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SEEU REVIEW
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IMPROVING QUALITY OF TEACHING AND SELF ASSESSMENT USING AUTOMATIC TOOLS

Arben Hajra
a.hajra@seeu.edu.mk
Fidan Limani
f.limani@seeu.edu.mk
Visar Shehu
v.shehu@seeu.edu.mk
DOI: 10.2478/seeur-2013-0016

Abstract

This paper presents the development, usage, implementation and testing of software tools in order to enhance and promote assessment and self assessment among the teaching staff in a university. We also present a new plagiarism detection tool and algorithms that will be later integrated in the University's Learning Management System, Libri, which could be optimized to detect and report plagiarism for papers written in Albanian and Macedonian languages.

Keywords: *Self assessment, questionnaires, quality of teaching, plagiarism detection*

Introduction

Quality assurance in education is one of the most important application types of QA. Nowadays, offering quality in education, especially in higher education, is a very popular and strategic decision in many countries. In addition, there is an increased competition between institutions at the same level education for having successful students. For this reason, performing QA activities is a very important measure for Universities being attractive on the market. [2]

The South East European University (SEEU), as a new university in Macedonia, since its inception is trying to promote new values and new standards for improving higher education in the region. Those efforts have ranged from including experienced professionals from distinguished universities abroad, to providing the necessary technicalities - in terms of classrooms and equipment - of a qualitative teaching/learning environment.

The aim of this paper is to develop web-based tools and services to improve QA in education by using data mining techniques and mobile technologies. It proposes a new model that includes: (i) the application of data mining techniques for extracting student profiles, web usage patterns and abnormal student behaviors, (ii) wireless communication with students via mobile technologies, and (iii) web-based services to fulfill general quality assurance processes. Even though there is some previous work which use one or two of these technologies, they do not cover all of them in the same application. Using these technologies in one model provides more advantages for supporting QA activities.

Quality Assurance (QA) Web Application

For the purpose of easing and automating the work of the QA office at SEEU, we developed a web application which enables the QA staff to easily create and distribute different tools for quality assurance purposes such as questionnaires, that, in combination with the analysis section of the application, will provide insightful information on the current state of the teaching/learning process, as well as provide feedback information that is crucial for the future measures of maintaining and/or advancing the QA processes. The application has multiple modes of usage, and not only gives users the ability to create multiple choice questions; it also offers the ability to create open questions that can be further manually analyzed. Figure 1 shows a screenshot of the reporting panel of this application.

