

Model for Discovering Students' Skills in Educational Institutions

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Abstract. *Discovering and sharing knowledge is considered to be a challenge faced by every modern academic institution. Recent research results have emphasized the fact that student skills and competencies cannot be measured in a simple way. Therefore, in this paper we present a list of parameters for discovering knowledge, based on available materials and human resources. The main goal of our research is to define an implementable model for measuring student skills and competencies in a real educational environment. Our model eliminates emerged shortcomings from our previous experience in working with distance learning platform and promises good results.*

Keywords. Skills, competency, knowledge.

1. Introduction

Rapid development of information technologies has caused increased students interest in this field. Considering the fact that education has become necessity for the achievement of life goals, modern educational institutions are facing a challenging task; acquire and maintain the quality and reputation among a large number of similar faculties. This task is certainly not easy to fulfill, and therefore this research was conducted at the Faculty of Information Technologies (FIT) which is a part of University "Džemal Bijedić" in Mostar. For many years the aforementioned faculty is trying to achieve leadership position in IT education area and completely computerize all aspects of its activity, starting from knowledge distribution until finding plagiarism.

FIT is considered as regional pioneer in introducing an information system to support distance learning study. However, in order to be responsive to the demands of the labor market and discover new knowledge that will primarily assist their students in further professional development, FIT is facing with the necessity to improve existing software solution. Since FIT is the institution that needs to "produce" competent students for various IT fields, they need to constantly work on ideas that will complement this process and make it more efficient.

The research results presented in this paper can be considered as an effort to clearly evaluate the possibilities of information infrastructure as one of the key factors in finding and discovering the student's

skills. By analyzing available literature we could not find studies that propose a model and a list of parameters to evaluate the students' skills based on existing students' platform. However, a certain degree of similarity can be found in survey [1] which describes a specific application of data mining in learning management systems and a case study tutorial with the Moodle system. However, this survey has dealt with fewer parameters, and it's mostly focused on application of the main data mining techniques in knowledge discovery. Also, authors in [2] used the decision tree method to evaluate student's performance based on information like attendance, class test, seminar and assignment marks etc.

The paper is organized as following. Section 2 briefly describes concept of skill and competence. Section 3 introduces system components used for creating proposed parameter list for knowledge discovery, while section 4 describes the notion of the new knowledge. In section 5 we presented the problems in discovering skills. At the end, section 6 introduces the usefulness of discovered knowledge.

2. Skills and Competencies

Before detailed discussion of practical application of the ideas presented in the introductory part of the paper, it is necessary to make a distinction between the concept and the notion of skills and competencies.

Generally, competence is interpreted as the possession of an actual capacity to use some skills in order to learn something, to do something or to reach an aim. This can be applied to individual dispositions or to the distribution of such dispositions within a social group or an institution [3]. In other words, competence can be considered as the ability to successfully meet complex demands in a particular context through the mobilization of psychosocial prerequisite (including both cognitive and non-cognitive aspects)[4]. For example, ability to communicate effectively is a competency that can be linked to an individual's knowledge of the language, its practical IT skills and attitudes towards what and with whom he or she communicates.

Skill can be characterized as the ability to perform tasks and solve problems, while the competence is the capability to apply this learning in a particular context (education, business, personal or professional development). Competence is not limited to cognitive

elements (application of theories, concepts or tacit knowledge), but also includes the functional aspects (technical skills) and interpersonal characteristics (eg, *social and organizational skills*) and ethical values [5].

In the context of the educational process, it can be said that competence implies acquired skills that are expected of each student upon graduation, and their definition stems from the needs of the profession.

From the previous definitions it can be concluded that the competencies are much more complex than skills, but the skills are necessary for the acquisition of competencies. Specification of student's skills can be used for inferring about their future competencies. For example, if the student has programming skills, it is likely that he can acquire competencies in software development.

