TOWARDS SUCCESSFUL IMPLEMENTATION OF EPORTFOLIOS IN BLENDED LEARNING

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Introduction

Within its E-learning strategy developed in July 2007, the University of Zagreb defined that it would establish and maintain the ePortfolio system at the University and/or at the faculties belonging to the University. According to the report of the Office for E-Learning at the University of Zagreb, 11 of its faculties have announced a plan for conducting other activities defined by the E-learning strategy, among which is ePortfolio. To date several researches within the Centre for E-Learning have dealt with certain professional aspects of ePortfolio, such as the functionalities of tools that support ePortfolio. However, comprehensive research has neither been conducted by the Centre nor any university in Croatia. Therefore, the ePortfolio experience at the Faculty of Organization and Informatics (FOI), which belongs to the University of Zagreb, represents a very valuable contribution to supporting and developing lifelong learning in Croatia. This paper presents the most important steps in the process of ePortfolio implementation at the Faculty of Organization and Informatics. In the paper all the key aspects are considered and shown for the first time as a concept in its entirety: from a pilot project to its successful implementation at the course level.

The pilot project

The first phase was initiated in the winter semester of the academic year 2008/2009, during which an ePortfolio system was implemented in a hybrid course Security of Information Systems and as support for an international Tempus project. For this pilot ePortfolio implementation the following goals were defined: 1. To choose which ePortfolio system would be the best to use at the Faculty regarding the course structure since most of the courses at the Faculty are organized in a similar manner; and 2. To introduce the ePortfolio concept to students and educators.

The students were given a quick tutorial on using the ePortfolio systems and were also given assignments which they had to complete simultaneously in both ePortfolio systems at the end of each week (see Table 1). Since this was the students' first encounter with such a system, a lecture was given as an introduction to the concept of ePortfolio, as well to ePortfolio as a tool which they would use in the course. In addition, an agenda shown in Table 1 with stages of the ePortfolio implementation and its usage was given to students. Thus the students had a full insight into the entire process: they knew what their assignments were and what would be expected from them at any moment. In that same week they were given a quick tutorial on the use of the ePortfolio systems Mahara and ELGG in their laboratory classes. Further details about the pilot project execution can be found in Balaban (2010).

Stage	Title and description:
1	**Introduction to ePortfolio** 1. Introduction to the ePortfolio concept and systems; The need for an ePortfolio; Power of reflection 2. Logging into the systems and artefact upload: a. Upload course related artefacts: seminar, presentation, practical work b. Personal artefact upload (4-5 artefacts) -> "Best of me" section c. Tag the artefacts as follows: i. All course related artefacts are to be tagged with SIS08 ii. Tag all personal related artefacts arbitrarily 3. Fill in a personal profile (including the resume) and review at least 5 profiles of your peers
2	**Reflecting on ePortfolio**

	1. Monitor progress, problem solving ... 2. Reflect by answering the questions according to the template: a. What have I learned about the ePortfolio? b. What was the most interesting thing about using the ePortfolio so far? Explain why. c. What was less interesting in the ePortfolio? Why? d. Where can I apply the ePortfolio in the process of my lifelong learning? 3. Split in groups. Make a view available only to peers from your group in which you will include the reflection made in Step 2. Use the ePortfolio systems to give feedback on reflections made by other peers within your group.
3	**Using ePortfolio to make course related reflections** 1. Monitor progress, problem solving ... 2. Now a set of tasks has been created. Reflect on all 4 major units learned in laboratory exercises. For each of them, answer the following questions by using the given template: a. What have I learned in this unit? b. What was the most interesting part of this unit? Why? c. What was less interesting? Why? d. Where can I apply it in future?
4	**Analyzing the results and evaluating the systems** 1. Final conversation about experience and impressions. 2. Analyzing and scoring students' work in ePortfolio. 3. Evaluating the ePortfolio systems used during classes.