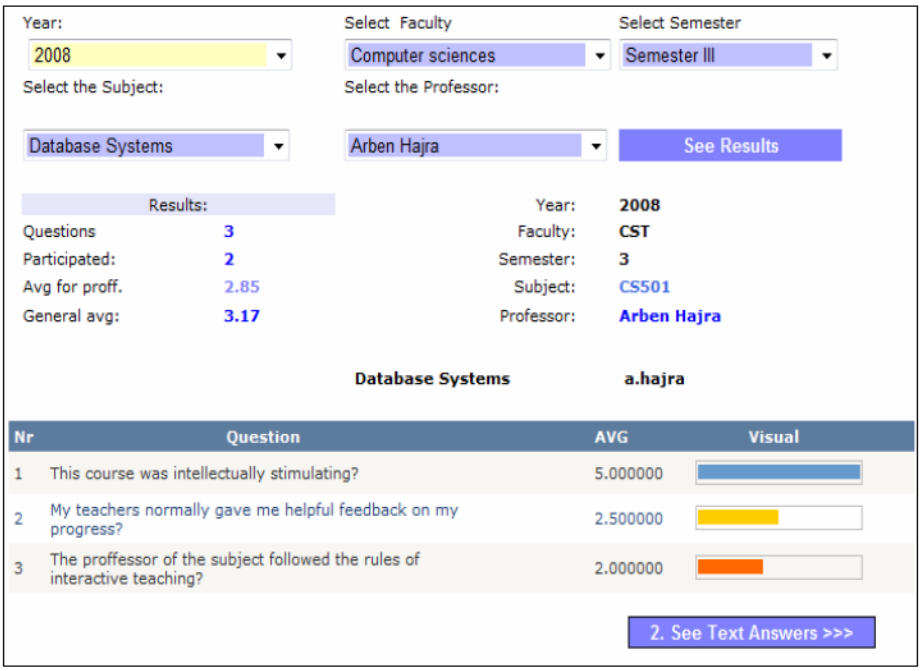


Figure 1 – Screenshot from the application

This tool not only gives users the ability to create questionnaires, but also by using advanced statistical methods, users can get much detailed insight on the data gathered. We tested this tool by distributing the questionnaires to a representative sample of undergraduate students from the CST department, with a total of 177 evaluations made, represented visually in Figure 2.

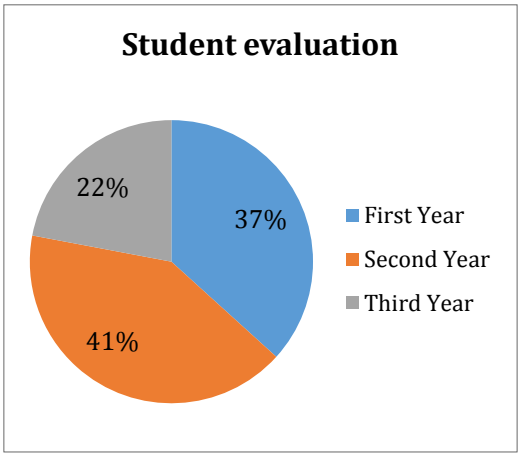


Figure 2 - Student evaluation distribution by study year

Questions asked on the surveys were generic, aiming to find out the competence of the teacher, the relevance of the course, the level of difficulty of the course etc. We did not post course or instructor names on this paper, but represented this information with symbols or randomly chosen names. Results from these surveys, although irrelevant for this paper, give us insight into the power of this tool, and can aid during the development of both curricula or find hidden issues among teaching staff of the university.

Correlation Analysis

One of the reports provided by this tool enables the user to view correlation between data points. One can see three types of correlation:

1. positive correlation – if students get a good grade in course A they will get a good grade in course B,

2. negative – students getting good grades in course A will get bad grades in course B

3. neutral – grades in course A are non dependant on grades from course B

This method was used to compare various courses in the CST department, and the results represented interesting patterns among several courses. Only the questions from the surveys that gave us a view of the level of understanding of the course materials were taken into consideration. Since the goal was to treat the positive or negative correlations, we scoped the analysis only on the reports exhibiting these correlations. It was interesting to see strong correlation between some courses that often appeared in pairs. Even though we expected to see some courses that appeared correlated (e.g., Programming I with Programming II) we also found out that courses such as Statistics was positively correlated with the course Databases.

The system would also give us correlation analysis between different courses taught by the same teacher. However, since we only tested the system with six courses, taught by three assistants, the results were not reliable enough to be shown. If the system was tested among all staff of the university we would be able to see much more interesting results, such as showing if a teacher would be biased towards one course or group of students.

Pivoting

Using different levels of granularity, we can not only see a summarized view of the reports, but also drill down to the lowest level of granularity. Using these methodologies, we can compare different departments: e.g., for the question "Did the teacher respect the scheduled time?" we would get the following result (answers given in a Likert scale from 0 till 5):

