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EDDL 5101
Educational Technology for Learning

ONLINE AND DISTANCE EDUCATION

Collaborative Situated Active Mobile learning strategies: a new perspective on effective mobile learning

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Introduction

Mobile learning (mLearning) research and practice is a growing trend in the Gulf region. In recent years, a number of major initiatives have been undertaken at the state level and by numerous higher education institutions. For instance, both the United Arab Emirates and Qatar have seen the launch of iPad distribution and integration programs at the post-secondary level (Barth et al., 2013; Gitsaki et al., 2013; Stein & Alsaleh, 2013). In Qatar, a partnership between Qatar Foundation, Qatar University, Qatar Petroleum and other petrochemical companies has given rise to a comprehensive project to develop mobile workplace English training applications (Ally et al., 2012). Research at College of the North Atlantic - Qatar (Power, 2012a, 2012b) has explored student responses to the use of mobile reusable learning objects (RLOs) accessed by scanning Quick Response (QR) Codes with mobile devices. However, Gulf-based researchers, instructional designers, and front-line educators who want to capitalize on the affordances of mLearning need more than just assurances that mLearning strategies will be supported by state and institutional policies, technical infrastructure, or receptive learners. They need assurances that their instructional designs will be effective, and they need practical guidance on what elements to include in mLearning design.

This paper proposes the term *Collaborative Situated Active mLearning* (CSAM). CSAM is a synthesis of established learning theories and analytical frameworks that have been frequently referenced in the mLearning literature. What CSAM offers is a new perspective for instructional design, reflective practice, and self-evaluation of mLearning instructional design that is summarized in Table 1:

Table 1: Elements of CSAM strategies.

C	Collaborative	Whatever apps or applications are used, the learning activity should involve collaboration of some sort between learning peers, and with their instructors.
S	Situated	Learning should be situated in a realistic context. This will increase motivation and learner excitement, and will make the activity more personally relevant to the learner.
A	Active	Learners should actually do something with the content they encounter, not just act as passive recipients.
M	Mobile	The learning should take advantage of the affordance of mobile technologies. More importantly, it should free learners from the tether of traditional classroom routines.

The following sections outline the grounding of CSAM in established learning theory, examine examples of mLearning projects that reflect CSAM strategies, and provide recommendations for future research and practice drawing upon CSAM in the Gulf region.

Collaborative Situated Active mLearning and Learning Theory

Mobile learning (mLearning) is an emerging trend in the use of technology to extend both access to educational opportunities and the range of strategies available to meet learning objectives. One of the most succinct definitions of mLearning is provided by Wexler et al. (2008):

> [mLearning is] any activity that allows individuals to be more productive when consuming, interacting with or creating information mediated through a compact portable digital device that the individual carries on a regular basis, has reliable connectivity and fits in a pocket or purse. (p. 7)

Ally (2009) extends this definition, and points out that mLearning empowers both learners and trainers by allowing them to "learn whenever and wherever they want [and] access training materials when they need it [without having to] wait for a certain time to learn or go to a certain place to learn" (p. 1).

While mLearning extends the range of strategies upon which instructional designers can draw, decisions about employing those strategies must be grounded in learning theory and research evidence in order to provide confidence in their efficacy. Formal research and mLearning practice has explored a variety of learning strategies in recent years. One such strategy is Collaborative Situated Active mLearning (CSAM), which simply means the use of mobile devices to facilitate collaboration in active learning strategies that are situated in an authentic context or natural environment. CSAM is not a term used in previous literature to describe a category of mLearning approaches. Rather, it is used here as a new descriptive term to compare the similarities in strategic approaches and learning objectives of a variety of mLearning projects in recent years. CSAM is also offered here as a new strategic planning framework to provide guidance for mLearning instructional design decisions, a framework for reflective mLearning practice, and a tool for self-evaluation of mLearning instructional design. Examples of this strategy can be found in recent mLearning research and practice (Ally, et al., 2012; Gitsaki, et al., 2013; McCoy, 2013; Nicoll & Hopkyns, 2013; Power, 2012a, 2012b; Santos, 2013; Schmitz et al., 2012). Support for this strategic approach can be found in Koole's FRAME model (2009) which illustrates how well-established work such as *Activity Theory* (Chaiklin, 2003; Kaptelinin & Nardi, 2006) and *Transactional Distance Theory* (Moore, 1989, 1991) can inform mLearning instructional design and evaluation. CSAM strategies are also supported by the literature on *Flow* theory (Chen, 2006; Csikszentmihalyi, 1997; Järvilehto, 2012) and Kozma's (1994a, 1994b) stance on the media effectiveness debate. Table 2 summarizes the major learning theories discussed in recent mLearning literature that support the CSAM framework.

What does an ideal CSAM strategy look like?

mLearning focuses on freeing learners from the constraints of the traditional classroom. While the 'mobile' in mobile learning often refers to the type of device used as a technological intervention, it is really about the mobility afforded to learners and trainers (Park, 2011; Sharples et al., 2005). Mobility means the ability to move from place to place freely, and mLearning means the ability to engage in rich and meaningful learning activities while moving about. That said, the focus of mLearning is on the learning activities that are taking place—not on the technology itself, which is only used to facilitate those activities. Mobile technologies can provide continuous access to tools and resources that enable learners to interact with each other and with their learning environment. This ability to interact enables collaboration so that even when on the move outside of a traditional classroom, learners can draw upon each other's skills, knowledge and motivation to learn more than would be possible acting in isolation.

The ability to interact with their learning environment in novel ways enables learners to actively explore concepts, objects or entire environments in ways that would not be possible without technology.

Table 2: Major theoretical support for CSAM strategies.

