms) for three key, mutually influential dimensions of L2 learning: *cognitive, affective* and *socio-cultural interactive*.

According to Oxford (2011), "[e]motions, beliefs, and attitudes can influence L2 learning and can be modified by strategies" (p.67). For the purposes of this paper, we focus on the unresearched affective dimension that plays a critical role in L2 learning in the S2R model.

The SR2 model includes two key affective strategies that can be learnt and taught in different ways, with and/or without technology support. They are: **1.** Activating supportive emotions, beliefs and attitudes, and **2.** Generating and maintaining motivation (Oxford, 2017). While these two strategies aim to help the learner directly promote positive emotions, beliefs and attitudes, and initiate and maintain motivation, the eight metastrategies included in the model allow L2 learners to be aware of and manage their affect in general terms. "Without meta-affective strategies, learners might be less likely to reflect on the affective needs and hence might not take the affective control that is often necessary for L2 learning" (Oxford, 2017, p. 63). The eight meta-affective strategies are as follows:

- Paying attention to affect
- Planning for affect
- Obtaining and using resources for affect
- Organising affect
- Implementing plans for affect
- Orchestrating affective strategy use
- Monitoring affect
- Evaluating affect.

These meta-affective strategies are grounded in the task-phases of the S2R model (Oxford, 2017): 1. *strategic forethought* (planning), 2. s*trategic performance* (implementation, monitoring and control), and 3. s*trategic reflection and evaluation* (of task, outcomes and self). When addressing affect and meta-affect in the three phases, the forethought phase mainly revolves around learners managing expectations and planning out any motivational roadmaps. While this phase is crucial for a learner to prepare and manage emotions, motivation and beliefs, Oxford (2017) emphasises that the performance phase is when they actually regulate emotion and volition. When learners experience tasks as challenging, overwhelming or even boring or unnecessary, they need affective strategies to cope. In the reflection and evaluation phase, learners can decide if these strategies were effective and whether they managed self-monitoring and self-regulating their feelings of motivation and volition. The task phase sequence illustrates to what extent learners need to be able to self-regulate *affect* as their success relies on self-monitoring, self-reflection and self-evaluation. In this context, there is a need for adequate support for the aforementioned affective language learning strategies, but also for making learners aware of possible guiding meta-affective strategies. In developing such support tools, we can take advantage of recent advancements in the fields of learning analytics and artificial intelligence (e.g., D' Mello & Jensen, 2022; Viberg, Wasson et al., 2020).

DESIGNING AFFECTIVE MALL SUPPORT

While diverse traditions in different fields, such as human-computer interaction and affective computing, address affect in different ways, they have in common an understanding that technology use influences affective states of the user (e.g., Wang et al., 2022). This is based on the idea that the technology affordances (e.g., in terms of timely feedback, based on detection of the user's affective state) may be beneficial in supporting the individual's learning. In the context of MALL, *affective* learning support can be provided to the L2 learner in two ways: first, through the design of a mobile language service (e.g., an app) that deliberately supports the L2 learner's affective learning, and second, through the assistance of the teacher. These approaches can be implemented either separately or in combination.

MALLAS Framework and Affective Language Learning

When designing mobile support tools for L2 learners' affective learning, we suggest designers can start with consulting the MALLAS framework, which is aimed at learning designers and is built on contemporary research within mobile language learning and learning analytics (Viberg, Wasson et al., 2020). It has been developed as an analytical tool that can be used to operationalise MALL support in a language learning setting. The framework can guide learning designers to direct their design choices when developing relevant support services (e.g., mobile apps). Also, the learning designer can prompt the teacher to facilitate students' targeted learning experiences (such as affective ones) by teaching them affective learning strategies and metastrategies.

Overall, MALLAS consists of three key parts: 1. *MALL,* which focuses on elements such as task design, context and design principles of mobile technology; *2. self-regulated language learning*, which

considers the different phases learners go through when performing tasks (i.e., plan, monitor and self-evaluate); and *3. learning analytic*s, or the process of improving the learning process through data, analytics and action (Figure 1). The L2 learner – through MALLAS – may acquire a target language more effectively through the affordances that could be provided by MALL, learning analytics and self-regulated language learning. For example, designers should consider drafting tasks which prompt learners to notice or report on their affective state, or design apps which leave room for reflection or self-reporting (for more, see Viberg, Wasson et al., 2020). In a scenario where a mobile app is integrated into a language proficiency course, designers could integrate 'mood' indicators for learners so they can signal what exercises or actions frustrate or motivate them. Through further dialogue with the students, the teacher could then consider whether particular L2 tasks and topics should be revisited or if the teaching style should be altered. Alternatively, in such an environment, an app could also prompt learners to keep diaries of their performance and record their emotions and feelings about certain successes or challenges. This data can inform both designers and teachers on possible bottlenecks in digital tools and on the evolution of learners' affective states in their learning trajectory.

