A Cross Device Learning Analytics Platform

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ABSTRACT

This contribution describes the results of a pilot study using YourLabs™ mobile knowledge evaluation system (KES) in two engineering courses at sophomore/junior and senior levels at the University of Arizona. KES is a next generation learning analytics platform that drills down to the depths of students' understanding in problem solving and provides students' self-reported feedback to the instructor in real time on any mobile device. Questions were created using a question creator in KES and then URL links provided by KES were given to the students. The students answered the questions, saw their results and were prompted to report where and what types of mistakes were made. KES delivered the learning analytics to the students and the instructor immediately. The instructor was able to review problem areas in class and make appropriate adjustments to instructional materials. Students in the two classes (Fluid mechanics and Geotechnical Engineering & Design) were surveyed using a 5-point Likert scale after four weeks of KES usage. A majority of students (90%) reported that KES was useful, helped them understand concepts and problem solving techniques, and would recommend more of their instructors use it.

1. INTRODUCTION

The most common way of evaluating student learning is through graded homework, quizzes, and examinations and the assignment of a letter grade. A letter grade is generally an aggregated weight of learning assignments at the end of a designated period, such as a semester or a year (summative assessment). Summative assessment provides very little room, if any, for timely instructor intervention to improve learning. KES is an innovative, next-generation learning analytics platform (patent pending) that gathers continuous, in-depth data on how students learn and deliver real time, customized learning analytics to advance students performances and to inform instruction.

The purpose of this contribution is to present a brief description of KES and the results of a pilot study at the University of Arizona on the potential of KES as an expanding evidence approach learning analytics platform.

2. YOURLABS™ KNOWLEDEGE EVALUATION SYSTEM

In KES, an instructor can create any type of problem solving activity ranging from a single step solution to multi-step solutions or clone one or more activities from KES' sharable library and delivers the question or questions to the students in-class or out-of class on any mobile device (e.g. smartphone, IPad, IPhone, laptop, desktop). KES' widgets prompt and collect detailed students' self-reported data at each step of a problem solving activity including data on whether a student understands the concept behind the problem solving activity/step or not. KES then generates real time learning analytics to show, for example, if a student solved the problem correctly, how long that student took to solve the problem compared to his/her peers, how many students understood the concept behind the problem solving activity, what variations in answers were submitted, how long did each student take to solve the problem, what step did the students had difficulty with, what types of mistakes (e.g. arithmetic, sign, wrong equation, etc.) were made in each step, and how many students understood the concept of each step. The analytics provide both the students and the instructor with actionable

information. The student can self-reflect and take corrective actions. The instructor can review the appropriate learning materials with students, improve instructional materials and methodology, and re-evaluate students' performances. KES can conduct real-time and historical analyses to discover connections, contexts, meta-cognition and learning styles to better understand how students learn.

3. PILOT STUDY AND RESULTS

A pilot study in two classes – CE 218 Mechanics of Fluids (60 sophomore/junior level students) and CE343 Geotechnical Engineering and Design (48 junior/senior level students) – in the Department of Civil Engineering & Engineering Mechanics at the University of Arizona was conducted in fall 2012. Over a four-week period students were requested, after a lecture in class, to use their mobile devices and answer a question that the senior author prepared using KES' question creator (see Figure 1 for an example).
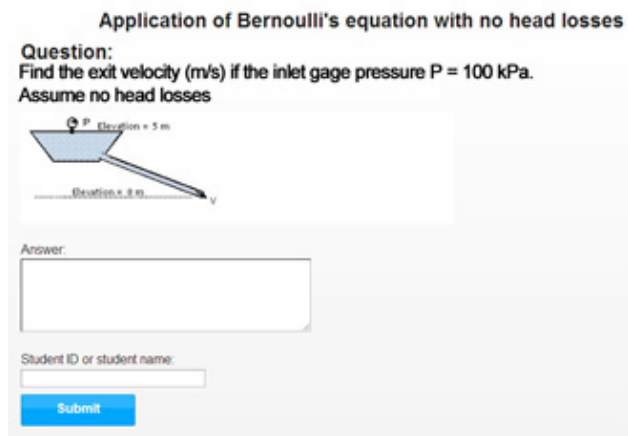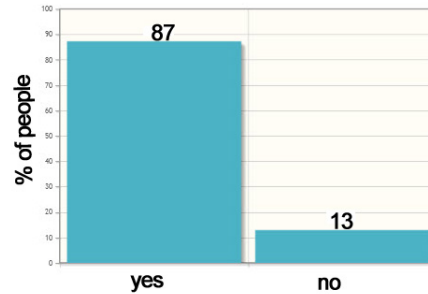

Figure 1: A sample Mechanics of Fluids KES question

The students answered the question and then KES prompted them to self-report on their performances. Then, KES generated learning analytics to evaluate students' critical thinking, concept understanding, problem solving skills, and where and what types of mistakes were made. For example, for the problem shown in Figure 1, 87 % of the students understood the concept of Bernoulli's principle and 79% understood the concept behind step 1 of the problem solving approach (Figure 2). The types of mistakes made in step 1 (Figure 3) show that 17% of the students used the wrong equation, while 11% of them made arithmetic error. Some written verbatim comments posted by students and captured by KES

included "I converted the 100 kPa to Pa when apparently we don't need to. I don't understand why." and "used top of the system as datum. misplaced quantities for pressure in equation."

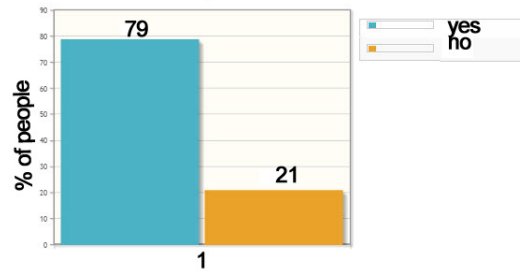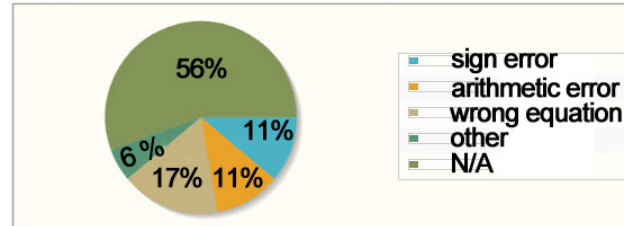
Figure 2 KES concept understanding analytics

Figure 3 KES custom analytics of errors made in a step

In a survey, a majority of students (90%) reported that KES was useful, helped them understand concepts and problem solving techniques, and would recommend more of their instructors use it.

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