Theory	**Elements Supported**
Activity Theory (Chaiklin, 2003; Kaptelinin & Nardi, 2006)	Collaborative Situated Active Mobile
Framework for the Rational Analysis of Mobile Education (FRAME) (Koole, 2009)	Collaborative (Social Aspect) Situated (Learner Aspect) Active (Social Aspect, Learner Aspect) Mobile (Device Aspect)
Flow theory (Chen, 2006; Csikszentmihalyi, 1997; Järvilehto, 2012)	Situated Active Mobile
Transactional Distance Theory (Moore, 1989, 1991)	Collaborative
Zone of proximal development (Chaiklin, 2003; Kaptelinin & Nardi, 2006)	Collaborative Active

Modern mobile technologies now have the ability to facilitate active exploration by learners of all ages. An ideal CSAM strategy should focus on the activity, with the technology taking on only an enabling role (Naismith & Smith, 2009). It should focus on interactivity on as many levels as possible, between learners, content and authentic situations. It should be enjoyable and engaging and offer an appropriate level of challenge to stimulate interaction, but not frustration. While there is no single solution to effective mLearning design, researchers and instructional designers can find sound guidance in CSAM strategies and their supporting learning theories. An overview of the theoretical underpinnings of CSAM is provided below, followed by examples of practical applications, and suggestions for further research and practice.

How do we design for (and evaluate) CSAM strategies?

Three categories of elements must be considered when designing effective mLearning instruction. Firstly, careful consideration must be paid to the characteristics of the intended *learner audience*. This includes demographic profiles, as well as specific learning needs and learning style preferences. Examples of specific considerations might include the ages, educational levels, intrinsic motivation levels, technology skill backgrounds, geographic proximity to (or isolation from) peers and instructors, and personal interests, among others.

The second category of elements relates to the types of *interaction* that will be built into the instructional design. CSAM strategies should aim for the highest possible levels of interaction across all possible domains. This includes interaction with the learning context (or environment) and content, as well as between peers and with the instructor. The idea is to avoid having individual learners simply receive content; rather, all actors should be working together to build contextualized understandings and skill sets.

Mobile devices represent the third category of elements to be considered. While they may be absolutely critical to the learning strategy, they should actually represent the most invisible of the elements. The devices should act only to facilitate the interactions that are taking place and stimulate participation by the learners. To achieve this, devices must be selected based upon their ability to facilitate access to and exchange of content between learners, the coordination of collaborative efforts and the freedom to interact with learning content in authentic, situated contexts. As Naismith & Smith (2009) explain, quoting Hawkey (2004), the devices "should be easy to use and unobtrusive; [they] should enable the experience rather than detract from it" (p. 250). Other than their ability to facilitate an otherwise impossible learning strategy, consideration must also be paid to the overall usability of the mobile devices. This includes factors such as actual access to the devices, connectivity requirements and associated costs. It also includes the cognitive loads associated with device usage. The mobile devices should be as easy to use as possible so that learners can focus on the required content and activities, and not on manipulating the technology (Koole, 2009). Ideally, the devices should also make it easier to access content and collaborate with peers, thereby reducing the cognitive load normally associated with coordinating such logistics.

Numerous attempts have been made to provide practical guidance on mLearning instructional design. Elias (2010) applies *Universal Instructional Design* (UID) principles to mLearning, and focuses on aspects of device access, usability and cognitive load. Traxler & Wishart (2011) provide a checklist of practical suggestions for mLearning design based upon the combined experiences and wisdom of a number of researchers and practitioners. However, it is the *Framework for the Rational Analysis of Mobile Education* (FRAME) model developed by Koole (2009) that most effectively integrates the three categories of mLearning design considerations with established learning theory. The FRAME model (Figure 1) shows how aspects of learner needs and characteristics, elements of social (and environmental and content) interaction and the characteristics of mobile devices interact to create an optimal mLearning experience.

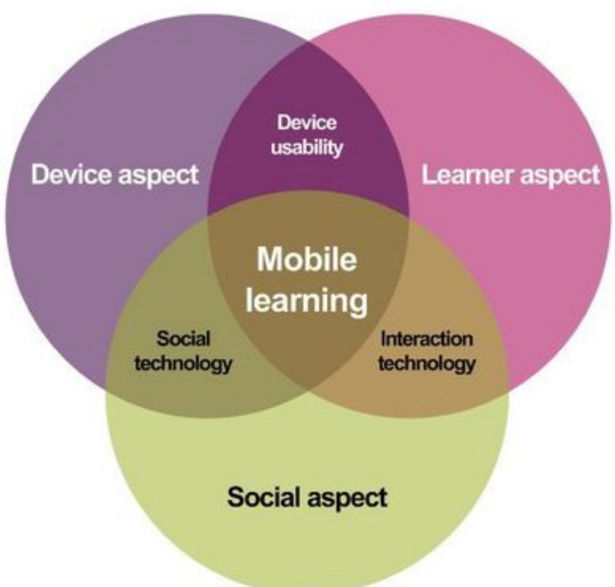

Figure 1: The FRAME model (Koole, 2009, reproduced with permission).

The FRAME model draws heavily upon both *Activity Theory* and *Transactional Distance Theory* to illustrate the required interrelationships between the actors in an effective mLearning strategy. It is also consistent with *Flow* Theory, which also provides insight into the principles of effective CSAM strategies.

What learning theories and literature support CSAM strategies?

The efficacy of learning strategies and instructional design decisions is grounded in rigorously tested and well-established learning theory. CSAM strategies are consistent with intersections of the key elements of the FRAME model, which is itself based upon such learning theories as *Activity Theory*. FRAME draws heavily upon Vygotsky's work in the field of *Activity Theory* and his description of the *zone of proximal development* (Koole, 2009). The *zone of proximal development* (Figure 2) illustrates gaps in the various levels of thinking, activity and learning that individual learners are capable of achieving (Chaiklin, 2003; Kaptelinin & Nardi, 2006).

