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Strategies for Improving Learning Performance by Using Crowdsourcing and Flipped Classroom

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Abstract: We conducted a survey indicating the wide variety of computer literacy and computer skills among college students. Most teachers suggest that new teaching strategies should be deployed. To resolve these issues, we propose a strategy for improving learning performance in the Introduction to Computers class based on the concepts of crowdsourcing and flipped classroom. The design strategy attempts to resolve common issues in training teachers, designing teaching activities, and sharing knowledge and teaching experiences simultaneously. To accomplish the above goals, we make use of a crowdsourcing system which serves multiple purposes including (1) the innovation of teaching ideas; (2) the enhancement of instructor engagement and training process; and (3) the improvement of sharing knowledge and teaching experiences. To verify the proposed approach, an experiment involving over 10,000 students will be conducted.

Keywords: crowdsourcing, flipped classroom, MOOCs

1. Introduction

Although computers are popular in the current information era, not all students are able to take the full advantage of it. According to our survey, college students have a wide range of computer literacy and skills. Furthermore, most teachers suggest that new teaching strategies should be deployed. In this paper, we propose a strategy for improving learning performance in the Introduction to Computers class based on the concepts of crowdsourcing and flipped classroom in order to resolve these challenging issues.

Crowdsourcing was coined by J. Howe in 2006 [1]. Crowdsourcing systems enlist a multitude of humans to help solve a wide variety of problems. Prime examples include Wikipedia, Linux, Yahoo! Answers, and Mechanical Turk-based systems [2]. Strategies are known as crowd wisdom, crowd creation, crowd funding, and crowd voting [3]. However, applications of crowdsourcing are not only extensively used in general public domains, but also in the education field. In the web site of The Chronicle of Higher Education, examples and undergoing research projects in crowdsourcing can be found [4]. To implement crowdsourcing, open source and commercial platforms are available [5].

NY Times declared that 2012 is the year of MOOCs [6]. There are three MOOCs key players, Couresera, Udacity, and edX today. One of the key features in which a MOOC differs from traditional online classes is that MOOCs video clips are short (usually less than 15 minutes). The length of these videos take into consideration human cognition loading. With these video clips available, the concept of flipped classroom can be easily implemented. As a result, we integrate crowdsourcing and flipped classroom together to improve the learning performance. To verify the effectiveness of the design strategy, we also design an experiment involving over 10,000 participants. Data will be collected for further analysis from different dimensions.

2. Problem Statement and Design Strategy

In this section, we describe the survey and its results. In addition, we propose a corresponding strategy to resolve issues evident in the results of our survey.

2.1 Problem Statement

A survey is conducted to probe the computer literacy and skills of college freshmen. There are 10 items and five levels (not familiar to very familiar) for each category of computer skills. As shown in Figure 1, the survey indicates that the familiarity levels of students vary greatly. We also investigate what students expect to learn and what teachers think students should learn in the Introduction to Computers course. As shown in Figure 2 and Figure 3, the survey shows that the students' expectations and the teachers' opinions do not match well. It also indicates that the teachers' opinions are not unanimous. However, more than 70% of teachers suggest that the teaching strategy should be improved. Based on the survey mentioned above, we draw the following conclusions:
(1) the course content and activities should be present in a variety of ways to better suit the students;
(2) a mechanism that can enable teachers to generate ideas and share knowledge would be beneficial.

Option / Topic	Very Poor	Poor	Fair	Good	Very Good
(1) Typing in English and Chinese	22(4.1%)	105(19.59%)	198(36.94%)	142(26.49%)	69(12.87%)
(2) Software install and uninstall	56(10.45%)	100(18.66%)	115(21.46%)	170(31.72%)	95(17.72%)
(3) Use of Windows	56(10.45%)	117(21.83%)	159(29.66%)	144(26.87%)	60(11.19%)
(4) Use of Word	62(11.57%)	128(23.88%)	150(27.99%)	144(26.87%)	52(9.7%)
(5) Use of Excel	104(19.4%)	125(23.32%)	169(31.53%)	100(18.66%)	38(7.09%)
(6) Use of PowerPoint	122(22.76%)	132(24.63%)	157(29.29%)	92(17.16%)	33(6.16%)
(7) Deal with simple computer abnorma	191(35.63%)	178(33.21%)	101(18.84%)	44(8.21%)	22(4.1%)
(8) Simple image and audio editing	221(41.23%)	159(29.66%)	98(18.28%)	45(8.4%)	13(2.43%)
(9) Install operation system	312(58.21%)	112(20.9%)	68(12.69%)	32(5.97%)	12(2.24%)
(10) Computer programming	406(75.75%)	73(13.62%)	44(8.21%)	7(1.31%)	6(1.12%)

Figure 1. Computer skills of college freshmen vary greatly.

