

Incorporating R&D Activities into Computer Engineering Teaching & Learning Program in Albaha University

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Abstract—In this article we share a teaching CS subject experience at college of CS&IT, Albaha university with involving the students in our research activities.

Keywords—research-based learning; problem-based learning, undergraduate research

I. INTRODUCTION

Albaha University, located in Albaha Province, Saudi Arabia is relatively a new university, and the College of Computer Science and Information Technology (CoCSIT), is a three years old college in the university. The main problem with the teaching and learning activities in the college is the low motivation of students in participating in the class. One attempt to address the problem is to involve the students in any research activities that conducted by lecturers that related to the subject the students take in that semester.

However, a big question arises, is student research and research-based student learning for all students at all higher education institutions or are such just for elite students (and elite staff) in selected institutions? This paper attempts to answer the question.

II. RESEARCH-BASED LEARNING

Research-based learning (RBL) can broadly be encapsulated in the nexus between the approaches of enquiry-based learning and the features of undergraduate research.

Enquiry-based learning in its widest sense can be seen as an umbrella term, ‘covering a range of approaches to learning that are driven by a process of enquiry’ [1]. As such, it would include problem-based learning, project work, field-work, case studies etc. Undergraduate research - that is, research carried out as part of the curriculum by undergraduate students - would have the following essential components [2]:

- learning the epistemologies and forms of discipline-based inquiry

- learning particular disciplinary research methodologies
- producing work that mimics the forms of knowledge creation and dissemination in their disciplines and professional areas.

According to Healey and Jenkins, while enquiry-based learning models may contain some or all of these characteristics, in undergraduate research programs these features become significant, if not central, elements of the educational set-up. We choose to frame our work as research-based learning as it implies a stronger relationship with the methodological underpinnings of discipline-specific ways of knowledge-making than enquiry-based learning, and can extend beyond the undergraduate curriculum.

A. Teaching and Research Relation

A famous meta-analysis of 58 studies from 1949-1992 that examined the relationship between quantifiable performance in teaching and research has been done by [3]. The authors first set out various lines of argument for why relationship between teaching and research should be positive/negative/no relationship and then use the meta-analysis to examine them.

Models of the relationship between teaching and research can be classified into the following way [4]:

- Research-led teaching: based on the ‘information transmission’ model; curriculum structured around subject content; focus – understanding research findings;
- Research-oriented teaching: curriculum structured around research processes as well as subject content; focus – understanding research processes, teaching inquiry skills and ‘research ethos’;
- Research-based teaching - curriculum designed around inquiry-based activities; focus - learning through inquiry; the teacher-student division minimized.
- Jenkins and Healey [5] extended Griffiths’ classification, mapping it onto two axes in four ways as shown in Fig. 1

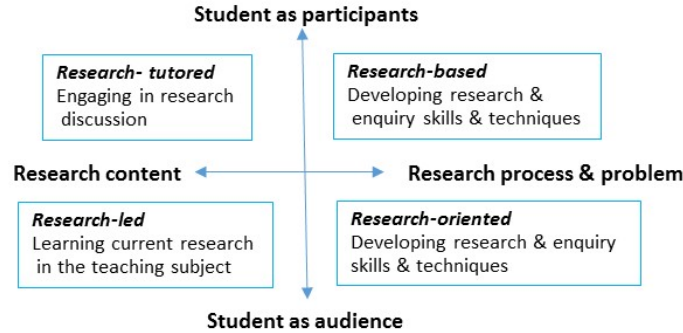


Figure 1. Extended Griffith's Classification on Research-based Teaching

III. THE ACTIVITIES

We facilitate student centered learning environment by forming a research group in the college and with good supports from the college management.

Students in Semester 5 of Computer Engineering who are taking Signals and Systems Analysis subject are being involved. Very fortunate, that this is a small class, with only 14 students. The subject is a 3 credit hours, without laboratory component. This course introduces students to the concepts of signal modeling and the interaction of signals and linear systems. The focus is on the continuous-time cases such as voice and music. Students learn signal and system modeling concepts; time-domain analysis including concepts of convolution and superposition; system response to different stimuli including impulse and step; frequency-domain analysis including concepts of Fourier series, Fourier transforms, and Laplace transforms; and applications of analytical tools such as signal representations, transfer functions, and filtering. Throughout the semester, MATLAB, a computational software program, is used to emphasize and to help in understanding important concepts of the course as well as a tool for solving homework problems. Cognitive skills to be developed through this course is the ability to demonstrate basic knowledge and understanding of essential, concepts, principles, and theories relating to topic on system response to different stimuli including impulse and step.

In this experiment, 7 students attended 1 hour bi-weekly extra activities either in the laboratory doing experiment or in the class to discuss the research materials. We select a research topic on sound identification on pitch shifting using Shifting Pitch Synchronous Overlap Add (PSOLA).

Pitch shifting is a technique used to change the pitch of sound signal without influencing the duration or speed of the sound signal. The inverse of the process of pitch shifting is a time stretching used to change the duration or speed of the sound signal without changing the pitch, that is by doing a resample in the sound signal but this manner also influences the duration or speed of the sound signal [6]. The PSOLA algorithm is structured with 2 phases, the first phase is called as analysis phase and the second phase is called as synthesis phase (see Fig. 2).

We use recorded sound signal with sampling frequency of 8,000 Hz and duration of 1 second.

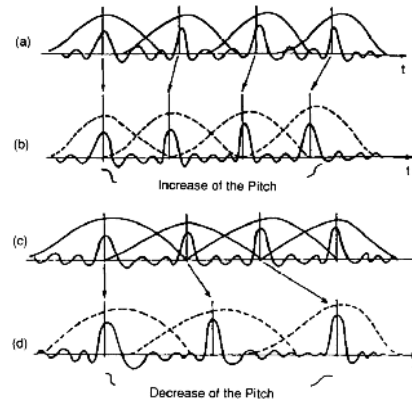


Figure 1. PSOLA Process

IV. CONCLUSION

Tentatively, we may conclude that the answer to the question in Section 1 is that student research and research-based student learning are for all students at all higher education institutions.

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