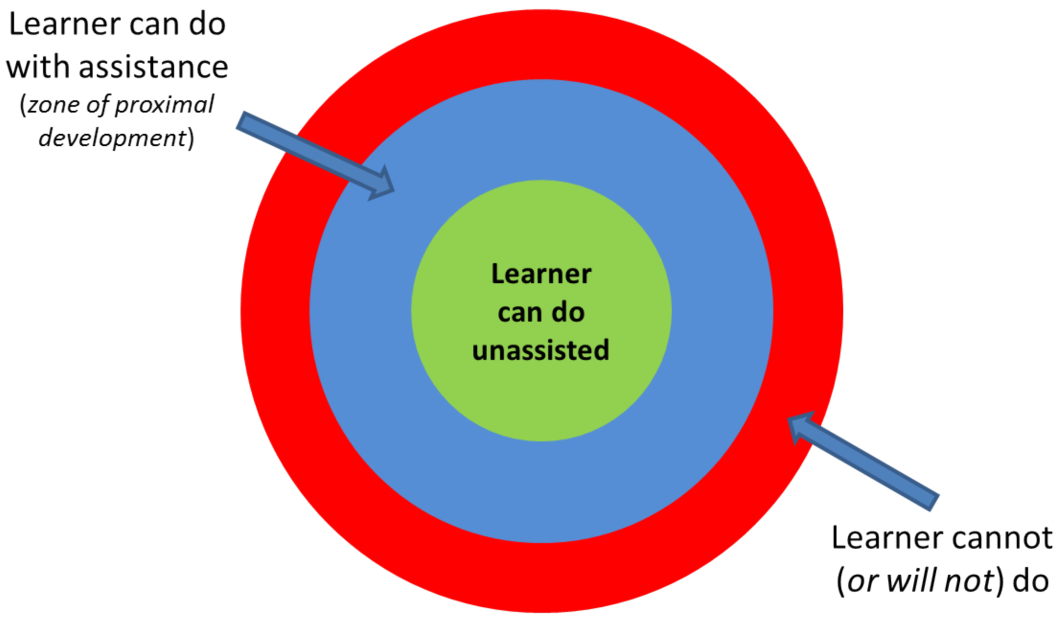

Figure 2: Vygotsky's *zone of proximal development*.

The central core of the *zone of proximal development* represents what learners are currently able to do without assistance. It is surrounded by more advanced learning tasks and skills which the learner could "potentially do with assistance" (Koole 2009, p. 37), i.e. the zone of proximal development. CSAM aims to capitalize on the combined area of possible achievement both individually and in collaborative efforts. In an ideally designed active mLearning scenario, collaborative learning efforts and technology will combine to increase the potential for learning and reduce the size of the outer range of learning tasks and skills which individuals and groups of learners either cannot or will not do (Figure 3, below):

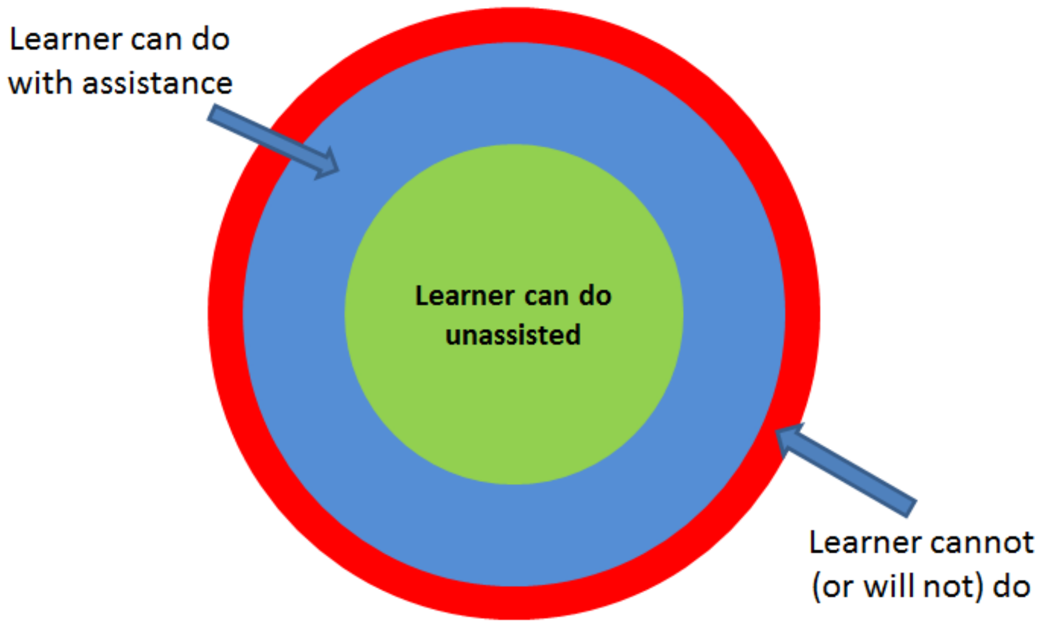

Figure 3: Increasing learning potential into the zone of proximal development.

The ability to increase learning potential through social collaboration (and, in particular, playing games or competing) is supported by van Shaik & Burkart's (2011) recent meta-analysis of research into the learning potential of social animals (including humans). That research demonstrates that species that learn through social interaction and play have a far greater capacity for overall learning potential. It also shows that individuals who participate in more frequent learning through social interaction demonstrate increased potential for learning independently.

Sharples et al. (2005) also draw upon Activity Theory in an effort to begin the development of a theory of mLearning. They explore mLearning as a "cultural-historic activity system mediated by tools that both constrain and support [learners] in their goals of transforming knowledge and skills" (p. 6). They describe a *semiotic* layer of learning, in which cultural tools such as mobile phones mediate specific actions towards a learning objective. They also describe a *technological* layer, in which mobile technologies

> function as interactive agents in the process of coming to know, creating a human-technology system to communicate, to mediate agreements between learners […] and to aid recall and reflection. (p. 8)

These descriptions of how learners interact with technology and each other in mLearning fit with

> a social-constructivist approach, which views learning as an active process of building knowledge and skills through practice within a social community (p. 3).