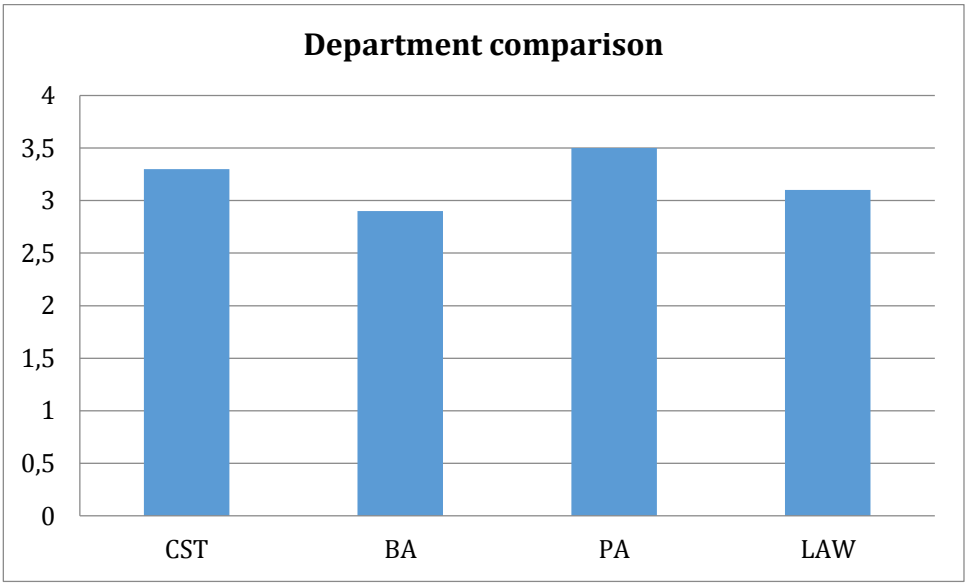


Figure 3 - Comparing departments

We could alter the level of granularity to view the same results for one department only, summarized for faculties of that department (e.g., for the CST the faculties would be BI, CST, and ICT); or we could drill down even further and the level of detail would be represented for different courses or different teachers and so on.

Using these methodologies, we were able to identify issues between staff members. For example, for a given teacher John Doe we were able to see that he would only get bad evaluations from students when his assistant would be Jane Doe. Both John and Jane have good evaluations when they teach courses with other people.

Other reporting tools

We have also implemented other statistical methods of analyzing data, which

help us discover many advanced patterns in our data. Among them are:

1. Finding association rules – we are able to discover associations between various data objects. For example, we can find patterns such as: if teacher A teaches a course, and a student B comes from city C, the probability of him passing the course is high.

2. Clustering – students can be grouped together into clusters. Interesting reports were those identifying groups of students that came from a given high school with a probability to fail or have good success during their university studies.

Of course, these reports would be much more complete if we conducted university wide surveys, since this way the amount of data gathered would be much bigger and our reports would be much more reliable and accurate.

Results and recommendations

Using the reports generated from our application we were able to identify many elements which could help improve the quality of teaching in our university. Using correlation analysis, we can redesign our curricula to create the system of prerequisites which currently does not exist at the university. We could see that where students having difficulties in a course such as Statistics, they would almost certainly have difficulties in a course such as Databases as well. One decision which might be made would be to make Statistics a prerequisite for students that want to register for the course in Databases.

We were able to also identify issues among staff members. Even though it is difficult to explain the nature of the issues, one positive result might be that the Deans of those departments have enough data to decide how to pair teachers with assistants.

Plagiarism detection

An ongoing problem that we have found among students is their usage of non cited publications and presenting them as their own work. This problem has its roots in pre-university education, where there is a lack of training on academic writing skills. Among the biggest issues is that new students lack the ability to recognize plagiarism. SEEU has continuously made efforts by offering informing students of the rules, providing courses, publishing materials etc in order to introduce students to the issue and consequences.

There are plenty of plagiarism detection tools out there such as TurnitIn, Viper or Plagium. However, none of them has a support or a database for papers in the Albanian or Macedonian language used at the university. This is why we started writing our own plagiarism detection engine, which will store papers in local languages. The tool can be used both by professors and students. Professors can check whether their students have submitted original work, while students can make sure they have cited submitted work as needed.

