Keyword Based System to Enhance the Efficiency of Student's Performance Report in Computer Science Education

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Keyword Based System to Enhance the Efficiency of Student’s Performance Report in Computer Science Education

Jos Timanta Tarigan, Elvyawati M. Zamzami, Ivan Jaya, Sri Melvani Hardi
Faculty of Computer Science and Information Technology, Universitas Sumatera Utara
jostarigan@usu.ac.id

Abstract. The most common way to show student's education result is by using a single value to evaluate his/her study. However, this method does not have the capability to track the content delivered during the class session. In computer science, this may become a major problem since student’s capability to use programming language, software, and hardware are important to measure their skill. In this paper, we propose a system to enhance the efficiency of students’ performance record. The system is aimed to give a more detailed skill regarding student’s education history by supplementing the final score with the related technologies such as programming language, software, and hardware, used during the class. In this paper, we will go through the design of the proposed system and present a thorough review on previous related researches and available technologies that may be used to support the system.

1. Introduction
The use of information technology is vital in modern education process. Using computers and internet is common to develop an efficient and effective way to support educators such as developing and distributing contents, managing class, and performing evaluation. Not only this solution can increase the effectiveness of the education process, but also the system may help lecturers and students to evolve the education process to a better one.

While the education system has been revolutionized by the penetration of education software, there are still problem to measure student’s capability based on the result. Most school and university still depend on a single final score which sometimes does not present enough information regarding student’s experience during the classroom. Hence, it is sometimes hard for lecturers to keep a detailed information regarding student’s progress. Moreover, in computer science education where changes and new technologies are available in high frequency, it is important for university and lecturers to update their content/curriculum to keep in track with the industry. This may cause of problem where students who take the same class with different period may receive a different content and experience.

In this paper, we present the design of our system aimed to solve this problem. We propose a system that intended to keep track of student’s performance by using keywords. These keywords are then weighted to represent the quality of knowledge of the student. The later section of the paper will describe in detail regarding the proposed solution. Additionally, we will go through the implementation of the system in current education process to give a thorough idea on how to attach the system in modern classroom.
2. Related Works

Computer Science education, especially in higher education level, has become one of the most researched topics in educational related research. One of the main problems discussed amongst computer science educators is the content required to be delivered to students. An article published by the IEEE Computer Society present a study regarding the state of computer science degree in 2018 [1]. The author performed an interview with six senior computer science educators only to find that even though there are frequent changes in modern computer science, computer science education still maintains its core classes. Some of the interviewees agreed that while the subject tend to be similar in the last decade, the content delivered to students has been evolved to match industry’s need.

However, these findings may cause another problem; the definition of student’s capability after passing a class may be different. Hence, it is important to investigate how to increase the linearity of students’ academic performance and their skill/ability. Like other engineering subject, computer science education heavily depends on practical instead of theory. The experience of student to perform programming tends to be more valuable than classroom theory session.

There are several studies that focus on transforming current education process. Some researches focus on analysing and transforming the teaching method to include more practical session in the curriculum. A research by Swart [2] presented an experiment that compares two theory-practical fusion approach (phase lock loop and transmission line). Other studies focus on using information technology as the core of the teaching method such as using tablet PCs and slate devices to improve interactivity between student and teacher during classroom session [3], implementing digital input as a solution to paperless process [4], using web-camera to analyse student attention level during classroom session [5], and using social media as a tool to aid home education [6].

Another interesting studies regarding education process transformation is the introductory of Mobile Learning. Commonly known as m-learning, this concept introduces the use of internet connected mobile devices that allows education process to be performed anytime anywhere [7]. However, unlike common e-learning software, the development of m-learning software requires further approach considering that the mobility of the users and device limitations. Mwandosya et al. presented a study concerning the development of Mobile Education Tool for higher education teachers [8].

3. Current States of Student’s Performance Result

The current state of our education process in university level is similar; students perform a learning process throughout a semester and received a score-based result. The evaluation process is done using various test tools such as quizzes, tasks/projects, and tests. Based on these results, educators summarized the result of each student using a single score.