Table 1. Stages of the pilot project and instructions for students

Both goals were accomplished and in the course of the pilot project a comprehensive questionnaire (Balaban & Bubas, 2009) was also created to enable evaluation and comparison of different ePortfolio systems. Finally, the ePortfolio system Mahara was chosen as the default ePortfolio system at the Faculty as its interoperability enabled very tight integration with the Faculty's learning management system Moodle.

Preparing the environment and the students

Based on the results from the pilot project, a second phase was initiated. For this phase a twofold goal was defined: 1.To install and provide support for the needed ICT functionalities; and 2. To prepare students to work with ePortfolio. Among the ICT-related issues it was necessary to decide on hardware and software requirements, study the possibilities of Moodle and Mahara integration and determine whether changes in the application interface would be needed. The process of introducing the ePortfolio concept to students through training tasks was conducted within the course Informatics 2. This course, which is taught in the summer semester, is enrolled by undergraduate students. They were introduced to the ePortfolio concept and its application in lifelong learning. In addition, Mahara ePortfolio was demonstrated to them with a detailed description of its functionalities and its particular support to lifelong learning concepts. Besides working with the application, students learned how to (self)-reflect and present their artefacts in different ePortfolio views.

ICT support

Before deciding which Web application to use as the official ePortfolio system it is essential to analyze the technical requirements and organizational issues related to ePortfolio implementation. From the technical perspective it is important that the system is reliable and that it does not require constant maintenance. The system should be able run on inexpensive hardware and it should be easy to scale in case of an increased load. Finally, one of the probably most important technical requirements is that the ePortfolio system should be both secure and easy to use.

Introduction to Mahara

Mahara (Derrin et al., 2010) is an Open Source ePortfolio and social-networking Web application (Wikipedia). What distinguishes Mahara from other similar systems is that Mahara puts a strong emphasis on the ePortfolio part of the system. Other similar applications like Elgg (Mayank, 2008) are primarily social-networking applications that can be configured to serve as a kind of an ePortfolio

solution. Mahara is an Open Source solution available under the GNU GPL v3 license (2010). Basically this license permits free usage and modification of the Mahara system by giving:

- freedom to use the software for any purpose,
- freedom to change the software to suit your needs,
- freedom to share the software, and
- freedom to share the changes you make.

It is developed using the well known and reliable Open Source technologies (Linux, PHP, Apache, MySQL/PostrgeSQL).

Technical and organizational considerations

Although Mahara does not essentially support advanced horizontal scaling methods it can be scaled horizontally since it is built on standard Open Source technologies that offer a variety of plug-ins. As it is an Open Source application every potential security problem is quickly detected by community members and required patches are quickly available for download. During the last two years that we have been running Mahara, the system has proved itself to be reliable although more bugs were detected in the system than we initially anticipated. The bugs were usually of minor importance and were mostly related to system's usability. After filling out the bug report the development community would quickly respond so patches were provided in a reasonable time. Since Mahara is a relatively new application that has gone through a few substantial code changes it is understandable that there bugs will occur in the system. However, it is important to note that there have not been any bugs that would lead to security breaches. It should also be mentioned that the number of bugs has decreased in recent versions of the system due to system maturity and achieving a stable code base.
Besides merely technical considerations it is important to consider organizational issues and the overall environment in which the ePortfolio will be implemented. Each student should be given its ePortfolio user account at the beginning of the first semester and students should have access to their ePortfolio until they graduate. Since ePortfolio is a collection of personal achievements students should be able to keep those records after finishing their study. Furthermore, besides tracking students' personal achievement records an ePortfolio should be used in the everyday learning process so the teacher must have an option to give students assignments related to using the ePortfolio system. To make those assignments feasible, it is evident that the ePortfolio system must support an export functionality and that it should be possible to integrate it with the institution's Learning Management System. Moodle, which is the Faculty's official Learning Management System, and Mahara can be connected at the authentication level so users can switch from one system to another while having to enter their credentials in order to authenticate themselves only once. Moreover, Mahara version 1.2.0 supports import and export of ePortfolio data with LEAP2A support and static HTML export. By providing LEAP2A and HTML export support we can be sure that each student will be able to transfer their ePortfolio data after finishing their education. Owing to this we can roughly plan a maximum number of students as we are certain that we would be able to delete previous students' accounts (and data) without having to plan long term data backups.