The system combines our own modified text mining algorithms, as well as string similarity methods as the ones mentioned in our spell checking system. Using a simple web based interface, one would be able to upload multiple documents and check them with each other. If someone wants to use this approach, then the system will be language independent. The application also offers a web service interface, which enables other tools to use the same system. Currently, Libri LMS at South East European University (https://libri.seeu.edu.mk) will be the first system that will integrate this solution.

Each submitted paper in the Albanian or Macedonian language will be indexed, and stored in our database. The database will be encrypted so no one will have access to those files. In this way, our database will grow, and the results will be much more accurate. The indexing and storage methods will be fully transparent; we will publish all the source code online. Later on, we will also publish the plagiarism detection algorithms.

Due to the approach of storing each document on servers, we had a scalability problem which has to be dealt with in the near future. The database size grew beyond our expectations. Thanks to the storage capabilities provided by South East European University, we have been able to keep the system working, although, in the future, we will have to scale the database in multiple servers.

Preliminary results

Currently, we are at the stages of building and indexing the database of papers submitted by students. We are indexing more than 25000 papers submitted to the Learner Management System (Libri) over the past 3 years of its existence. The results from the systems are very satisfactory. The system is capable of accurately detecting not only completely plagiarized documents, but also non-cited phrases or paragraphs. We are also working on integrating the system with Libri LMS, so both students and teachers can check papers for plagiarism. The following figure shows some of the reports generated by the system:

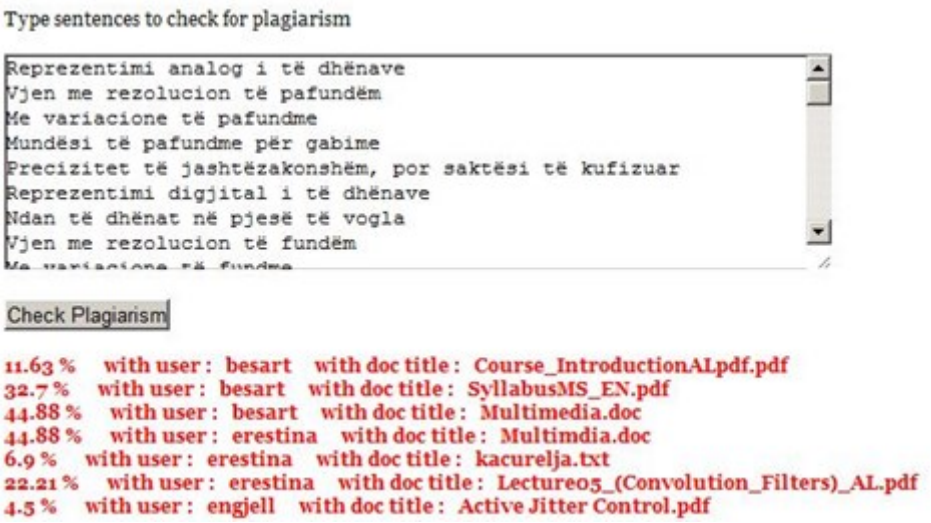


Figure 4 - Reports from the plagiarism detection tool

We expect the system to be widely used among teaching staff of our university, and later on we plan to offer the same services for other universities in the region. In this way, we will build a much richer database of papers and thus improve the quality of the system. Students will also be able to identify plagiarism and improve the quality of papers submitted by them.

Conclusion

Universities today are constantly trying to address the challenge of improving quality assessment in their study programmes. In providing an efficient and effective solution, in this paper, we suggest several methods and techniques, implemented in an information system, to support the quality assurance initiatives in any university. Our solution facilitates data collection, storage, and analysis of quality assurance processes, together with the component of identifying useful patterns from the gathered data.

Moreover, to further support the goals of qualitative teaching and learning in a university setting, the solution also offer a plagiarism detection component, which could ease teachers' effort in monitoring the quality of student work.

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