Lappeenranta University of Technology
School of Business and Management
Degree Program in Computer Science

**Maksim Vlasov**

# ELECTRONIC LEARNING PORTFOLIO PLATFORM AS AN EMPLOYMENT MEDIATOR

Examiners : D.Sc. (Tech.) Uolevi Nikula
Prof. Jari Porras

Supervisors: D.Sc. (Tech.) Uolevi Nikula
Prof. Jari Porras

# ABSTRACT

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**Electronic learning portfolio platform as an employment mediator**

Master's Thesis

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This thesis studies a possibility to utilize the artifacts of educational process, presented in a form of electronic portfolio, as a assistance tool for students in finding an employment after their graduation. Due to the fact that one of the main success factors in finding suitable employment is the possession of actual experience and skills in a given field, which a graduate may not have at that time, we investigate the problem of creating such a platform that assists in generation of such knowledge portfolio, which can be used to demonstrate own abilities which were accumulated during studies. For that, we conduct a review of existing solutions in this area to identify the most suitable candidate for that role.

# TABLE OF CONTENTS

## LIST OF SYMBOLS AND ABBREVIATIONS

| | |
|---|---|
| CMS | Content Management System |
| CVS | Comma-Separated Values |
| HTML | HyperText Markup Language |
| PHP | PHP Hypertext Preprocessor |

# 1 INTRODUCTION

## 1.1 Resume

It is a frequent situation that when an individual graduates, who just a moment ago has been a student, he faces the challenge of finding a job. Some students manage to find their work places before the graduation, others test their abilities in taking a freelance position in the same field where their studies are specialized to gain real work experience (which so often is a stumbling block when an employer is more interested in those who have had actual work experience in the named field), others may get help in a form recommendations from the institution for participating in various competitions and contests, but as a rule all those cases are a minority of students.

The first step in job seeking is a creation of the resume. A traditional resume is a profile where the individual lists all his important skills and experience that may be of interest to an employer. A resume can also be accompanied by certificates which ratify the possession of named skills and references to the works he has produced, where the employer can get acquainted with practical examples of what the candidate is capable of.

On the one hand, because the student often has no real work experience and his skills are generally limited by what can be gained during studying process, the process of creating a resume can be quite a challenging step. On the other hand, it is worth noting that the experience and skills the individual got during his studies still do have a value, and it's just a matter of representing them in a form that is the best to demonstrate them.

Let's take a brief look at the two main problems which a student faces during resume creation and what are the possible solutions:

1. **"I have knowledge of X"** – the problem lies in the fact that with no real work experience it's difficult to assess how far and in what directions the individual's knowledge can cover the given area. But this problem can be examined from the other viewpoint – as a way to demonstrate his scope of capabilities the student has his passed courses. The content of the courses, the institution and their teachers who were providing that knowledge, as well as the resulting grades, all of them are

quite a good way to estimate and show what it can be expected from that candidate in given area.

2. **"I have experience with Y"** – in such cases, the person usually provides examples of his works that he did in his spare time, or participated in open projects, or works for which he has a permission for demonstration from his previous employers. The student most likely doesn't have such samples but on the other hand he has ones he did during his studies. Many courses in order to be passed requires the students to write a variety of practical assignments, create reports, conduct group works and other artifacts of study process. Despite the fact that this is not a business/professional level of work, a qualified specialist can spot the direction, approaches and methodology and a way of thinking of that individual. In a sense, these works can serve as an unofficial form of the tests, which candidates are usually taking when they applied for a position.

As we can see, with the right approach, even with no real work experience a student is still able to demonstrate what he is capable of. And this work is intended to investigate the means of what can be done in order to assist students in this matter from the practical point of view.

For that the individual need to prove and demonstrate his ability to perform the proposed work, and this is where the problem arises – if until now the individual had no real work experience, it is much more difficult to demonstrate what he is capable of. On the one hand, he has no real work experience, on the other – he has those which he accumulated during studies in the institution, and with the right approach they can presented in a good light.

## 1.2 Vision

First of all, let's find out who is represented as stakeholders in this situation, what are their goals and needs.