Integration and customization

Figure 1 shows the overall positioning of the ePortfolio system from both organizational and technical perspective. An ePortfolio system has to communicate with the LMS system, Digital Library and Student Information System. At present the only existing integration is the one with LMS, which only exists at the login level (Single Sign-On, SSO). Since Mahara currently supports the LEAP2A standard (Grant, 2010) there is not much that can be done regarding Mahara's integration with LMS on the side of the ePortfolio application itself. For users to be able to export and import their data from LMS to ePortfolio, LMS system must also support exporting and importing data using the LEAP2A standard. Moodle 2.0, which will be published in July 2010, will fully support importing and, even more importantly, exporting of various data (snapshots of forums, assignments, etc.) to the Mahara ePortfolio system. So, given the SSO and import/export functionality to be provided by Moodle 2.0, full integration between ePortfolio and LMS will be possible. Nevertheless, the integration of Mahara with other systems like the Digital Library and Student Information System will be more difficult since currently no API for accessing internal Mahara data using the standard Web services

technologies like SOAP, REST or XML-RPC is available. One option is to leverage the new Moodle 2.0 Web services and use a tight integration between Moodle and Mahara to control user data only on the Moodle side. Although this would make some segments of user administration easier it does not provide a solution flexible enough to support a wide range of desired functionalities. As a result, it is up to the development community to build Web services support to allow for a full integration of Mahara with external systems on the user level.

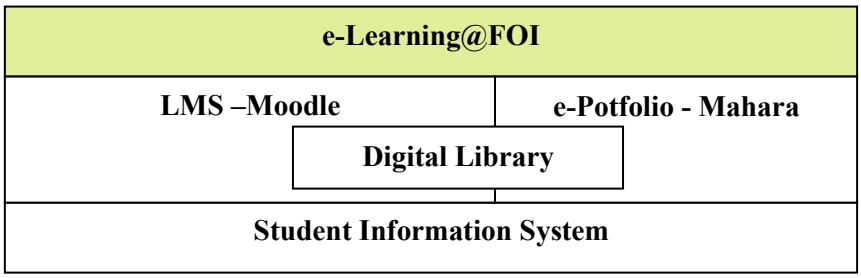

Figure 1

Mahara has been designed to be easily pluggable and customizable and it is exactly for that reason that it is written in the PHP programming language. The entire Mahara architecture is organized around plugins (***, 2009), from content types to user authentication and each plugin can be modified and customized. Besides, Mahara's core is written in a framework-like fashion so it easy for developers to develop new functionalities/plugins on top of the Mahara core system. Since Mahara supports a wide range of functionalities not much configuration was required to fit it in the Faculty's e-learning process. The SSO integration with Moodle, also known as Mahoodle (2010), is well documented and it was easy to set up because Moodle provides support for integration from its side as well. Visual design is also easily customizable since Mahara uses a standard template system similar to products like Moodle, Drupal and Joomla. As for the time being there is no support for the Croatian language we are using the interface in English, although it is being translated into Croatian.

Introducing ePortfolio to students

The course Informatics 2 is taught in the summer semester and is enrolled by most of the students at FOI. This blended course is used to introduce the ePortfolio to students. For that purpose several lectures were delivered to students accompanied by ePortfolio materials explaining the ePortfolio, its purpose in lifelong learning along with potential benefits. These introductory actions were almost identical to stages 1 and 2 in the pilot project. In addition, laboratory sessions were held to make students familiar with Mahara as an ePortfolio application and its functionalities. After that, students had two weeks to try out the application, to explore the reflections segment and do their first task in ePortfolio. It consisted of making their own reflections about the ePortfolio following the questions provided in the template. The questions were the same as those in stage 2 of the pilot project (see Table 1, stage 2, task 2).

