Monitoring Student Activity During Computer Science Programming Assignments

*Keywords: student monitoring, performance assessment, programming assignment, student achievement*

1. **Introduction and Background**

Student progress is being constantly monitored through homework assignments, quizzes, tests, projects, and standardized tests [2, 7]. Monitoring can help the student learn more and attain better grades and help the instructor teach more effectively [7, 9, 10]. Clearly, monitoring student activity is an important action for teachers to improve education. Technology is playing an important role for student monitoring.

Student attendance is being monitored by colleges and universities via advanced technologies such as RFID (Remote Frequency Identification) [3, 12]. Online student behavior is being monitored [1, 4, 11, 13]. Students are being monitored in collaborative learning environments [5, 6]. Teachers are concerned with student attendance and are monitoring the performance of on-line students. Hence it is important to develop technologies that enable educators to monitor student progress which will help to improve education.

1. **Problem Statement**

Even though research has been conducted for mobile coding behavior [8], there is little research concerning the monitoring of students during computer science programming assignments. Therefore, I propose to develop a web based application that can report on the student activity on a Linux server that is utilized for the programming assignment. This web application, would be accessed by the computer science professor and would provide a novel interface that allowed for searching for the student activity during the time period that the student is developing the program. The goal is to provide the professor with the information he needs to determine the student’s effort put into the assignment as well as an indication of the programming proficiency of the student compared to the rest of the class.

During the programming assignment, through this student monitoring tool, I am specifically interested in reporting: (1) When was the last time each student logged on? (2) How many times did each student log on? (3) What was the total amount of time each student was logged on? With this reporting information, I am interested in researching these three questions:

1. Does the number of student logins compared to class average predict the grade earned?
2. Is there a correlation between the total amount of time a student is logged in and the grade?
3. Do the class averages for number of logins and total time stay consistent from class to class?
4. **Research Roadmap**

The DSR (Design Science Research) paradigm will be utilized concentrating on four central goals: analysis, explanation, prediction, and prescription [16]. As described by behavior science, I am interested in theories for the interaction of the professors with this web student monitoring tool [17]. The first dimension of my research will include building the web interface to produce the logon report along with theorizing and justifying the research. A second dimension will include the methods created for the prototype [18]. Hopefully, mid-range theory and prediction could be developed that could help professors educate better and to help students attain improved grades [19]. Rigorous verification will be performed via artificial and natural methods [20].

To explore my research questions, my research plan is as follows: (1) develop a web based prototype that reports on student logon information; and (2) practical implementation and investigation based upon empirical data from computer science classes offered at DSU (Dakota State University).

1. *Preliminary Design*

The prototype will be written in the PYTHON programming language and will utilize PYTHON CGI (Common Gateway Interface) [14]. PYTHON CGI will allow for a web interface that can search for and report on data that resides on the Linux server. Linux contains a ‘last’ command which provides the necessary logon information for each student id [15]. Therefore, PYTHON CGI can provide a search screen for the professor and then based upon the search criteria, the Linux ‘last’ command will be called to gather the student monitoring information. The student monitoring information will be presented in a student monitoring report to the internet browser. This report should help to investigate my three research questions as well as help the professor to improve education by actively monitoring the student activity.

1. *Evaluation Plan*

First, the prototype will be developed in my lab consisting of a VM (Virtual Machine with the Linux OS (Operating System). Several users will be created, mimicking the student naming conventions of DSU. The prototype will be evaluated for last logon, number of logons, and total time spent logged in for these users created in my VM. Once evaluation is completed in my VM, then the prototype will be copied onto a DSU Linux server for further evaluation. Then, a slow roll out will follow. This student monitoring tool will be used for a few classes to work out any bugs. Finally, this tool will be offered to all computer science teachers at DSU. Lastly, a questionnaire will be developed, based upon my research questions, that will be presented to the computer science professors utilizing this tool. It may take several years to fully investigate my research questions.

1. *Future Research*

Concerning the student monitoring tool, additional monitoring artifacts may be considered. For example, the tools could monitor the amount of time the student spends editing a file or the amount of times recompiling a program due to compile errors. Also, advanced analytics could be added. For example, based upon the artifacts collected, the total amount of time, predictions may be possible such as the predicted grade earned by the student or even if the student was caught cheating.

In terms of theoretical building, the tool could be utilized by many more computer science classes at DSU and at other universities. Maybe, the various professors, after using the tool, will help to investigate other interesting research questions? Perhaps other important artifacts will be discovered for student monitoring? I could work with various professors to determine the usefulness of this student monitoring during program assignments and get their opinion for monitoring student activity on Linux servers.

1. **Expected Contributions**

By developing a web based system to monitor student activity on Linux servers during programming assignments, my research should provide the following five contributions: (1) Usage of technology to monitor student activity on Linux servers. (2) This tool provides a proactive mechanism for monitoring student activity. (3) Allows the professor to determine the total amount of logon time for each student for a programming assignment. (4) In specific, this research provides needed insight into which artifacts should be included for student monitoring for programming assignments. (5) Ultimately, this research provides an extra tool needed to improve the education of computer science students.

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