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Team-Based Mobile Learning: A Framework for Supporting Interactive Learning

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Abstract. It is noteworthy that collaborative teamwork is still new and emerging in Chinese universities comparing to higher-educational classrooms in western countries. Team-based mobile learning is deemed an essential way to improve students' learning in this interactive environment. This paper therefore introduces a new model for structuring team-based mobile learning in college classes. This Team-based Mobile Learning (TBML), ties together the multifaceted elements involved in the success of a mobile learning (mLearning) innovation in an interactive learning environment. In the TBML model, mobile learning is integrated into formal classroom teaching, so that it can support students with both their individual learning goal and performance goal when carrying out their teamwork.

Keywords. Team-based learning, mobile learning, interactive learning environment, intelligent learning platform, framework

1. Introduction

With the widespread use of mobile technologies, mobile learning is changing the educational environment by offering learners the opportunity to engage in asynchronous, ubiquitous instruction [1]. Featured with portability, immediacy, connectivity, ubiquity and adaptability, mobile learning enables collaboration among learners, improve interaction and communication between teachers and students [2], and facilitates access to learning anytime and anywhere by connectivity and employ of multiple apps for educational purposes [3]. Despite the great advantages of mobile learning, there is criticism about the distraction and overwhelming use of the mobile technology in the education. This paper introduces a framework for team-based learning in an interactive learning environment, which aims to promote active learning and participation by integrating team-based projects in mobile learning.

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2. Key Terms

2.1 Team-based learning (TBL)

Team-based learning (TBL) is an active and widely-adopted learning method to help students achieve course objectives and learn how to function in teams [4]. It is grounded in constructivism and social learning theories. According to Michaelsen and colleagues [5], the premise of TBL is to promote active and effective learning through small group interactions across a semester. Research conducted by Gomez, Wu, and Passerini [6] and Sibley [7] indicates that TBL is also suitable for large class settings. However, traditional TBL approaches, especially in large-size classes, present many challenges [6]. For example, the time spent on the in-class activity may vary from team to team, leaving limited time and space for the interaction between different teams and with the instructor. With mobile technology providing portability, social interactivity, context sensitivity, connectivity, and individuality [8], team-based mobile learning becomes a potential solution to the problems occurring in large-size classes, where collaborative learning might have been carried out without using online or mobile technologies.

2.2 Mobile Learning (mLearning)

Mobile learning refers to the learning method taking place via wireless mobile devices, such as smart phones, PDAs, and tablet PCs, through which these devices are able to move with the learners to allow learning anytime, anywhere [9] [10]. According to Crompton and Traxler [11], mobile learning (mLearning) can be a potential game-changer for higher education. Many research findings [12] [13] [14] have exemplified the positive effects of mobile learning in formal and informal education. In contrast, Chu [15] argued that mobile learning might be disappointing or may even negatively affect the students learning achievements if without proper treatment employed. To address this problem, therefore, it is necessary to propose a model or framework to guide through mobile learning.

3. Existing Framework for Mobile Learning

In this section, we introduce several existing models and frameworks for mobile learning and team-based learning.

3.1 The Framework for the Rational Analysis of Mobile Education (FRAME) Model

The Framework for the Rational Analysis of Mobile Education (FRAME) model (Figure 1) was developed as a basis for assessing the effectiveness of mobile devices for distance learning by Koole [16]. It incorporates aspects related to the learner and the mobile device, as well as the social aspects and content design. In the model, Mobile Learning (ABC) is the convergence of device usability aspect (A), learner aspect (B), and social aspect (C). It also represents the central intersection of context learning (AB), interaction learning (BC), and social computing (AC). The framework implies that content for mobile devices must be designed in the form of learning

objects to allow for flexibility in course development and delivery and to cater to students' individual needs. Another takeaway from this model states that designers of mobile learning must develop learning activities to cater to different learning styles since different students perceive, interact with, and respond to a given learning situation in different ways. In this sense, designing appropriate learning projects plays a vital role in mobile learning.



Figure 1. The Framework for the Rational Analysis of Mobile Education (FRAME) Model [16]

3.2 Mobilegogy Model

Based on the understanding of existing strategies for mLearning, Mobilegogy Model presented by Machun and her colleagues (Figure 2) is a guide for the designer to successfully tailor mobile learning and incorporate the capabilities of mobile devices into effective mLearning designs. It provides an opportunity to apply the strengths of mobile technology to create a unique experience for the learner. The mobilized eLearning portion of the model contains elements that should be present in all well designed learning, such as practice, assessment and real world applications. Mobile platforms expand the designer's ability to be creative when incorporating these elements. Most importantly, the model reminds the designer data capture can be incorporated into a lesson [17]. In our proposed team-based mobile learning model, the intelligent mobile learning platform used in the interactive learning environment meets this need by collecting large amount of data in the teaching and learning process.



Figure 2 Mobilegogy Model [17] (reprint with permission)

3.3 Computer-mediated Learning Model

When it comes to team-based learning in interactive learning environment, the computer-mediated learning module (Figure 3) is an important step forward in the study. This computer-supported team-based learning model extends learning in small teams from the traditional classroom to the hybrid classroom combining face-to-face and online teaching and learning [6]. The model evaluation shows positive impact of motivation, enjoyment and team contributions on learning outcomes resulted from the use of team-based learning with the support of computer tools. But the model does not indicate the learning goals of the activities in the computer-facilitated team-based learning.