While this process is capable to measure student’s performance in class, it does not provide an adequate information regarding student’s skill and experience achieved during the class. Relevant information regarding programming language, software, and tools/hardware/devices does not provided clearly in student’s result. Some education institution has provided the description of the course but most of the times, the description is based on the pre-semester course plan, not the fact that occurred during the class session. This situation may create gap between student’s skill and experience and their performance in classroom and can be a problem for future educators and employers.

4. Keyword Based System

Our proposed system tries to minimise the problem previously explained by adding supplement information in students’ result that describe a more detailed information regarding the education process. The aim of the system is to add relevant student’s experience information such as programming language, library, framework, software (editors, source code management system), development methodology, and project management system to study result report. To perform this task, we propose the use of keywords to represents this information. These keywords are attached to
each class taken by the student. Hence, future lecturers and employers will have a better understanding regarding student’s skill.

However, one of the main obstacles in performing this solution is to embed an accurate keyword to each class. Relying on lecturers to provide keywords may not be the best solution due to two things: attaching keywords to each part of the education process can be exhaustive and the classroom experience may be inconsistent with the purpose of the subject. Hence, it is important to add a method/system to fetch the keywords automatically. We will go through with the possible solution to automate the fetching process for each common education component.

4.1. Class-Based Lecture

There are various methods used in class-based lectures. It highly depends on the subject and the behaviour of the lecturer, and the condition of the environment. Moreover, the advancement of education technology may increase variety of methods used in classroom. Teachers/lecturers using advanced teaching aid technology such as slideshow, audio-visual content, and smart whiteboard has become a new trend in modern classroom. Nevertheless, lecturer from poor and developing countries still heavily rely on conventional method such as oral teaching and whiteboard. Therefore, it is difficult to define a single solution to perform keyword gathering during a class session.

Fetching keywords from text-based teaching material (such as presentation, lecture notes, and textbook) is trivia. Various method is available to perform automated keyword extraction from text-based document. A system proposed by Rose et al. is capable to perform an automated keyword extraction from a single text-based document [9]. Another interesting approach on keyword extraction is proposed by Bohne et al. [10]. Their system is claimed to have a more accurate result on keyword extraction by considering the structure of the content and applying weight on each keyword.

4.2. Written Test

It is safe to assume that written test is also a text-based document. The previous solutions to extract keywords from text-based content can be applied with this content. However, most of the times, the test itself is already weighted by lecturers as a mean to increase the accuracy of the result. This weight value is critical to put weight on the keywords. Yet, it is hard to obtain simply by using an automated system. Hence, lecturer’s role to manually attach the value on each keyword is crucial to significantly increase the effectiveness of the keywords.

4.3. Project-Based Work

In computer science education, project-based work is probably one of the most accurate depiction of student’s knowledge, skill, and ability. Hence, most lecturers heavily depend on project-based work to evaluate the result of the education process. Most programming class will have a project-based work as student’s homework or mid/final test. Extracting keywords from this component and measuring the weight of the work is vital to increase the effectiveness of the system to represent student’s knowledge and experience.

Yet, categorizing and valuing project-based student’s work be complicated; there are solutions to automatically detect programming language, but this information alone is useless without adding the context/purpose of the language. There is currently no known technique to automatically detect and categorize the project. Moreover, the scope and complexity of the project may be varied and does not represented by the physical size of the software. Our current solution to apply keyword-based system to a project-based work is for lecturer to manually embed the keyword and its value to each project given to student. Combined with the final score of the project, we can have the representation of student’s experience while performing the project.

5. Conclusion and Future Works

In this paper, we present a system that may increase the effectivity of student’s report to represent student’s experience and capability by using weighted keywords as additional information. The aim of
the system is to allow lecturers to have a detailed information regarding student’s capability. Moreover, the system may help employers to accurately hire the person with appropriate skill and decrease the learning process. While it is too early to claim the effectivity of the system, we are confident that when implemented correctly, the proposed system may increase the linearity of academic performance and student’s ability/skill.

Our future works would be to implement the system and test its effectivity in real life classroom. While the system itself is generally simple to develop, the implementation may be complex since it involves students, lecturers, and employers to collaborate. Moreover, performing the test may require a series of lengthy test to be able to conclude the validity of the solution.

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