When it comes to information technology, the primary issue is to determine the technical skills of the students, which can be categorized according to different market requirements. General problem that arises in this field of research is the issue of trust. The claim about a specific skill or competency must be verified before they are inserted into the profile of the student. Achieving quality results and their exploitation for the proper purpose and further expansion is influenced by numerous factors, starting with the interests of individuals to college readiness and ability to act in this direction.

The professional development of people working in education and training is one of the vital measures to improve quality of learning at all levels. In identifying a set of key competences, it is recommended to start with the richness of information already available and derive the 'common elements' from that which has already been developed. This can be achieved through three basic steps [8]:

- **Competence identification:** Compiling all available information about the duties, tasks, responsibilities, roles and work environments related to the job and identifying the relevant knowledge, skills and required attitudes.
- **Competence modelling:** Developing a consistent competence profile by making use of the compiled information on tasks, responsibilities and necessary knowledge, skills and attitudes.
- **Competence assessment:** Checking whether the set of key competences is complete.

3. System Components

Hereafter we briefly outline the system components, used every day at FIT, which can be considered as relevant for a new-proposed way of sharing knowledge presented in this paper:

- Records of students success
- Monitoring student presence

- Communication via the community services where topics are arranged by subjects of the curriculum
- Evaluation of teaching materials

The success of students is monitored through the module for testing, grades of student's seminar papers and written exams. The FIT system also allows creating records of individual liabilities in the course, and the overall success score ranges from 6 to 10.

For the past few year system supports the monitoring of the presence in the classroom for all subjects categorized by the type of instruction being performed (lectures, exercises and workshops).

Through the community services, students can share their experiences in the field of interest; ask questions one another, as well as teaching staff. The benefit of this form of communication is informal sharing of knowledge, which certainly contributes to an understanding of particular content.

One of the system valuable functionalities is rating of the course materials. Students have the opportunity to give their opinions about the quality of these materials, expressed through grades on scale from 1 to 5, as well as through comments.

Among others, the aforementioned system components are fundamental for collecting the data in order to form new knowledge.

4. The New Knowledge

Many authors have written about the concept and value of knowledge which produced several different definitions that share same meaning. However, each business idea is more or less incorporated in one of the following; Knowledge is the capacity to take effective action [6], the value of knowledge assets is determined primarily by their use [7].

Information system for determining IT students' skills may be considered through the context of previous, with the goal of creating proposal and potential business opportunities for their further achievements. This way the process of knowledge discovery is primarily directed to benefit the students.

Faculty database keeps significant amount of information, but the question is how to use all existing resources to determine students' technical skills in order to guide them in various IT fields. When creating suggestions about existence of particular skill it's not enough to only consider student success or grades. The starting point shouldn't be the knowledge, skills and experience that student gained during the studies, but also success achieved in high school. In terms of IT skills, only a certain group of subjects is of interest, where the acquired ability of understanding the given field will be evaluated based on the gained grades. The logical selection of important factors is the success achieved at the faculty concerning vocational subjects relevant to the specific profile. Based on the existing

information system and its previously described components, it is possible to monitor students' interest in specific course content shown in classes as well as their activities on community service.

From a practical perspective it is important to point out that all of the mentioned components have a quantitative measure that makes establishing certain rules and conclusions easier. Student success is viewed through the given grade, attendance through the total number of class hours where the student was present, interest in specific course content through quality scores and comments, and the community activities through the number of messages/posts including the evaluation of their usefulness. Various system aspects have different effects on forming the final output, so it is necessary to introduce weighting factors according to skill being observed. We believe that the subjects of the curriculum should be classified into groups based on the intensity of practical work required from students. This ensures that in the process of evaluating students' technical abilities the grades are seen differently for each subject category. Contribution of particular subject depends on the skill and competency being observed. Teaching staff has the most important role in determining the significance of their subject in the process of evaluating these skills and competencies.

In addition, it is important to recognize all the remaining essential elements that can contribute to the establishment of authentic profiles. The current system version doesn't contain data about student participations in projects which aren't part of course curriculum or the monitoring of their cognitive and interpersonal skills.