Impedovo (2011) notes that one of the key concepts of Activity Theory is that human activity is "always mediated" (p. 105) in some form or another as learners attempt to construct an understanding of reality. In the case of mLearning, it is the mobile technology that mediates interaction within a learner's environment while also expanding the possibilities for such interactions. The linking of Activity Theory and mLearning by Koole, Sharples et al. and Impedovo provide a foundation for justifying the use of CSAM learning strategies.

Combining social interaction and the affordances of mobile technologies to increase the range of learning tasks and skill sets that learners could potentially achieve in Activity Theory's zone of proximal development model is also consistent with the principles of *Flow* theory. In his presentation at the 11th World Conference on Mobile and Contextual Learning, Järvilehto (2012) described the principles of Flow theory and its application to mLearning pedagogy. Flow theory was developed by Csikszentmihalyi (1997), and focuses on what people can achieve when they reach an ideal state of concentration and enjoyment. It describes how participants in games (or any other type of activity, including learning) can get into a *flow zone* where they become completely engaged with the task at hand. Csikszentmihalyi describes *flow* as "happening when a person's skills are fully involved in overcoming a challenge that is just about manageable" (p. 2) and notes that this "acts as a magnet for learning new skills and increasing challenges" (ibid.). To get into this level of engagement, the learner must have just the right amount of stimulation in the form of both interest and challenge (Chen, 2006; Csikszentmihalyi, 1997; Järvilehto, 2012). With too little interest or challenge, the learner becomes bored and strays off task to find stimulation elsewhere; with too much challenge, the learner becomes anxious and will either fail in the endeavor, or give up out of frustration. The concept of the flow zone is illustrated in Figure 4 (below):

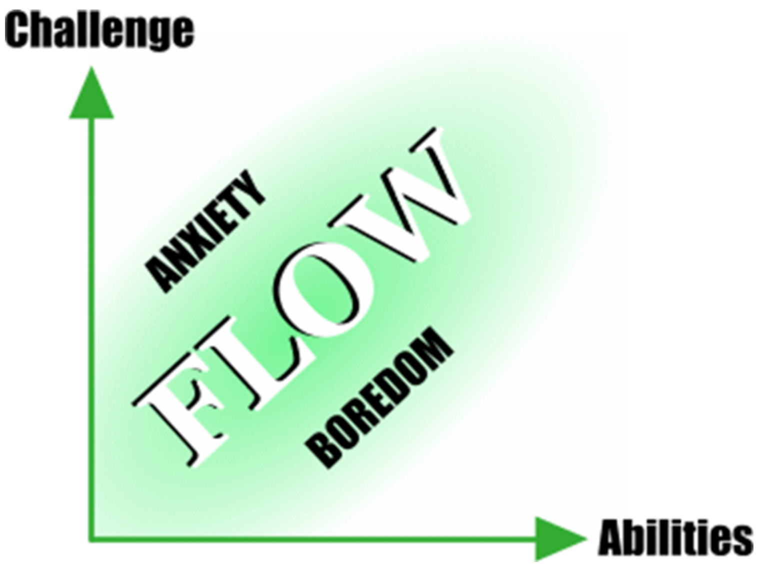

Figure 4: The flow zone.

Achieving this balance of stimulation and challenge brings the learner into active participation in knowledge construction and skill development (Järvilehto, 2012). In addition to the balance between the levels of stimulation and challenge in the specific learning activity, engagement in collaborative learning also has the potential to bring the learner into a *flow zone*. As Csikszentmihalyi (1997) describes, social interaction has its own unique challenges and rewards that demand the attention of the learner:

> A successful interaction involves finding some compatibility between our goals and those of the other person or persons, and becoming willing to invest attention in the other person's goals. When these conditions are met, it is possible to experience the *flow* that comes from optimal interaction. (p. 5)

These aspects of collaborative learning activities can stimulate individual interest and engagement; and the combined knowledge, skills and support of a peer group can also mediate the potential for anxiety when faced with complex learning tasks. Thus, when collaborating on a learning task the individual is more likely to get into a flow zone and thereby more likely to succeed in meeting the learning objective. Since this is the ultimate aim of CSAM, it could be said that this learning strategy aims to use mobile devices to foster collaborative learning in an authentic, situated context, with the aim of bringing individuals and groups of learners into the flow zone for their learning activity.

One of the ultimate aims of CSAM strategies is to reduce the distance between learners, what they are learning and those with whom they are collaborating in knowledge and skill development. This reduction of distance is described by Moore's (1989, 1991) *Transactional Distance Theory* (TDT) as the reduction of physical, psychological and knowledge-level gaps. *Transactional distance* can be managed by controlling either the structure of a learning program, the dialogue (or interactivity) between the actors involved, or the autonomy of the individual learner.

Learning activities such as exploring physical components of a computer system, practicing language skills while on the job at a petrochemical refinery, or walking around an urban environment to explore changes to local waterways have the potential to be highly unstructured activities. *Transactional Distance Theory* postulates that the more unstructured a learning activity or program is, the higher the degree of *transactional distance* (Park, 2011). However, examples of these very types of activities are presented later in this paper to show how the introduction of mobile devices in CSAM strategies can mitigate this potential. For instance, the exploration of physical components of a computer system described in the example of the QR Cache research project (Power, 2012a, 2012b) would exhibit a high degree of transactional distance if no guidance were provided to students. The learners would likely have no idea which parts were important to look at, where to find relevant information about those components, or how to connect the functions of those components in a holistic understanding of computer system functionality. In other words, the information presented, and it's relevance, would be distantly separated from the needs and learning capacities of the learners. The use of the CSAM strategies provides cues as to what activities learners should engage in, what artefacts to explore (or create) and what data to collect. In the QR Cache project, learners quickly grasp which components to explore via the mounting of quick response codes on the devices. They are guided through a scaffolded exploration of those components, and cued to provide feedback to demonstrate their growing understanding, and to engage in both small and large group discussions to further clarify comprehension. Another prime example of this mitigation can be seen in an augmented reality waterway exploration application described by Schmitz et al. (2012). That application's CSAM strategy focuses learners, who are roaming outside of a traditional classroom setting, on a specific natural target. It cues them as to which data are relevant, prompts them to interact with the data and each other to produce new artefacts (decisions about environmental protection policies), and helps them to visualize the long-term implications of their decisions.