Other reflections were related to the remaining three main topics of the laboratory exercises: Linux OS, OpenOffice and Python programming. Students were asked to reflect on those topics according to the instructions provided in the template. The template for reflection was provided at the end of each topic.

At the end of the semester the students stated that they had found reflections very interesting. On the other hand, the teachers were given feedback about the topics and the attractiveness of the content, which enabled them to make slight modifications accordingly. In the course of the semester the students got familiar with ePortfolio and learned how to use the system. They also learned how to use ePortfolio as a pedagogical tool since their reflections were evaluated. Moreover, they were prepared to show their CV or to create a showcase ePortfolio to present themselves in different contexts. With all this, prerequisites were met for a comprehensive usage of ePortfolio in other courses.

Full scale use in blended course

In the fourth semester of the undergraduate study students enrol in the course Selected Chapters of Mathematics (SCM), which is quite a complex course consisting of six chapters. In addition to

monthly tests, students have to work on many problem-solving exercises that imply using mathematical theory as well as ICT tools that support problem solving. The ePortfolio was therefore introduced in order to fulfil two goals: 1. To enable students to reflect on their progress in the course; and 2. To provide a tool for the assessment of learning outcomes to be used by both students and teachers. At the end of the course, evaluation of ePortfolio implementation was conducted.

Course description

EPortfolio was introduced as a new element in continuous assessment of students' coursework on the SCM course in the academic year 2008/2009. The course is taught in the fourth semester of the Information Systems study programme. It is generally considered as a difficult course and one not easy to pass because it covers a variety of mathematical topics and a certain level of mathematical pre-knowledge is required. Therefore, one of the goals of ePortfolio implementation was to investigate problems students encounter during the course and devise possible teaching strategies to overcome them. In order to do so, students were asked to write their reflections on the course itself (topics, the role of the course in the curriculum, possibility of usage and implementation of the course content, etc.), course activities and their performance. Furthermore, there is also a discussion on the accomplishments and difficulties arising during the course, involving clarifying the concepts within the course and its integration with other courses, as well as reflections on mathematical modelling and the role of mathematics in the IT profession in general.

The methodology of ePortfolio use

SCM is structured into six chapters, so students had to reflect on the issues they had learned, referring to the learning outcomes, for each particular chapter continuously. Students' reflections in ePortfolio needed to be written within two weeks after the lectures on a certain chapter had finished. In doing so, the open source ePortfolio system Mahara was used. This system enables students to write their reflections in the form of a blog with six posts corresponding to each of the aforementioned chapters. This blog system is fairly functional because one can see the date of the last post editing and the attachments can be commented separately (i.e. feedback can be given to students for each attachment). Along with every reflection students also needed to attach an artefact (homework, solved test, solved midterm exam, solved exercise from lecture presentation, model, description of its possible application, organized lecture notes, computer experiment made, for instance, in Wolfram Mathematica, etc.) explaining why they had decided to attach that particular artefact. The work done in ePortfolio was not an obligatory condition for fulfilling their course requirements and getting the professor's signature in their student's transcript. However, by participating in it students were able to collect 6% of the total amount of points awarded for coursework in SCM (i.e., 6 points, or one for each chapter). In awarding these points, teachers used the following criteria: student understanding of the basic course concepts presented in the reflection, student achievement evidenced by the attached artefacts and creativity of their choice. The teachers' motivation for introducing this new kind of assessment was to systematically gather reflections and evaluation of learning outcomes in working with a large group of students (approximately 250 students on SCM and only 3 teachers – 1 professor and 2 teaching assistants). In this teaching environment there is a significant number of students who do not have the opportunity to express their opinion and the teachers can hardly manage to monitor their individual achievements. The intention of using ePortfolio was thus to obtain a certain insight into the progress and work of each student. It is important to mention that the activity related to ePortfolio represents a contribution to the usage of technology in education and, on the other hand, serves in raising the students' awareness about their own work and progress in the course.