Keeping in mind the principles of self-regulated affective language learning, grounded in the S2R model (Oxford, 2017), one can argue for providing pathways for learning in which there is room for *planning, performance,* and *evaluation.* Designing spaces in which L2 learners are not only expected to perform tasks and exercises, but where there is room to plan what approaches to take would be beneficial for learning performance and could strengthen affective learning. In line with the scenario given above, a proficiency app in which learners are asked to practise productive skills like writing and speaking could include warm-up scenarios, in which they are presented with ways to keep their motivation high, or in which they can look up how to deal with feedback from teachers and peers. To reflect, they can indicate whether they actually applied some of the strategies provided, and whether these strategies helped them activate affective states.

Finally, *learning analytics* in MALLAS comprises data, analytics and action, which in combination are employed to detect the learner's emotions and, based on the results, to provide relevant support. As indicated above, both designers and teachers would benefit from early detection of stress or frustration among students to alter pathways, designs or approaches taken. Likewise, positive or motivational aspects that students report on can serve as inspiration for future practice and material development, and can enable designers to transfer examples of good practice to other contexts or designs. Here, it is important to stress that affective states cannot be directly measured because they "are conceptual entities"; what can be measured includes "learner actions" and "context" (D'Mello & Jensen, 2022, p. 121). This approach is frequently explained as "interaction-based" and "log-file based" affect detection (e.g., D'Mello et al., 2006).

It is important to stress that designing affective mobile language learning support presupposes the collection and measurement of sensitive learner data for affective state detection (e.g., from cameras for facial expressions and body movements), behavioural information (e.g., keystrokes and pressure interaction logs), or eye tracking (Uria-Rivas et al., 2019). This suggests that critical issues of students' privacy, security and ethics should be considered in all cases (for more, see Viberg, Wasson, et al., 2020; Häuselmann, 2021; Ong, 2021). Mutimukwe et al. (2022) stress that it is also important to consider contextual factors that may influence students' privacy concerns.

The Role of Affective Computing Design

To be able to effectively support the learner, MALL designers need to carefully consider the affordances of *affective computing*. Affective computing researchers and practitioners explore the possibility for technologies to interpret and adapt to user emotions (Brave & Naas, 2007; Klein et al., 2002), with the overall goal to bridge the gap between humans and machines such as mobile technologies. Ultimately, this should enable artificial agents (e.g., language learning chatbots that could be built into a mobile app) to communicate with humans more naturally and respond to emotions, in addition to textual cues. That is, affective computing focuses on detection of emotional reactions and then applying this

Figure 1.
MALLAS framework (Viberg, Wasson et al., 2020)
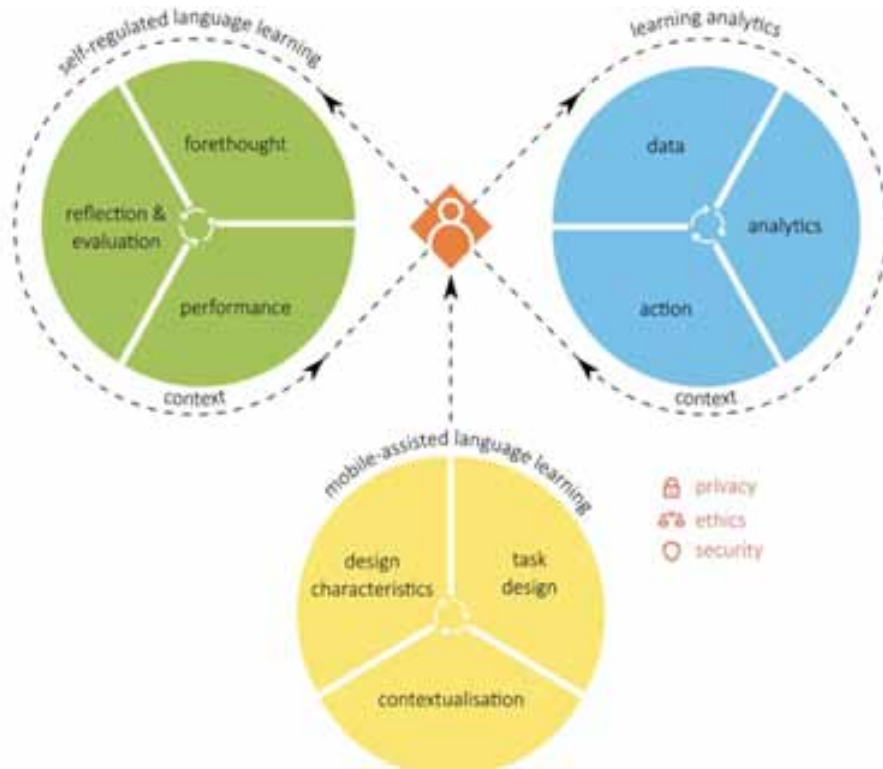
information to assist individuals to manage their emotions (Rosalind, 1997). This is highly relevant in educational settings, where emotions can affect engagement and performance (Cabestrero et al., 2018). Emotion recognition aims at detecting the emotional state of individuals, and largely focuses on audio/speech emotion recognition and visual emotion recognition (Wang et al., 2022). Another earlier study (Mehrabian, 1968) revealed that human emotions are expressed mainly through facial expressions (55%), voice (38%), and language (7%) in daily human communication.