Option	Numbers	Percentage
A、 Office software	406	75.75%
B、 Install operation system , backup and recovery	332	61.94%
C、 Computer troubleshooting	349	65.11%
D、 Computer security	290	54.1%
E、 Common network access	218	40.67%
F、 Flash animation	314	58.58%
G、 Photoshop image editing	310	57.84%
H、 Utility Software	280	52.24%
I、 Multimedia Technology	321	59.89%
J、 Assembly and maintenance of computer	260	48.51%
K、 Installation and use of commonly used software	269	50.19%
L、 Database Technology	232	43.28%
M、 Video Editing	296	55.22%
Total	**536**	

Figure 2. Students' expectations of what they will learn in the Introduction to Computers course

Option	Percentage
Install operation system backup and recovery	68%
Computer troubleshooting	80%
Common network access	56%
Installation and use of commonly used software	68%
others	8%

Figure 3. Teachers' viewpoints: Course contents that should be enhanced differ among teachers

2.2 Strategy for improving learning performance

We propose the following strategy to resolve the challenging issues mentioned in Section 2.1. The main concept is depicted in Figure 4. It consists of four main mechanisms: MOOCs videos, idea generation, flipped classroom, and performance evaluation. First, we prepare videos in MOOCs format for students to learn course materials and discuss with classmates online. Second, instructors work together in a crowdsourcing system to generate teaching ideas and design suitable class activities for students. Third, we conduct flipped classroom in class. Fourth, the corresponding data will be collected to perform further analysis to improve the design. The preparation of MOOC videos will be executed in a consistent manner. Our focal points are the crowdsourcing system and performance evaluation, which we will elaborate in more detail in Section 3.

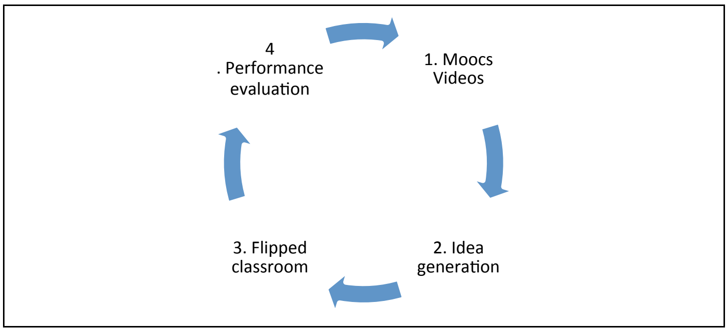

Figure 4. Strategy which includes four mechanisms to resolve challenging issues in the Introduction to Computers course

3. System Overview and Crowdsourcing System

3.1 Framework of the System

Let us consider several common challenges with teaching on-site at many educational institutions: (1) how to execute instructor training; (2) how to share teaching and learning experiences; and (3) how to do teaching evaluation. In this section, we propose strategies to simultaneously resolve the above issues. In the realm of learning, co-construction is an approach whereby the emphasis is in working collaboratively or in partnerships. 'Co-construction of learning' deepens relationships and understanding between all learning partners and can lead to improvements in the quality of education (Wikipedia, 2013). The designed system targets co-construction between instructors and instructional designers. The corresponding design philosophy and framework of the system are described in this section.

First, the instructors and/or instructional designers that will engage in the course design and lecture delivery are invited to be the participants of co-construction. Participant requirements include familiarity in relevant areas such as (1) pedagogic design; (2) course content; and (3) lecture delivery. The design philosophy, as shown in Figure 5, is based on the funnel of content creation, which is inspired by the 'marketing funnel', an idea in widespread use in marketing and sales (D. Clow, 2013). By way of analogy, we have four stages in our design framework:

- Awareness – instructors understand the target material and task (e.g., specific chapter, section, or knowledge node);
- Acquisition – instructors enhance teaching activities by query, peer discussion, and any knowledge acquisition processes;
- Action – instructors create their learning activities or modify other instructors' inputs, i.e., an ideation step;
- Consequence – the leader of the activity designers terminates the design process and concludes with final results.