The type of interaction occurring in CSAM strategies places an emphasis on controlling the dialogue (or interaction) factor in managing transactional distance. Past critics of technology-mediated distance education pointed to the static nature of much educational media as generating a high level of transactional distance (Park, 2011): instructors could deliver content to remotely located students, but could not interact in response to those learners' emerging needs; while learners could receive the technology-mediated content, but could interact neither with it nor with the instructor. However, while groups of learners may be in close physical proximity in a traditional classroom, that does not necessarily mean they are interacting — so there may still be a high degree of transactional distance between them. Emerging mobile technologies change this dynamic by enabling learners, their peers and instructors to interact both synchronously and asynchronously over greater physical distances and in more varied ways. While removing learners from the traditional classroom may increase the physical distance between them and their instructor, the use of mobile devices can actually reduce overall transactional distance by allowing for more frequent and meaningful interactions (Koole, 2009). Mobile devices can also provide organization and structure to that interaction, so as to reduce the cognitive load associated with managing such logistics. Interaction also occurs between learners (or groups of learners) and the content (or environment). Using mobile devices to focus the learner on a more authentic, learning context has the aim of reducing transactional distance by making that content situated, concrete and meaningful, as opposed to abstract (such as in a textbook).

The autonomy of the learner is one aspect of Transactional Distance Theory that is contentious for some critics of its application to mLearning strategies. Autonomy could be viewed from the perspective of the individual's ability to master learning objectives without assistance or intervention from peers or instructors. In this case, CSAM strategies appear counterintuitive in that they promote social as opposed to individual effort. However, Moore (1989, 1991) points out that as learner autonomy increases, so too does transactional distance. This is because the learner working independently becomes separated from instructors and peers physically, and in terms of guidance and support for learning activities, which appears to contradict the ultimate objective of reducing transactional distance wherever possible. This does not mean that promoting an individual's ability to learn autonomously is an undesirable goal: CSAM strategies aim to capitalize on collaborative learning efforts to focus learners, build upon collective skills and ultimately increase the learning potential of the individual. Autonomy could also be viewed from the perspective of the amount of choice that learners have in deciding about learning objectives and paths to meeting those objectives. From this perspective, CSAM strategies have the potential to increase this type of autonomy. By freeing learners from the traditional classroom or laboratory, CSAM strategies give them a broader range of environmental contexts and artefacts to explore and increase the range of tools and strategies they can avail of in that exploration. However, when designing mobile learning opportunities using CSAM strategies, instructional designers should be careful to create a match between level of choice and the ability and responsibility of target learners to weigh the options available to them.

Park (2011) notes that several researchers have pointed out similarities between Transactional Distance Theory and Cultural-Historical Activity Theory (as drawn upon by Sharples, et al. (2005)). She emphasizes that differences in their treatments of autonomy, social interaction and technological mediation may simply stem from confusion over contradictory terminology. Overall, CSAM strategies are strongly supported by Transactional Distance Theory, as they are by both Activity Theory and Flow theory.

The efficacy of using mobile technologies in CSAM strategies to foster active learning, flow and reduction of transactional distance also finds support in Kozma's position on the media effectiveness debate. While Clark (1994a, 1994b) argues that media (such as mobile devices) themselves have no effect upon learning achievement, Kozma (1994a, 1994b) and Hastings & Tracey (2005) contend that the capabilities of modern technology allow for the possibility of teaching and learning strategies that would previously have been impossible. Certainly, without recent advances in mobile technologies the positive effects upon interaction and transactional distance levels generated by CSAM strategies would not be possible.

Figure 5 summarizes the four aspects of Collaborative Situated Active mLearning strategies and their grounding in established learning theories and analytical tools.