Results

Since e-learning is implemented rather intensely at the Faculty of Organization and Informatics, it is common for a questionnaire on students' satisfaction with the SCM course to be conducted at the end of the term, for which LMS Moodle is commonly used. The questions include those concerning the learning and teaching environment in SCM. Two new questions were added to the questionnaire in the academic year 2008/2009 concerning the ePortfolio activity: whether ePortfolio was useful to them and how much time they spent on average working on their reflections. In the sample, round 55%

answered that ePortfolio was useful or even very useful to them, which is a good result considering the fact that ePortfolio was a novelty to them. Others were indifferent or not so favourable. We have to point out that among those examinees there were also students who had not participated in ePortfolio exercise. Students were also asked to provide quantitative analysis of the usefulness of ePortfolio based on which some improvements for next academic year have been prepared. Most criticism was pointed towards the fact that the portfolio exercise is very time consuming and that six reflections in one semester were too much to write. In the academic year 2009/2010 the results were better because 80% responded that e-portfolio was useful or even very useful to them. It can be considered that better results are due to some organizational changes we introduced in that academic year. First of all, that student has to write their reflections only three times in one semester.

The following part of this section contains a more detailed analysis of students' ePortfolio results and their relation to the total sum of course points awarded to students for their coursework (i.e., ePortfolio together with the all the other activities). In order to determine whether there is any relation between the two, the aforementioned data were shown in a graph.

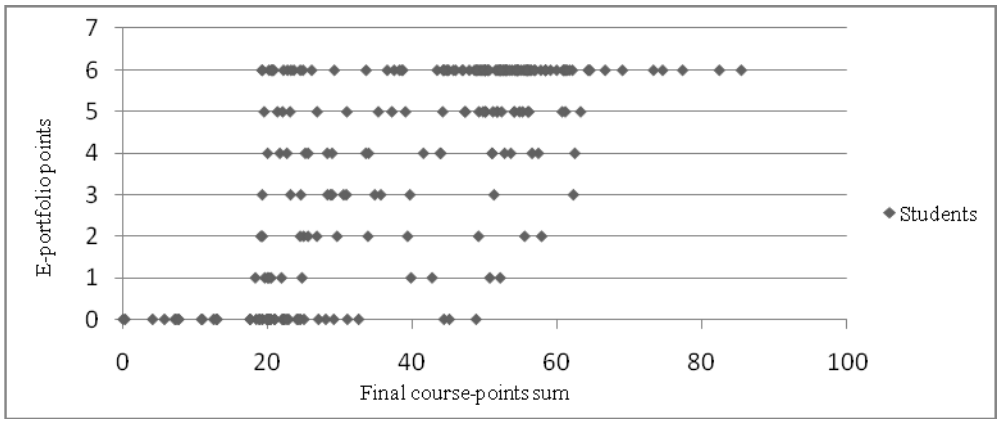

Figure 2. Relation between ePortfolio points and course total points

To fulfill their course obligations and get the professor's signature in the student's transcript, each student needs to collect at least 20 points out of a possible 100. Otherwise they have to enrol the SCM course again in the following year. Having collected between 20 and 50 points, students are entitled to take a regular exam. To pass SCM on the account of their coursework, which is continuously assessed, students need to collect at least 50 points. Consequently, there are two thresholds of interest: 20 and 50 points. In *Figure 2* it is evident that most students are grouped around those two numbers. Except this horizontal grouping, we also have vertical grouping: 55% of all students have 5 or 6 points, 25% have 1, 2, 3 or 4 points and 20% of them 0 points. Therefore this analysis indicates that students can be divided into 3 separate groups for further analysis: students who got 5 or 6 points for their ePortfolio activity (i.e., the "Upper group"), students who got 4,3,2 or 1 point for their ePortfolio activity (i.e., the "Middle group") and those who decided not to do activities in ePortfolio (0 points for ePortfolio activity – i.e., the "Bottom group"). Figures 2, 3 and 4 show the relation between these groups.