Affective computing can be realised with unimodal or multimodal data, consisting primarily of physical information (e.g., text, audio and video) and physiological signals (e.g., EEG) (Wang et al., 2022). Yet scholars stress that even though affective computing systems using either unimodal or multimodal data have made considerable efforts and breakthroughs, there are only a few robust and effective algorithms to predict emotion and recognise sentiment in diverse settings (Wang et al., 2022).

Recent developments in AI technologies also provide new opportunities, for example, in terms of the provision of personalised timely feedback to L2 learners (Pikhart, 2020). At the same time, scholars stress the notion of "meaningful human control" (Stephanidis et al., 2019), which is explained as follows: "despite the 'intelligence' of the technology and its potential to make automatic inferences and decisions, humans should be kept in the loop through supervisory control and monitoring of intelligent autonomous systems" (p. 1233). Furthermore, the authors highlight that the important features of intelligent systems are transparency, understandability and accountability, which all contribute to building a relationship of trust between the user (the learner) and the system (e.g., a mobile app) and "boost the performance of the human-automation team" (p. 1233). In the MALL setting, the role of 'supervisory control' can be provided by the system, but also by the teacher.

The Role of the Teacher

Next to ensuring proper design, the role of the teacher, and by extension the role of the learning network, cannot be underestimated. A learning network – which is composed of teachers and peers, their teaching and learning methods, scaffolded support, materials and tools for learning – that allows for collaborative, gamified, indoor or outdoor learning opportunities can truly be innovative in the current learning and teaching practice of MALL (Zain, 2021). In a study by Chen and Lin (2018), for example, teachers introduced activities to curb fatigue and demotivation in students, demonstrating how teaching activities and teacher interventions in MALL can positively influence the process of learning and the progress learners can make.

In order to support learners in their affective learning practice through MALL, teachers can promote collaborative discourse, both between them and the learner and between the learners themselves. Ye, Chan and Hsu (2021) highlight in their meta-analysis of teachers' technological pedagogical content knowledge (TPACK) in the context of designing technology-enhanced instruction, that teachers need to work towards eliciting meta-cognitive and reflective thinking within dialogues with students and prompt them to share stories, ideas, experiences and reflections. While some studies advocate for some form of teacher control in MALL contexts (e.g., Kim, 2018), other studies have found that such collaborative learning networks best flourish without direct teacher intervention. Peeters and Pretorious (2020), for instance, found that a teacher's task-based design, with prompts to make students collaborate and share experiences and stories, enhanced 'learner leadership' and fostered the formation of a virtual community of practice. The study also showed that in a context in which a teacher was primarily leading collaborative discourse with students, learners felt less engaged and did not complete all the tasks at hand. In line with findings from several TPACK studies (see Ye et al., 2021), teachers need to consider what purpose MALL has in their classrooms, how all learners can be included and engaged, and which incentives, activities and prompts need to be integrated (Peeters & Pretorius, 2020).

In summary, both thoroughly designed mobile technology (e.g., a language learning app aimed to support L2 learners' emotions) and teacher support can influence students' affective learning, where a mobile tool-in-use, for example, can enhance feelings of enjoyment and satisfaction through the use of gamification elements and progress charts that aim to raise students' awareness of their learning progress. Teacher support and intervention, however, can be needed when more complex emotions or affective states have to be addressed in the learning process, or when learners' awareness of different SRL strategies or metastrategies is lacking (Peeters & Mynard, 2021; Viberg, Ma, et al., 2020). Setting up collaborative and reflective dialogue, and providing opportunities for all learners to be challenged while being able to learn with and from others, can become a cornerstone of new MALL practice. In this sense, human-centred design and teacher support go hand in hand in order to fully foster affective learning in MALL, and to ensure that learners stay engaged with the content, feel motivated and have positive attitudes towards the learning process.

CONCLUSION

In this paper we highlighted that there has been little research on supporting affect in MALL and identified why this topic is vitally important. Out-of-class learning contexts put the onus on MALL app users to self-regulate their learning. We argue that self-regulation is more effective when it is explicitly supported through MALL app/system designs that incorporate affective learning analytics and AI, and through appropriate support provided by teachers. This type of support includes teachers providing affective SRL training when necessary, as they can raise students' awareness of the range of tactics, strategies and metastrategies they can employ in their learning trajectory. Facilitating collaborative dialogue among students, in which they can share experiences and voice their ideas, has also been identified as a valuable addition to the teacher's role in MALL. Effective affective learning design and support for self-regulated MALL – that will facilitate language learners' L2 acquisition

– in the future will require experts from different disciplines to work together more closely in order to understand multiple perspectives on affect in mobile language learning and to develop innovative learning spaces and designs.

CONFLICT OF INTEREST

The authors of this publication declare there is no conflict of interest.

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