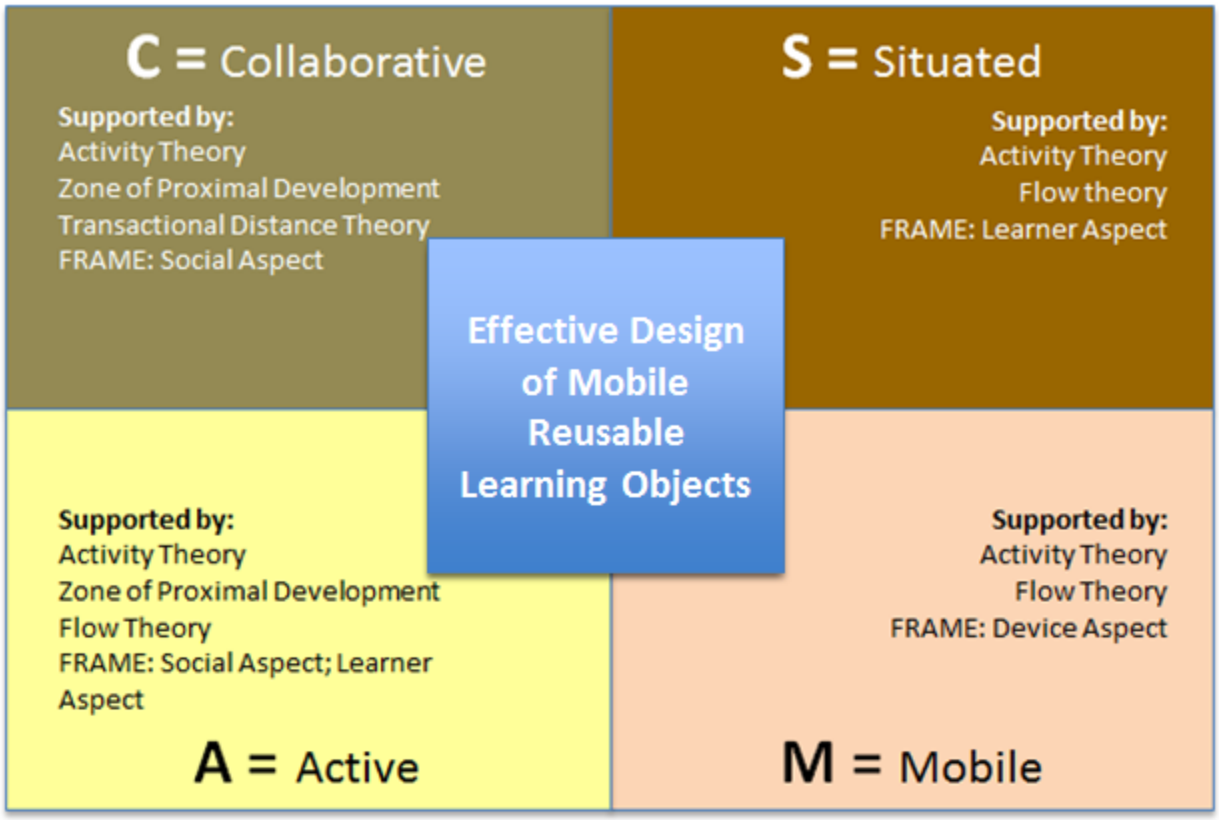

Figure 5: CSAM and supporting theories.

Examples of Collaborative Situated Active Mobile Learning Strategies in Practice

CSAM strategies in action in the Gulf, example 1: QR Cache

Learning about computer concepts and devices from a textbook can be challenging, especially for students learning in a second or foreign language. The *QR Cache* research project (Power, 2012a, 2012b) used web-based Reusable Learning Objects (RLO's) accessed by scanning Quick Response (QR) codes by students with their own mobile devices. QR codes were mounted on actual computer equipment, so that learners could access just-in-time information about terminology and functions as they explored the equipment in small groups at their own pace. Figure 6 illustrates one of the mobile RLOs that learners would see after scanning a QR code mounted on the back of the chassis of a personal computer.

In this project, learners reported enjoying the active learning much more than using a course workbook. They also learned how, and reported a desire, to continue using their own mobile devices to look up relevant information whenever they encountered a new learning situation either at school, the workplace, or in their personal lives.

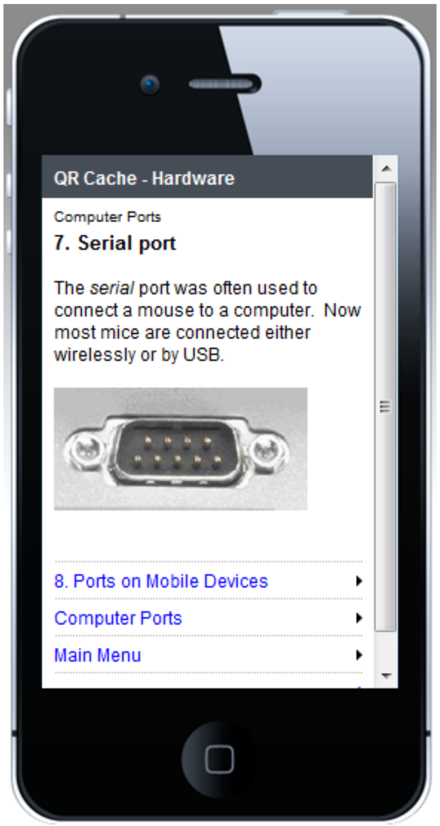

Figure 6: A mobile RLO from the QR Cache research project.

The QR Cache project integrated mobile RLOs that were designed based directly upon CSAM strategies. For the Collaborative aspect, learners worked together in small groups while exploring the various computer components and viewing the RLOs. Learners also completed brief surveys at the end of each RLO to test their newfound knowledge of the computer terms and the functions of the parts. The results of these surveys were instantly displayed on learners' mobile devices as pie charts, which were also displayed on a large projector screen as a starting point for whole group discussions. For the Situated aspect, the learning activities were situated in the realistic context of a hands-on exploration of actual computer components. Learners were able to see and touch parts of the computers that they may or may not have already been familiar with using, but learned more about those components via the information provided by the RLOs. For the Active aspect, learners had to handle real computer components hands-on, receive the information about the computer components, and demonstrate their comprehension through the post-activity surveys and group discussions. Many of the post-activity surveys accessed through the RLOs asked learners to provide additional examples of similar components, drawn from their own previous experience and ongoing active exploration of the personal computer components. For the Mobile aspect, not only were the RLOs accessed using mobile devices, but learners were also afforded the opportunity to break from a traditional classroom experience by exploring computer equipment throughout the laboratory without being required to constantly refer to a cumbersome textbook or workbook.

CSAM strategies in action in the Gulf, Example 2: Workplace English Training in the Qatari petrochemical industry

A consortium of Qatari petrochemical companies including Qatar Petroleum has partnered with Qatar Foundation and Qatar University to develop mLearning applications for workplace English language training (Ally et al., 2012). That ongoing project utilizes custom built native apps installed on mobile tablets using the Android operating system. The apps are accessed by learners while on-the-job to provide quick, just-in-time lessons, as well as formative and summative feedback on their mastery of critical workplace English skills. For instance, learners are guided through the components of writing proper safety and equipment maintenance reports, and engage in interactive activities which require them to select the proper terms, and to sequence them correctly in a realistic report.