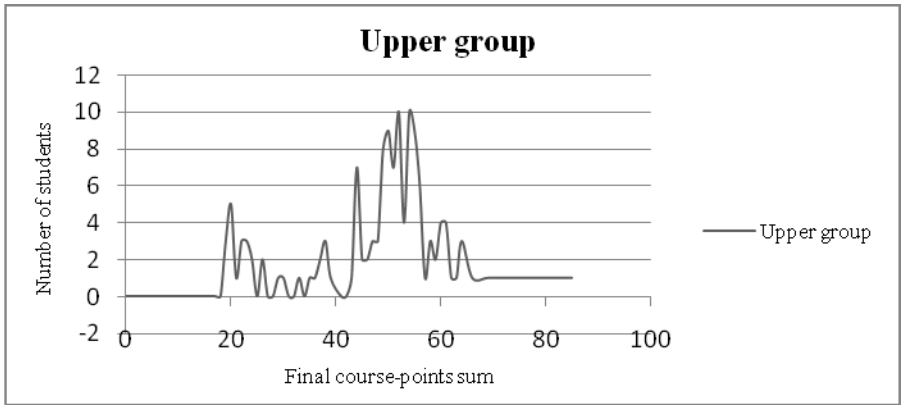

Figure 3. Score distribution in the "Upper group"

The Upper group consists of students who devoted their time to writing reflections following the instructions and did so for every chapter (except perhaps one). They showed a certain level of understanding of the course matter. The results in *Figure 3* show that most of them are grouped around 50 points or more. The Middle group is quite different. The majority of students in this group are slightly shifted to the left, which means that most of them did not pass SCM through their coursework and are situated between 20 and 50 points (*Figure 4*). It can be assumed that they had intended to pass SCM through their coursework but the assignments turned out to be slightly too difficult for them at the time. Finally, it is obvious that no-one from the Bottom group passed SCM through their coursework, the only exception being one student who succeeded in doing so due to additional exercises.

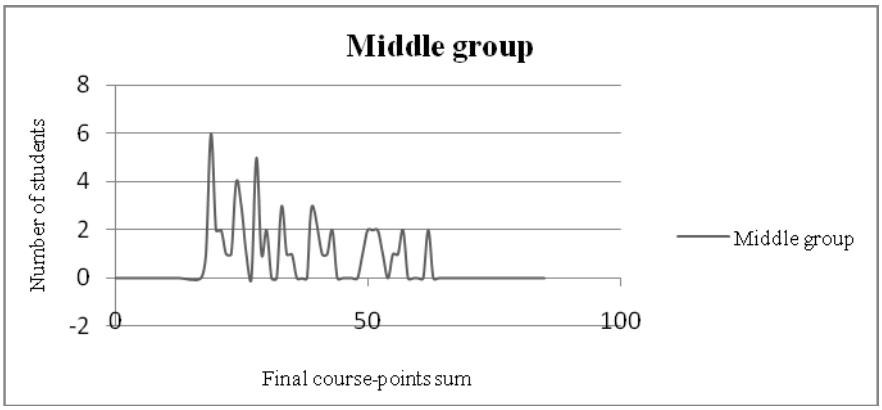

Figure 4. Score distribution in the "Middle group"

