

Use of Mobile Application to Improve Active Learning and Student Participation in the Computer Science Classroom[‡]

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ABSTRACT

This poster addresses a significant learning barrier experienced at many CS departments, specially at predominantly minority institutions, which is the problem of students' inability to keep being engaged and interested in classroom. In our project, we investigate the applicability of using mobile devices in the classroom and incorporation of interactive problem solving using those devices to increase class engagement and active learning for students. By allowing the students to solve problems in their preferred devices, the project expects to create a friendly learning environment where the students want to retain, be active and skillful. The poster will present the design aspects of Mobile Response System software that will be utilized to communicate, collaborate and evaluate interactive problems. The poster will also showcase several interactive problem-solving activities utilizing mobile devices and MRS software, which have been developed and are being adopted in CS and IT courses at Winston-Salem State University (WSSU).

SIGNIFICANCE AND RELEVANCE OF THE TOPIC

Recent statistics indicates that although being about one third of U.S. populations, only 10.3% of bachelor's degrees in computer science are granted to underrepresented and minority population [1]. It is also reported that minority students express the desire to go into CS and other STEM major at the same rate as students with other ethnicities, however more minorities switch to another major after being enrolled to a STEM program [2,3]. Similar crisis is being experienced at the CS department of WSSU, an HBCU, in terms of students beginning with CS/IT as their major and then dropping out or changing their majors. A major proportion of the student who choose to stay in computing field also encounter significant learning barriers which prohibits active participation and persistence in learning. Many of our CS undergraduates are first generation college students in their families and lack of direction and proper guidance from their families typically cause an obstacle to perseverance in learning. Additionally, many of them have a low sense of self-efficacy regarding to the mathematical, programming and technical aspect, which prevents them from actively participating in the classroom environment.

Researchers at Rochester Institute of Technology have reported that their use of a technology-rich learning environment in several undergraduate engineering-technology courses has improved learning and decreased withdrawals from, or failing grades in, the courses [4]. Boston University [5] adopted tablet-based problem solving exercises in their freshman mathematics class and reported noticeable increase in student attendance and course completion. Many other approaches [6,7,8] also reported enhanced educational experiences when technology such as mobile devices has been adopted in the classroom for students to participate and solve problems.

2010 Pew study of mobile device usage [9] revealed that African American and Latinos are the most active users of the Internet from mobile devices. The study also revealed that minority cell phone owners take advantage of a much greater range of their phones' features compared with other ethnicities. At WSSU, it is common for students to multi-task and use their mobile devices while in class, studying, or performing other activities.

Inspired by the Pew study and the reported impact of utilizing technology-rich class environment at other institutions, our project aims to design, develop and incorporate a Mobile Classroom Response System (MRS) in order to enhance student's engagement, active learning and problem solving skills at WSSU. By using mobile devices, we expect shy students to interact anonymously and participate in class discussions. By asynchronously prompting students with interactive problems related to the lecture material in their mobile computing devices, we expect students to maintain more focus on the course content being presented and ultimately to learn and retain information better.

The proposed project includes four distinct activities: 1) development of the MRS software, 2) development of interactive problem solving course modules and corresponding rubrics that can utilize the MRS software, 3) deployment of the software and course modules in target classes at WSSU, and 4) assessment and documentation

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of progress toward our goal and performing continuous improvement. The purpose of the MRS software is to provide a collaborating and responsive environment where students can solve their problems in an interactive way and communicate their solutions with the instructor and the instructor can communicate questions, answers, feedback and student performance data with the students. The developed MRS software and corresponding course modules will be deployed in one sophomore and one junior course, which are required courses for both CS and IT majors in the department and involve use of mathematics and problem solving. A comprehensive evaluation framework will be utilized for assessment and evidence-based continuous improvement across three years of project duration. The project team includes two CS faculties to develop the MRS software and course modules, one education faculty to formulate and execute evaluation and assessment and an independent external evaluator to review, assess and guide the project evaluation towards achieving the desired goals.

This research is expected to enhance the understanding of developing an interactive mobile response system and how to use such devices in the classroom to improve student's class interaction and problem solving skills. The successful execution of this project will advance research and the knowledge of mobile device usage in CS classrooms and more importantly the way it impact teaching strategy and student learning at WSSU and other institutions. The work seeks to explore the transformative power of the adoption of mobile technology in classroom environment to improve educational experiences.

It is expected that this project will invigorate interest in Computer Science among African American students through exposure to the technology-rich learning environment. By enhancing student learning and problem solving abilities, it is also expected that this project will improve the quality and quantity of underrepresented minority students in STEM workforce or graduate study. The instructional software system, course modules and study results will be disseminated through websites, publications and presentations and other institutions can effectively incorporate them in their undergraduate computer science curriculum. Undergraduate student researchers working under this project will be expected to gather valuable experiences on software development in mobile platform, which is getting increasing focus from the industry. The project will also enrich the teaching strategies of educators of minority-serving and other institutions by including a diverse set of active learning components.

CONTENT

The poster will present experience and insight gained in this research and showcase a synopsis of the three-year project. More specifically, the poster will present the overall system design and software architecture of the MRS system, descriptions of key system elements, description and example of interactive problems and course modules, strategy to incorporate evidence-based continuous improvement to the proposed system, evaluation approaches and current status of the research.

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