1. **Students** – as noted earlier, this party is interested in getting the job after graduation. They have a need to show their best qualities to interest potential employers [1][2].

2. **Employers** – this party is interested in getting qualified personnel with rich experience. But since no one is born with experience, they recruit beginners as well. They have a need to find new staff with good skills and/or show high promises [1].
3. **Institutions** – this party is interested in having their graduates to get good jobs. The more its students to succeed in a career, the higher the prestige of the institution is, the greater will be the number of people who are willing to get an education in that institution. They have a need to raise the prestige thanks to the success of its graduates [2].

As you can see, the problem affects three parties, institutions, their students and employers. What are the most obvious ways to help them?

1. **Direct interaction** – the most basic and most practiced approach in the majority of cases. Employers engaged in publishing vacancies and recruiting candidates, including graduates of prestigious institutions. Students, on the other hand, are engaged in preparing their resume, making requests to the labor exchange or directly involved in the search for interested job on their own. Finally, institutions are doing their best with trying to carry out recruiting events, inviting representatives of various specialized companies to advertise their businesses in order to attract outstanding students to get jobs from them after graduation.
    - Positive aspects – relative simplicity and widespread which showed its good results in the course of many years.
    - Negative aspects – high costs of time and other resources.

2. **Intermediary** – usually a labor exchange. Students post their resume and preferences on jobs, employers similarly provide open positions and name which skills and experience of the candidates they are interested in, and institutions are trying to cooperate with labor exchange to some degree. In its turn, the intermediary tries to help all parties to find each other.
    - Positive aspects – relatively simple, fairly widespread, low resource costs.
    - Negative aspects – average efficiency, very high time costs, weak control by the stakeholders.

3. **Information platform** – creation of the institution portal which would provide help to its students to demonstrate their skills, and employers – to quickly and efficiently find candidates from this institution.
    - Positive aspects – the simplification of the portfolio management process for students (achieved by integration with institution database), and for employers by providing rich information about potential candidates, their skills and knowledge.
    - Negative aspects – the establishment and maintenance of the platform requires a lot of resources, "locality" of the solution, not being a widespread practice.

As you can see, each approach has its pros and cons where there is no indisputable "leader". On the other hand, despite the fact that they solve the same problem, these approaches do not conflict with each other, but rather complement. If we take a look from student point of view, he can engage in job search on his own, and at the same time he will have the support from labor exchanges, including assistance from software platform which help to manage his portfolio of knowledge and experience relatively easy and efficiently. From the point of view of employers, aside of publishing job vacancies, they can participate in fairs which are held by institutions and communicate directly with possible candidates, and at the same time they can have rich opportunities to get acquainted with the skills of all students of that institution. This means that the use of all those approaches will provide a greater positive impact than relying solely on one.

So we came to the conclusion that the more options there are for all parties to achieve their goals, the better chances to achieve positive results. And about utilizing approaches, while the first two – direct interaction and labor exchange – are fairly obvious and self-explanatory due to their prevalence, in the case of using the software platform the situation is different. In order to set the latter approach in motion, the following issues need to be solved:

1) **What requirements must be satisfied by the platform?**
2) **What known existing platforms are capable to meet the requirements of all**

**parties?**

3) And finally, **what risks are associated with the use of such a platform?**

These are the goals for this thesis - creating these artifacts, and reporting the results of doing these:

- List of requirements and constraints from all stakeholders
- List of key use-cases which the platform can operate
- Review of existing solutions
- Review of the degree of examined existing platforms are capable to cover the needs of stakeholders, and what changes are required in order to utilize it

# 2 RELATED RESEARCH

## 2.1 Education

Typically, work is an inalienable part of life for every adult individual. The individual does the work for self-realization and fulfilling the means for his own existence. At the same time work is a process of transformation for collective knowledge, experience and skills into valuable goods. Since people do not inherit any prior skills or knowledge before the birth, all of it they acquire during their life.

Modern society is built upon the standard that a person dedicates a major part of his life on receiving an education, and continues to do so for at least next 18 years [3]. During that time he gets valuable knowledge and skills that he is going use to support his life [4]. For that reason, a person begins this learning journey from early years.