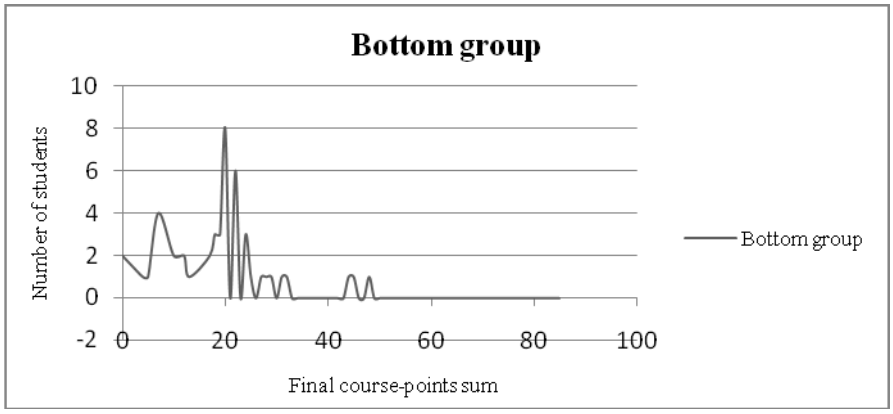

Figure 5. Score distribution in the "Bottom group"

Results in *Figure 5* suggest that the students' goal was merely to reach 20 points so they would not have to take SCM again in the following year. The number of students in each group who eventually passed the course through their coursework is shown in *Figure 6*. It is evident that a great majority of students who passed the course in this way were in the Upper group. We can therefore use the ePortfolio analysis as a useful instrument to identify students' competences and motivation in the course. As ePortfolio is associated with learning outcomes, it is reasonable to analyze the artefacts students attach (notes, short tests, midterm tests, homework etc.). It may be helpful to analyze the nature of their reflections as well (i.e. do they reveal understanding or are simply copy-and-paste definitions).

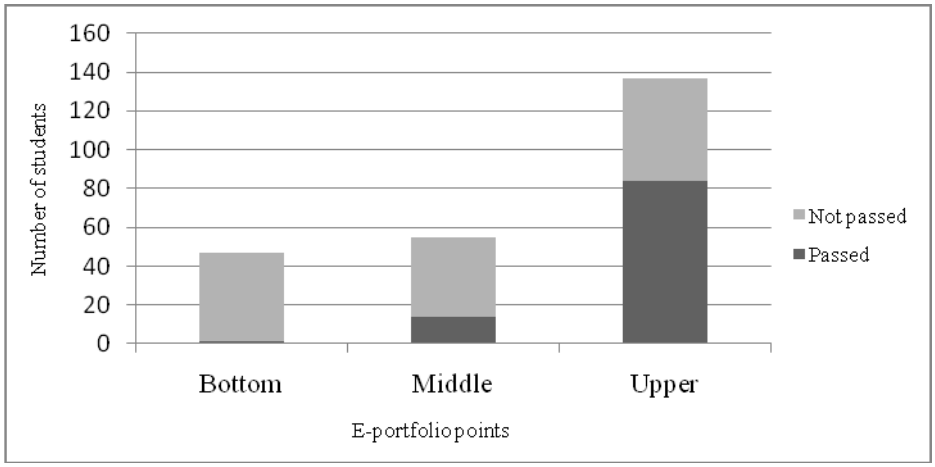

Figure 6. Comparison between categories regarding the pass rate

These issues provide a possible course of further research and more thorough analysis. Finally, we would like to emphasise the role of ePortfolio in the process of raising students' awareness and critical thinking about their own achievements and motivation. This, along with self-monitoring their learning progress, has a vast influence on their study success.

Conclusion

This paper presents the process of ePortfolio implementation over almost 18 months starting from the pilot project and ending with its full scale implementation. Today more than 500 students are using ePortfolio at the Faculty of Organization and Informatics. This is the second year that ePortfolio has been used in the courses Informatics 2 and SCM. We intend to introduce ePortfolio in a few other courses, one of which is the Psychology of Teaching. In this course students will be taught how to use ePortfolio to set up their own goals and monitor their own progress in achieving those goals. It is obvious that, if the potential of ePortfolio is to be entirely exploited, students should also be introduced to lifelong learning and how ePortfolio supports its elements. We hope that in a few years we will be able to fully utilize ePortfolio capabilities not only as a pedagogical tool but as a concept embraced by students, educators and employers. That kind of a concept would enable students to not only become more effective and reflective learners, but also to present themselves to future employers and all the other stakeholders.

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