

Smart Classroom: An Improved Smart Learning Paradigm for College Education

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Abstract—Smart learning strategies have proved to be effective for college education with the development of smart devices. However, most smart learning strategies pay extreme attentions to smart devices and ignore the in-classroom feedback of students. As a result, college students sometimes regard smart learning as in-classroom tasks and fail to obtain effective interactions with teachers. To overcome the weakness of the current smart learning strategies, this study focuses on the strategy that makes college students fully participate in the process of the smart classroom. An improved smart classroom paradigm is proposed to offer college students a better environment with abundant communications to both smart devices and college teachers in the classroom. In this improved strategy, college teachers become the handler of smart devices and lead students to participate in relevant tasks. On the other hand, college students will follow the instructions from teachers and study under an improved smart learning environment with direct course guidance. To prove the effectiveness of the proposed framework, a preliminary practice has been experimented on a college course named “Sensor and Detection Technology”.

Keywords—smart classroom; smart learning; college education; educational reform

I. INTRODUCTION

In the past decades, smart learning strategies have been widely used in the purpose of educational reform to improve the quality of in-classroom education. Among various types of education environments, college education benefits more from smart learning due to the large owning rate of smart devices (e.g., smartphone, tablet PC, smart watches). By the use of smart devices, different teaching materials can be integrated together, which provides students with an easy access to the key information of in-classroom courses. Nowadays, as the development of information technology, the functions of smart devices are becoming more and more various. Therefore, more applications on smart devices are developed to meet the growing demand of college education based on smart learning.

Recent years, scholars in the field of smart learning and college education have proposed a series of research works to apply smart learning to practical education. Xie defined the

intelligent environment of the smart classroom for tele-education purpose [1]. Domermuth developed the detailed strategy aiming at creating a smart classroom for in-classroom education [2]. Suo introduced web service technology into the open smart classroom to improve the performance of the intelligent environment [3]. Chen reviewed the previous works and concluded the features of the smart classroom [4]. Cloud computing was integrated into the web service technology to modify the paradigm of the smart classroom by Guo [5]. Chen proposed a speech-driven technique to implement a novel application of the smart classroom for college education [6]. Zhu developed a better combination between the flipped classroom and the smart classroom [7].

However, most researches just took smart devices as carriers of teaching materials instead of traditional textbooks. Thus, students may spend more time staring at the screen of smart devices but obtain limited knowledge compared to traditional reading materials. In fact, smart devices are able to accomplish more complicated in-classroom tasks which are more than simple carriers. Besides, the function of communication is often ignored since it is always considered that using the communication function will distract students and lead to lower study efficiency. In this proposed work, an improved smart classroom paradigm is designed to make full use of smart devices for college education. The structure of smart learning is modified and the in-classroom function of smart devices is further extended to help college students obtain enough communications with teachers even if they spend much time using smart devices in the classroom.

The rest of this paper is organized as follows: Section II introduces some basic knowledge of the smart classroom as well as the detailed structures of the improved smart classroom paradigm. Then, a preliminary practice of “Sensor and Detection Technology (SDT)” is conducted to evaluate the performance of the proposed paradigm. In Section IV, the conclusion of this paper is made.

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II. THE IMPROVED SMART CLASSROOM PARADIGM AND ITS IMPLEMENTATION

A. Background of the smart classroom

Smart learning strategies are developed to provide necessary support and environment for students no matter whether they are in the classroom or not. As a branch paradigm of smart learning, the smart classroom integrates smart devices and students to create a human-computer communication mode. By using smart devices and related technologies, the smart classroom builds a bridge between intelligent education and traditional classroom activities. Besides, the knowledge of teachers is delivered to students with a more direct view with smart carriers. Under such a learning environment, learning happens everywhere in the classroom. Students are able to study from the screen, desks, tables, blackboard and classmates.

Another significant feature of the smart classroom is the collaborative learning based on smart devices. Students with smartphones in the same wireless network can communicate with each other easily without the limitation of the distance in the classroom. On the other hand, teachers can assign tasks, tests and discussions easily and clearly with the help of smart devices and the web service technology.

In the smart classroom, students are involved in an intelligent space with smart devices and wireless network to have an easy access to the knowledge of courses. Due to the advantages of the smart classroom, many teaching paradigms have implemented the strategy such as the flipped classroom.