Figure 3. Computer-mediated Learning Model [6] (reprint with permission)

3.4 Conceptual Framework of Mobile Collaborative Learning

According to a recent ten-year (from 2007-2016) literature on mobile technologysupported collaborative learning, the conceptual framework of mobile collaborative learning (Figure 4) aims to respond to Tsai's [18] assertions of social constructivism Based on this model, when learners study in groups with the help of mobile technologies, they have more chances to interact with abundant information, peers and experts from society anywhere and anytime, which is beneficial to them for constructing meaningful knowledge by handling, thinking, and reflecting on the diverse information and opinions [19]. Like the computer-mediated learning model, the framework doesn't show how the mobile collaborative learning can benefit learners from various perspectives such as learning performance, self-efficacy and so on.



Figure 4. The Conceptual Framework of Mobile Collaborative Learning [19]

4. Team-based Mobile Learning (TML) Model

Drawing from the aforementioned models, here we propose a new and innovative model to guide team-based mobile learning in large-size classes. In the Team-based Mobile Learning (hereafter, TBML) model (Figure 5), mobile learning is integral to both formal classroom teaching and informal out-of-class learning through team-based projects. The projects may take on a variety of forms, such as slide presentation, art show, video and so on. There are two goals in conducting a team-based mobile learning project, specifically, the learning goal and performance goal. The former refers to students' personal aim of mastery of the subject content. For instance, in an English as a foreign language course, students' individual goal is to improve speaking, reading, writing, and translating abilities. Differently, the latter goal focuses on the enhancement of students' collaboration and teamwork. Both the learning and performance goals work together to improve students' self-efficacy and team potency.





4.1 Intelligent Teaching Platforms

Intelligent teaching platforms are teaching and learning tools dedicated to both learners and teachers. Similar with the traditional ones like Moodle and Blackboard, they can not only create accessible repository, but also provide interactive learning environment through synchronous and asynchronous class activities. More importantly, as intelligent learner-centered platforms, they integrate learning analytics, cloud computing, and adaptive technology. Moso Tech (hereafter, MT) in the study conducted by Zhu and Wang [4] is a typical example of an intelligent teaching platform. This platform becomes an integral part of the TBML model in Figure 5. On this intelligent teaching platform, instructors create team-based activities, facilitate mobile learning, and collect analytics on students' learning status.

4.2 Individual Study and Test

In team-based mobile learning, it is important to get the individual learner prepared for the learning task and take readiness assessment tests. To ensure individual preparation, the learning materials should be allocated to the intelligent learning platform timely and appropriately. Questions are designed to evaluate students' conceptual understanding of the learning materials. Michaelsen and colleagues [5] suggest approximately twenty multiple-choice questions at the start of each new module for the readiness assessment test. However, depending on the complexity of the learning task, the number of questions may vary from five to twenty. For example, in an English class, the team-based presentation project is based on a 15-minute video speech which lasts 20-30 minutes. To get all students prepared for the project presentation in face-to-face class, five multiple-choice questions are an appropriate design to test students' understanding of the video speech before the project presentation.

4.3 Multiple Team Activities

To achieve both the learning and performance goal through team-based projects on the mobile platform, there are various activities conducted during the process. First of all, before the team project, the performing team discuss and decide the topic, and then upload the resource to the intelligent teaching platform. To ensure the class readiness for their project presentation, they design the questions and initiate a readiness assessment quiz in the interactive learning environment. When performing their project in class, they may involve other teams' participation by conducting brainstorming, survey, question-answering game and so on. After the project performance, other teams make peer assessment and give them a score according to the rubrics established at the beginning of the semester.

4.4 Self-efficacy and Team Potency

According to Bandura [20], self-efficacy is defined as people's beliefs "about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives". In Internet-based settings, many research [21] [22] [23] indicate that students with higher self-efficacy gain better performance than those with lower self-efficacy. Team potency is another belief shared by team members that their group is effective at achieving assigned results [24]. The study by Monteiro and Vieira [25] demonstrates that team potency has a positive relationship with self-efficacy. In the implementation of the TBML model, the hypothesis is that the achievement of both learning and performance goals is closely connected with students' self-efficacy and team potency, which are reflected by collaboration and teamwork in the team-based project.

4.5 Learning Outcome and Performance Evaluation

In the TBML model, learning outcome is mainly evaluated by quizzes, tests, exams and peer assessment. For one thing, students' personal learning goal is specifically related to the subject and content they are learning. And it is mainly evaluated by quizzes and tests. For another, performance goal is assessed through peer evaluation on the team-

based project performance. Students' collaboration and teamwork should be taken into account in the performance evaluation.

5. Research on the TBML Model

Currently we are conducting a study to validate the framework of TBML proposed in this paper. In the study, we apply TBML model to design and conduct a College English course in a comprehensive four-year university in China. Class activities are centered on a variety of team-based learning projects, such as video speech sharing, paragraph translation, essay writing, and presentation in small teams. All learning activities occurred in this platform (Moso Teach), the intelligent mobile teaching platform, which collects data using its built-in analytics tools and records students' learning process. Students' individual learning goal will be achieved by undertaking tasks and activities before, during, and after the team-based mobile project. Their learning is evaluated by periodical quizzes and the final exam. As for the performance goal, the TBML model aims to improve learners' collaboration and engagement through the holistic process of the team-based mobile learning. The assessment will be based on classroom observation, students' comments and interactions through various digital and social media. Detailed of this empirical study have been reported in a paper that will appear in a special issue showcasing X-Reality and Immersive Learning in the Journal of Interactive Learning Environment [26].

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