While the full range of apps for this research project is still under development, it is possible to demonstrate how these mLearning resources follow CSAM strategies. The Collaborative aspect can be accommodated with learners working together on-the-job (or during their downtime) to explore and complete interactive activities. The Situated aspect is strongly supported in this context, as learners can utilize the mLearning apps while on-the-job to complete activities of immediate relevance to their workplace needs. The Active aspect is represented in the requirement for learners to master key workplace English terms and concepts, and to actually manipulate English terms and forms to create realistic, relevant reports. The Mobile aspect is represented both by the type of device used (tablets), and by the mobility of the learners themselves as they move about their workplace and easily access learning opportunities exactly when they are needed. The use of tablets with pre-loaded apps and content also means that learners can take their learning with them both to work, and during their downtime, so they can easily reinforce their learning whenever it is convenient for them.

CSAM strategies reflected in the proceedings of the Mobile Learning: Gulf Perspectives *Symposium 2013*

The *Mobile Learning: Gulf Perspectives* symposium hosted at Zayed University in Abu Dhabi, UAE, in April 2013 saw a number of presentations and discussions of mLearning initiatives that can be analyzed for elements of CSAM strategies. One of the prominent themes of the symposium was the ongoing iPad integration project being undertaken in collaboration between the State and higher education institutions (Gitsaki, et al., 2013). While many discussions at the symposium focused on policy-level and technical infrastructure issues related to the implementation of the pilot project, there was also discussion of the benefits to learners of both the iPads and other Bring-Your-Own-Device (BYOD) projects. Speaking at the closing panel discussion, one Zayed University student reflected on the Mobility aspect of CSAM by describing the freedom that the iPads gave learners from carrying around bulky textbooks, the ability to access her learning content at any time, and the ease of contacting her peers and instructors. During a presentation on BYOD approaches, Dr. Ieda Santos of the Emirates College for Advanced Education (ECAE) described accessing online quizzes through mobile devices both in and out of class as a means of providing formative and summative feedback to learners (Santos, 2013). Similar to the QR Cache project, Santos described displaying the results of such quizzes on a larger screen to spark collaborative class discussions. She also described using social media tools to facilitate back-channel discussions during traditional face-to-face class sessions. These activities represent the integration of the Collaborative aspect of CSAM.

The Collaborative, Situated and Active aspects of CSAM were also well represented at the *Mobile Learning: Gulf Perspectives* symposium in the wide variety of poster presentations about ongoing mLearning projects in the Gulf Region. For instance, one poster (Nicoll & Hopkyns, 2013) described the use of cartoon 'puppets' (or avatars) to facilitate conversational English language learning. In that example students, with guidance from instructors, used mobile apps to practice their language skills in authentic contexts by actively manipulating their avatars and what the virtual puppets were saying. This mLearning example integrates the Collaborative aspect of CSAM by facilitating collaboration between learners and instructors. The Situated aspect is integrated through learners' immersion into realistic conversational English manipulation. The requirement for learners to actually manipulate conversational English and the actions and environments of their avatars represents the Active aspect of CSAM.

In another poster presentation, McCoy (2013) described the use of iPads to enable beginner level English students in Zayed University's Academic Bridge Program themselves to take on the role of a grammar teacher. Learners used their iPads to research and gather resources related to a specific grammar topic; they then used the tablets to record, edit, and disseminate short video lessons on that topic, which were uploaded to YouTube to share with their classmates. The Collaborative aspect of CSAM is represented in this mLearning example by the sharing of the completed video lessons, and the resultant peer-teaching. The Situated aspect is seen in the immersion of learners in an authentic task with personal relevance: using mobile technologies to communicate with colleagues and to learn English grammar skills that will be used throughout their educational and professional careers. The Active aspect is represented by the requirement of learners to not only learn about a grammar concept, but to create a reusable learning object to teach that concept to other students.

While neither of these mLearning projects were designed using the CSAM model for guidance, their effectiveness can be analyzed through the lens of CSAM to provide useful guidance for future endeavors in the region. Their congruence with CSAM principles also lends support for recommending that practitioners directly draw upon CSAM for guidance when making instructional design decisions.

An emerging frontier with prospects for mLearning in the Gulf: augmented reality games for Collaborative Situated Active mLearning

Augmented reality (AR) applications allow mobile devices to display enhanced images of a user's current environment. These enhanced images may include graphical renderings to show details about local structures, or provide overlays of textual and graphical information onto real time images captured using the device's camera (Augmented Reality, 2012). Schmitz, et al. (2012) describe a Chicago-based pilot project where secondary students use AR applications on mobile devices to explore the effects of climate change on their own environment. Learners visit local waterways and use their mobile devices to view images of those waterways both as they appeared one hundred years ago and how they might look in a century from now. They then use their devices to participate in challenges based on making decisions about environmental protection policies, and their decisions in the game affect the AR displays of the future waterway images. The object of the challenge is for groups of students to see who can implement the most effective policies to protect their local waterways.

In the augmented reality game described by Schmitz et al. (2012), the Collaborative aspect of CSAM can be seen in the potential for learners to work together as they explore their city's waterways. The Collaborative aspect can also be seen in the competitive nature of the learning activity, as learners compare their results to determine who has made the most effective environmental protection policy decisions. The Situated aspect is represented in the activity's requirement of learners to explore their actual urban environment and waterways: the realistic context of the activity immediately shows results that are relevant to the lives and lifestyles of the learners. The Active aspect is represented through the manipulation of policy decisions by the learners, which in turn have an impact on the virtual content they encounter. The Mobile aspect is represented by the use of mobile devices equipped with augmented reality applications, and by the freedom to learn outside of a traditional classroom in learners' own urban environments.

While the game-based learning described by Schmitz et al. (2012) is situated in the context of Chicago in the USA, the concept behind this example of CSAM learning has potential applications in the Gulf context. For instance, this type of augmented reality game could be adapted to the context of any Gulf city. Learners ranging from K12 students to urban planners or post-secondary engineering students could use AR games to collaboratively investigate the impacts of land-reclamation and terraforming mega-projects such as the Palm islands in Dubai, UAE, or the Pearl and Lusail developments in Qatar, for example. Such mobile games could be used to both motivate and challenge Gulf learners in realistically situated contexts, and subsequently have a long-term impact on the ability of these learners, to understand the implications of engineering design decisions upon environmental sustainability.