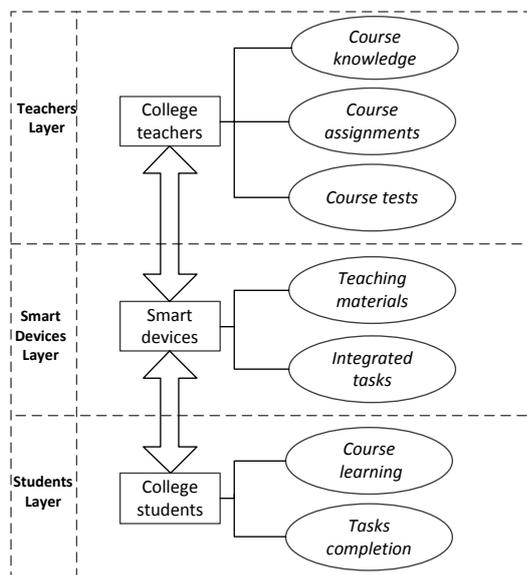


Fig. 1. Structure of the traditional smart classroom for college education

B. The paradigm of the smart classroom

In the beginning, the smart classroom was developed for tele-education purpose. As a result, the major task of the smart classroom is to provide a connection between teachers and students with smart devices. In the traditional paradigm of the smart classroom, the above elements form three individual parts in the learning structure. For teachers, they play the role

of “deliverer”, whose knowledge related to the course is projected into smart devices in the form of courseware, videos, voice and web pages. The main function of smart devices is “carrier” since knowledge from teachers is stored in them and makes them teaching materials. For students, they are still “learner” although smart devices have taken the place of traditional textbooks and other paper materials. The detailed structure of the smart classroom for college education is described in Fig.1, where the three major elements are separated into three parts.

C. The improved smart classroom paradigm

Although the smart classroom has been widely used for college education, the functions of smart devices and web service technology are not fully discovered for in-classroom learning. There are some limitations of the traditional smart classroom structures:

- a) Although the smart devices layer connect college teachers and students with intelligent interfaces such as multimedia, the interactions between teachers and students are as weak as using traditional paper materials. Teachers post teaching materials and tasks online while students learn and finish tasks on smart devices. When college students face difficulties, they are not able to ask teachers for immediate help. The gap between students and teachers remains after the smart classroom is introduced.
- b) The active learning of the traditional smart classroom is not enough since the form of in-classroom teaching and learning has not been changed essentially. Under such a smart environment, no more discussions or other creative learning strategies are designed in this paradigm. On the contrary, students often spend more time staring on the screen of smart devices, which may lead to undesirable distractions.
- c) In the smart classroom paradigm, web service technology plays an important role in the learning procedure. However, many implementations of the smart classroom ignore the function of network and merely regard smart devices as carriers of teaching materials. A better combination between smart devices and web service technology should be developed to meet the increasing demand of real-time smart learning.

To acquire a better performance of the smart classroom paradigm, an improved model is proposed in this paper, where the advantages of the traditional model are preserved. The modified model is described in Fig.2.

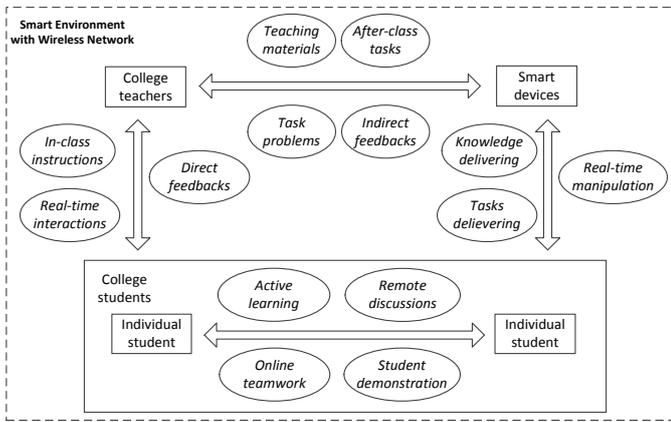


Fig. 2. Structure of the improved smart classroom for college education

In the proposed structure, the gap between college students and teachers is eliminated by introducing real-time interactions and direct feedbacks. Different from the traditional model, an additional bridge is built to create a more direct communication between students and teachers. Hence, students are able to ask questions by voice input or finger touch when they are facing difficulties in understanding teaching materials, while teachers can answer the questions immediately and assign corresponding tasks to enhance the knowledge mastery level of students at the same time through smart devices.

Besides, actions between college students with smart devices are paid more attentions to for the purpose of active learning. Unlike the traditional way of individual learning, the improved model allows those students who are not sitting closely to have the chance of teamwork and discussions. Students whose opinions are similar for a certain topic will be organized into one team or group through smart devices and wireless network. Then, they can share their own ideas easily without the limitation of distance. Meanwhile, student demonstration is introduced as well, which can display excellent course works from students on smart devices to all in-classroom members.