Regardless of the method being used for monitoring additional students' activities, via existing platform using new set of functionalities or collecting and combining with the available data, they shouldn't be neglected in the terms of their significance for the evaluation of competencies. The main contribution of our research is a list of the identified parameters (described in Table 1.) and their contribution in determining students' skills. In Figure 1 the aforementioned parameters are presented as a model for discovering students' skills.

5. Problems in Discovering Skills

Before discussing the benefits that came with a new method of knowledge sharing, it is important to emphasize obstacles and shortcomings identified so far, in order to recognize the best way of successfully implementing presented idea. The accent is not on technical system aspects and possible ways of implementation. Table 1. is an original result of the authors. Contribution for each skill is verified based on the authors' previous experiences in educational process.

Table 1. System components for discovering students' skills

	Description	Contribution		Information availability
		Technical skills	Cognitive skills	
High school success	Grades of particular professional subjects	Significant	Significant	Documented
		Insignificant	Insignificant	
		Insignificant	Insignificant	
Class attendance	Number of hours in classes, activities and efforts through practical work	Significant	Noticeable	Electronically, without students' activities evidence
		Noticeable	Significant	
		Significant	Significant	
Community activities	Number of messages/posts for a certain group of subjects, the usefulness score of the uploaded content	Significant	Noticeable	Entirely electronic
		Noticeable	Insignificant	
		Insignificant	Insignificant	
Grading e-learning materials	Downloaded materials, the quality score	Noticeable	Noticeable	Entirely electronic
		Noticeable	Insignificant	
		Insignificant	Insignificant	
Participation in projects	Additional projects, role and success evaluation	Significant	Significant	No records
		Significant	Significant	
		Significant	Significant	
Students success	Grade of each subject	Significant	Significant	Entirely electronic
		Significant	Insignificant	
		Insignificant	Insignificant	
Presentation skills	Presentation skills demonstrated during the studies through seminars and practical work	Significant	Insignificant	No records
		Insignificant	Insignificant	
		Insignificant	Insignificant	
Team work	Working within teams, contribution and final output of project	Significant	Significant	No records
		Significant	Significant	
		Significant	Significant	

As previously mentioned, evidence of class attendance is system feature which proved to be very useful in the past semesters. The teaching staff has been keeping records up to date which ensures enough data for the process of decision making. However, there are no electronic or written records about students' activities during the learning process. Whichever way is used in this matter its benefits will be directly dependent on the staffs' will and abilities to assess these characteristic of students. It is quite difficult to impose additional obligations and expect to have results of high quality and trustworthiness. Additional problem concerning time period needed for data to be collected mustn't be ignored. To be exact, the minimum of 4 semesters is required to gain enough input data for the process of discovering skills at the institution such as FIT.

As for the monitoring of students' forum activities, the evaluation of uploaded content wouldn't be an issue, but the problem exists in terms of stimulating students to use it for the proper purpose. Only a group of students have shown real effort. Many of them are there to address some personal issues. The aim is to encourage more students to share gained knowledge and experiences during the study or projects' participations and involvement in various jobs with their colleagues. In this respect, new obligations are brought to the teaching staff again, where each of them should come up with certain tasks for every subject in order to stimulate more students to demonstrate their skills.

Evaluation of e-learning materials is one of the features of distance learning platform which students haven't been yet accepting as expected. They share comments and suggestions about content of these materials using other electronic services (such as e-mail), so there is no enough data that can be used for gathering students' preferences.