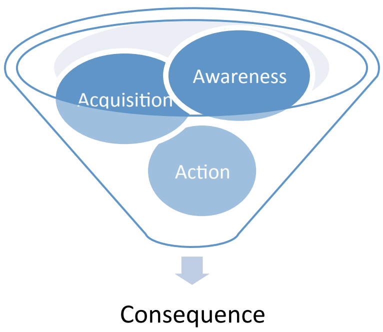

Figure 5. The funnel of idea generation

In order to implement the design philosophy mentioned above, four mechanisms are designed. We elaborate each mechanism in detail as follows.

- Awareness: Mechanism of participant invitation and task awareness
  Materials of benefit to participants are provided to orientate themselves. This consists of functions such as an invitation to the participants, a description of the lecture, a description of the lecture format and style, an announcement and confirmation, a guided procedure with templates and tools to help keep track of the task, a best practice guide and tutorials, and a record of the participants' usage.
- Acquisition: Mechanism of co-construction of learning activities
  The co-construction of learning activities is executed in this mechanism. It includes reading and offering comments and suggestions on the lecture content, designing learning activities, and selecting the preferred content and learning activities. This process is a knowledge generation and filtering preparation phase.
- Action & Consequence: Mechanism of lecture accomplishment
  Knowledge filtering and sharing occurs in this mechanism. At the appropriate time, the leader of the co-construction concludes with the final result and produces the top-ranked learning activities. Subsequently, he/she informs all participants of these activities.
- Feedback: Mechanism of outcome evaluation and analysis
  The feedback mechanism collects information related to instructor class experience, learners' assessment and survey, etc. to improve the co-construction mechanisms as well as lecture content and pedagogy design.

In order to ensure the quality of outcome, being able to smoothly transition between stages is also important. For instance, participants are not allowed to begin the acquisition stage before they complete the awareness stage. Based on the above description, the corresponding learning platform and tools will be supported in the implementation phase. Meanwhile, encouragement policies for participation will be designed.

4. Experimental Design

To validate the above design, a common course "Introduction to Computers" is selected. Four schools and over 100 instructors and 10,000 students will join the pilot study.

4.1 Syllabus

"Introduction to Computers" (G. L. Chen, 2009), the selected textbook, consists of 12 chapters and labs. Each chapter will be transformed into MOOCs format and includes text, videos, quizzes, discussion, and learning activities (Coursera, 2013). Instructional designers first divide each chapter into suitable knowledge nodes. The video length of each knowledge node is around 10 minutes. Instructors are asked to contribute in quizzes, discussion topics, and learning activity design tasks by following the designed format described in the co-construction management system.

4.2 Class Type

To gain a better understanding of learners' behaviors and their learning results, we arrange four types of learning classes for the experiment. Note that the size of each class may not be equal.

- Class Type A: online classroom only
  Students only take classes and read learning materials online
- Class Type B: flipped classroom
  Students attend classes on-site in the classroom and read learning materials online
- Class Type C: regular classroom
  Students attend classes on-site and are encouraged to read the learning materials online
- Class Type D: open online class
  Students attend classes on-site and gain free access to the learning materials online.

The lecture content and learning activities on the web will be available on a MOOC platform, the digital learning environment for all students and instructors. Meanwhile, instructors will be asked to access the lecture content co-construction management system to record and report the processes.

4.3 Data Acquisition

Data and survey from different dimensions, such as stakeholders, instruments, and objectives will be collected to perform further analysis. These data collections are mainly from MOOCs platform and lecture content co-construction management system. In each lecture unit, data collected include, but are not limited to, the following:

- Students: ePortfolio, log file data, assessment (formative and summative), resource utilization, discussion board action, learning outcomes.
- Teachers: log files data, engagement, content contribution, idea generation and sharing, feedback.

4.4 Data Analysis and Information Flow

Although the data collected can be applied to different research objectives, the main focal points of our evaluation are co-construction strategy and mechanisms. The learning analytics mechanism takes inputs from MOOCs platform and co-construction management, and its outputs are of benefit to the areas of pedagogy, research, and administration.

5. Conclusion and Future Work

A strategy to improve student learning performance in the Introduction to Computers is proposed in this paper. By using the crowdsourcing system, we expect the instructors to gain knowledge and familiarity in the lecture content and learning activities. As a result, it may reduce the load of preparing for class for the instructor and improve the quality of their teaching. The above goals will be verified via the designed experiment involving more than 10,000 learners. Data collected from MOOCs platform and co-construction system will be analyzed.

This is a pilot program. The experience and results obtained will be conducive to the enhancement of the co-construction system as well as the improvement of teaching and learning. It also paves the way to design more MOOC lectures effectively.

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