D. Features of the proposed model

Different from the traditional smart classroom model, the proposed model aims at making full use of smart devices and eliminating the gap between in-classroom members. The elements of the smart classroom are integrated into one smart learning environment instead of three separated parts. The advantages of the improved model are demonstrated as follows:

- a) The improved model keeps the advantages of the traditional smart classroom paradigm. Teaching materials are uploaded into smart devices with an easy access. Courseware, videos, voice, images and other multimedia methods are adopted. College students are able to receive a direct view of course knowledge points. Besides, college teachers can assign homework, discussions and tests to students in a convenient way through smart devices.
- b) College students, college teachers and smart devices are three fundamental elements of the smart classroom paradigm. The improved smart classroom model no

longer separates these elements but combines them into an integrated smart environment with wireless network. Therefore, the gap between different elements is eliminated especially for students and teachers. College students are not required to stare at the screen all the time since real-time interactions are encouraged in the proposed model.

- c) The improved model focuses more on the actions of college students. Students are not listeners in the improved smart classroom environment and become participators. They are led to group discussions, online teamwork and individual demonstrations regardless of the distance. Therefore, the active learning mode can be achieved and students act the leading role in the classroom.

III. PRELIMINARY PRACTICE

A. Background

For performance evaluation, the course named “Sensor and Detection Technology” (SDT) is conducted in the preliminary practice section. In this course, there are total 16 teaching units and 135 minutes for each teaching unit. The teaching purpose of this course is to make college students who major in automation master the principles, structures, functions and features of industrial sensors as well as relevant technologies. Since SDT is an engineering course with complex practical knowledge, college students often face difficulty in learning SDT. Past teaching experience and surveys reveal that using courseware and other multimedia teaching methods is not enough to achieve a satisfying comprehension of course knowledge.

B. Teaching unit design

The chapter “vortex flowmeter” is an important knowledge point which occupies one teaching unit. The teaching methods and materials used in the improved smart classroom are presented in TABLE I.

TABLE I. TEACHING METHODS AND MATERIALS IN SDT

Teaching Methods	Description
Real-time interaction	Teachers show vortex flowmeters and its working animations to students; Students guess the function of the structure on smart devices; Teachers pick relevant answers and implement face-to-face communications.
Smart assignment	Teachers assign an in-classroom test on smart devices; Students answer tests on smart devices; Teachers illustrate the correct answer to consolidate the knowledge of students.
Active learning	Teachers provide a topic on the practical use of vortex flowmeters; Students activate brainstorming and post interested opinion on smart devices; Students with similar interests form groups and discuss online.

In the real-time interaction design, teachers should firstly show a vortex flowmeter to students. Then students observe the structure of the flowmeter and watch the corresponding working animation on smart devices. According to the teaching

materials, students and teachers are encouraged to have face-to-face communications about the problem that how the flowmeter functions. This design part is expected to eliminate the gap between students and teachers by combining flowmeter display and multimedia teaching materials with direct communications.

In the assignment designing part, teachers upload an in-classroom test online and students able to work on the test on the smart devices. At the same time, real-time feedback will be extracted to the smart devices of teachers. The corresponding correct rates of these questions can be acquired immediately. Therefore, teachers can figure out whether students have any misunderstanding part and illustrate the knowledge point more clearly for students.

In the active learning design, students are asked to have more cooperation. Topic from teachers is going to stimulate the motivation of learning for students. Those whose ideas are similar will be organized into one group. Therefore, students in the classroom with the same opinion can communicate with each other through smart devices easily and distance is no longer a limitation for active learning.

C. Experiment result

Students who attended the preliminary class are asked to complete a survey about the implementation of the improved smart classroom. The result of the survey is shown in TABLE II.

TABLE II. RESULT OF THE PRELIMINARY CASE

Teaching Methods	Satisfactions		
	Poor	Good	Excellent
Real-time interaction	0.0%	20.3%	79.7%
Smart assignment	2.7%	44.6%	52.7%
Active learning	0.0%	10.8%	89.2%

The survey result proves that the overall satisfactions are significant. Most students found it useful after the improved smart classroom paradigm was implemented during the process of the SDT course learning. Students also felt it interesting since the novel learning environment had been adopted and they acted the leading roles in the stage of college education.

However, some students reflected that the assignment part is similar to the traditional strategies since smart devices are still regarded as carriers. According to the suggestions of students, the course assignment should be improved in a better way that it can be created automatically which is related to the weak knowledge points.

IV. CONCLUSIONS

In this paper, an improved smart classroom model is proposed to overcome the deficiency in the traditional smart classroom paradigm for college education. Compared to the traditional model, the proposed method aims at eliminating the gap between students and teachers and taking full advantages of the smart environment. Real-time interactions, smart assignments and active leaning strategies are designed to offer a better teaching and learning performance. A preliminary case of the SDT course is conducted to prove the effectiveness of the proposed teaching paradigm. The survey result after the lesson is collected and shows high satisfactions from the opinions of students. Future work will focus on the improvement of the smart assignment part to create a better interface for tests and tasks.

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