Mobile applications and CSAM strategies could also be employed to enhance learning in the Gulf Region through an adaptation of an existing partnership between the Department of Art and Design at Zayed University and the animation program at Winston Salem University in North Carolina, USA (Hawker, Elkady & Tucker, 2010). That initiative saw students collaborating to gather information about local heritage architectural structures to create virtual reconstructions. Mobile technologies could be utilized with augmented reality applications to help learners gather information about local heritage structures; they could also be used to create augmented reality artefacts to enhance dissemination of the data to a wider public audience.

Recommendations for future research and practice

mLearning researchers and practitioners have already begun to integrate Collaborative Situated Active mLearning principles into real teaching and learning contexts in the GCC region, both overtly and indirectly, because CSAM strategies reflect sound learning theory and lessons learned from mLearning practice. The aforementioned QR Cache research project in Qatar is an example of an effort to determine student perceptions of CSAM strategies, as well as their effectiveness compared to traditional (non-technology augmented) classroom practices (Power, 2012a, 2012b). That project was developed as an example of design-based research, with an aim of subsequent expansion into classrooms in other subject areas. Another active research project in Qatar is being undertaken in a partnership between Qatar Foundation, Qatar University and a consortium of national petrochemical companies including Qatar Petroleum and RasGas (Ally et al., 2012). That project is developing, and exploring perceptions towards and effectiveness of, mobile learning applications for teaching workplace English skills specific to the petrochemical industry. The research design in that initiative draws upon the same theoretical underpinnings that have been presented in support of CSAM strategies.

In terms of formal mLearning research efforts, it is recommended that both of the aforementioned projects continue, and that additional projects be initiated in the Gulf region. These initiatives should integrate a deliberate emphasis on answering questions related to the efficacy of CSAM strategies, such as:

- How do Gulf students respond to CSAM strategies? Are they more appealing than other traditional or technology-augmented classroom approaches?
- Does the use of CSAM strategies have a positive impact upon student achievement? Do they successfully impart soft skills not directly related to the overt curriculum?
- Are CSAM strategies more effective in some subject areas than others?
- Are CSAM strategies an appropriate approach in workplace learning contexts?

In terms of mLearning practice in the Gulf region, it is recommended that instructional designers heed the lessons learned from previous research and practice. This includes paying close attention to what learning theories such as Activity Theory, the Zone of Proximal Development, Flow theory and Transactional Distance Theory tell us about learner motivation, optimal learning conditions, and the benefits of social interaction in learning. The FRAME model provides an overlapping set of domains that must be considered in any effective mLearning design, and CSAM strategies represent one instructional design approach that is consistent with FRAME and accepted learning theories. The CSAM aspects can be used as a planning guide for mLearning instructional design (e.g. Table 3).

Table 3: CSAM guided questions for reflective practice.

Collaborative	Does your mLearning design provide learners with an opportunity to collaborate? • If yes, great! Are there any ways that learners could be collaborating more? • If no, are there any ways that the learning activity could get learners working together, or sharing skills or ideas?
Situated	Is your learning activity situated in a realistic context? • If yes, great! Learning is more meaningful and fun when it is in a realistic context. • If no, how can you change your learning activity so that it takes place in a realistic context?
Active	Do your learners have an opportunity to do something with the content they encounter in your mLearning activity? • If yes, great! Engaging with content reduces boredom, and makes learning more meaningful. • If no, is there anything your learners could do with the content to create a new artifact, or to make the content more personally meaningful?
Mobile	Does your mLearning design free learners from the tether of traditional classroom routines? • One of the aims of mLearning is to expand learning possibilities. It can be a powerful way to augment other successful classroom strategies. • Getting learners to use their mobile devices creates excitement, and gets them engaged in the learning activity. • You do not need to take your learners out of the classroom to free them from classroom restrictions! • If you do take learners outside of the classroom, using mLearning resources is a great way to provide them with the resources they will need, connect them with you and with each other, and focus learners on the intended learning task.

Table 3 is adapted from a recent workshop on creating CSAM mobile reusable learning objects, presented at the Technology in Higher Education 2013 conference in Doha, Qatar (Power, 2013). It suggests questions that mLearning practitioners should ask when reflecting upon the successes and shortcomings of their instructional designs.

Conclusions

Selection of appropriate learning strategies requires careful consideration of learning objectives, learner needs and available instructional resources. The efficacy of a learning strategy can be gauged by its fit with these elements and its support from established learning theory. While mLearning is still an emerging trend in distance and blended learning, it nevertheless has a wealth of learning theory support for the types of strategies being developed by practitioners. Collaborative Situated Active mLearning strategies attempt to foster social, content and context interaction so that learners can work together to develop concrete understandings and skill sets in authentic settings in order to satisfy previously abstract learning objectives. CSAM strategies take guidance from models such as FRAME, which are grounded in rigorously tested and well-established learning theories such as Activity Theory, the Zone of Proximal Development, Flow theory, and Transactional Distance Theory. Effective CSAM strategies use mobile technologies and learner interactions to increase the range of potential learning tasks that students can achieve either individually or in groups. They reduce extraneous cognitive load and facilitate the ideal balance of challenge and engagement to get learners completely focused on required learning tasks. And while they may not reduce physical separations, they strive to reduce the cognitive, ability and social distances between learners and content, their peers and their instructors. Various examples of mLearning research and practice in the Gulf region draw upon the key aspects outlined by CSAM, even in cases where CSAM was not deliberately used as an instructional design framework. Further research is needed to verify the efficacy of CSAM strategies in various contexts in the Gulf region; however, the strong grounding of CSAM in established learning theories and the FRAME model provides sound guidance to instructional designers throughout the region, or globally, who plan to integrate mLearning strategies into their practice.

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