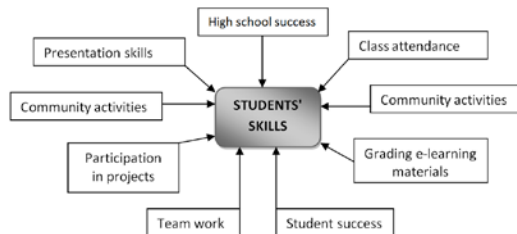


Figure 1. A model for discovering students' skills

Besides the final grade, the success of students in certain subjects can be seen through individual tasks, such as seminar papers and practical work. This way, acquired skills could be evaluated in more details. Setback that is seen here is the lack of up to date records for mentioned tasks. Success is being evaluated using the final grade only, regardless of the full system support for more detailed overview, indicating once more that the human factor has a key role for any progress and support in discovering new knowledge.

Missing data, which were characterized as significant in discovering students' skills and future competencies, depend exclusively on the employees' responsibilities. What is the quickest and most efficient way for these data to be collected is an important question that should be specifically considered. In doing so the starting point should be identified shortcomings of managing business activities so far.

6. The Usefulness of Discovered Knowledge

Benefits of creating students' IT profiles can be viewed through following:

- Students can use these profiles in order to achieve desired goals or to identify skills and competencies which they need to improve further.
- Within system being currently used at the faculty, additional module for establishing and keeping regular contact with IT companies can be implemented. It would also provide access to available students' profiles with the aim of making employment process faster and more efficient.
- Faculty can discover drawbacks of the curriculum and thus improve educational

process to contribute certain skills and competencies.

In addition, this kind of sharing discovered knowledge brings significant reputation to the faculty as the institution that seeks to justify students' confidence keeping up with technology and expectations. What is a better way to prove your success but through the satisfaction of all stakeholders, from students to employees who have already shown great interest and evaluated the FIT students as an extremely qualified for current market demands.

7. Conclusion

This paper briefly overviews the information system at the Faculty of Information Technology and its capabilities in terms of supporting discovery of new knowledge. The system barriers were identified, and the key factors for the profiling of students to support their employment and further training. Implementation success of the ideas presented in this paper mainly depends on the teaching staff, as well as the expertise of the person who is responsible for the actual implementation. The results will be as good as the time spent exploring the problem area of knowledge discovery as well as the specifics of the current system in an effort to combine them as efficiently as possible.

Each solution brings new problems, and certainly will not miss the employee's resistance in this regard. The initial phase should consider only basic skills that are supported by teaching curriculum. Also, without introducing a multitude of duties for employees, initial phases should present only those results that have great possibility to be successfully presented. Our future work will be focused on extension of the proposed parameter list in order to include market demands. Also, we plan to implement missing functionalities into current FIT system in order to evaluate affect of proposed parameters in discovering knowledge.

References

- [1] Cristóbal R., Sebastián V., Enrique G.; *Data mining in course management systems: Moodle case study and tutorial*; ELSEVIER, Computers & Education; vol.51, pp. 368–384 (2008)
- [2] Brijesh K.B., Saurabh Pa; *Mining Educational Data to Analyze Students' Performance*; (IJACSA) International Journal of Advanced Computer Science and Applications, vol. 2, no. 6, (2011)
- [3] Adama O.; *Defining and Selecting Key Competencies Contributions to the Lifelong Learning*; Second DeSeCo Symposium, Switzerland, (2002)

- [4] Rychen, D.; Salganik, L.; *A holistic model of competence; Key competencies for a successful life and a wellfunctioning society*; Cambridge, Hogrefe & Huber Publisher, pp. 41-62, (2003)
- [5] CEDEFOP; *Future skill needs in Europe Medium-term forecast*; Synthesis report; (2008)
- [6] Chris A.; *Knowledge for Action: A Guide to Overcoming Barriers to Organizational Change*; Jossey-Bass; First Edition, ISBN: 1555425194, (1993)
- [7] Alavi, M., & Tiwana; *Knowledge Management: The Information Technology Dimension*; Handbook of Organizational Learning and Knowledge Management; ISBN: 9780631226727, (2006)
- [8] B.J. Buischool, S.D. Broek, J.A. van Lakerveld, G.K. Zarifis, M. Osborne: *Key competences for adult learning professionals*; Zoetermeer (2010)