Usually the education process is divided into three levels: elementary, secondary and post-secondary [5]. Elementary and secondary educations are compulsory in most of the countries, which he or she is recommended to graduate from before starting a general labor [6], while post-secondary education is optional.

The purpose of compulsory education is to provide a skill basis that could cover any sort of professional area [6], whether it is science or philosophy. It would also help an individual find his own place in a society and decide on a specialty he would like to develop himself in or continue studying for post-secondary education. In a nutshell the compulsory education is based on the same study program that used across the entire country, with few exceptions to emphasize on specific subjects in certain schools.

On the other hand it is completely optional to get a post-secondary education. Its sole purpose is to provide a deeper knowledge in a specific field [7]. The main difference here is that it is up to the person what kind subjects he would like to study. Besides the opportunity to choose a post-secondary education school that specialize in certain area like information technology, health care or geology, it also possible to narrow down the future

expertise area even further by selecting specific courses during a semester.

## 2.2 Digital portfolio

During studying period a person gains knowledge and experience, performing various assignments, writing reports, presentations, and creates a variety of other artifacts. These artifacts serve as a representation of what the individual has reached, what skills he has received, how well he is able to utilize them, allowing to assess and demonstrate his level of development [8]. While teachers of institutions are doing everything in their power to ensure that all of their students get the most of skills and knowledge, a lot of the success depends on the student himself, his ability to recognize his own strengths and weaknesses. And as a result of accumulating all these needs, the idea of the learning portfolio has been emerged [9].

For simplicity, speaking of the portfolio, we will be implying learning ePortfolio, where the "teaching" part refers to its use for educational purposes of the students, and "e" – the format, where all the artifacts are stored in digital form and are usually available for online access under some terms.

The main idea of a portfolio is a creation of collection of educational artifacts which a student produces during his studying period, and that collection is one of the best ways to demonstrate his skills, the extend of being able to utilize them, knowledge and experience [9]. In addition to being a collection of artifacts, portfolio is capable of performing a number of other operations, which usually depend on the level of maturity model. For that we will use the model which was presented by Love et al. [10] where five levels of maturity model were allocated:

1. **Scrapbook** – the most basic level, where a portfolio acts as a storage where the student keeps all his works. This level is not intended to perform any other work, and keeping one is a personal initiative of a student, where he is free to implement it in any form or content.
2. **Curriculum vitae** – at this level, the process of creating a portfolio gets attention of a teacher or other institution representative who helps the student with the organization and the filling of the portfolio. This level of maturity still stays as a

voluntary project and is meant as an appendix to employment resume. The form of its presentation is still not restricted by anything, although digital form starts to prevail over the physical one.

3. **Curriculum collaboration between student and faculty** – at this level a number of requirements of portfolio management starts to emerge. The key features of this level is a possibility to provide a feedback on the produced work by institution teachers, as well as the creation and management of a portfolio becomes a mandatory activity for all students. Due to the introduction of the capability to provide a feedback on a studying artefact, physical and plain electronic forms lose their effectiveness to perform their role, making the web one the only possible form. From that moment onward, the institution begins to take an active role in the creation and management of a portfolio where the teachers can add to student portfolio a number of things like syllabi, assignments, as well as any other necessary information which can be required for perform the task. Among other things, since the full transition into web format, employers gain an opportunity to get familiar with students' portfolio where such an agreement between the institution, the students and employers have been taking place.
4. **Mentoring leading to mastery** – this level of portfolio shifts from just being a presentation of the student's knowledge to being an instrument of gaining the knowledge. At this stage the institution takes even more active participation, portfolio becomes, in a sense, a platform where the studying process is taking place. Teachers add studying assignments to students' portfolio which the student seeks to accomplish, enabling numerous attempts to be taken to achieve the required quality which is then locked out by the teacher from being editable any further due to reaching finishing line and no additional investments is required. Also, at current maturity level a portfolio gain a capability to be accessible freely by other people within the institution like academic staff and other students, although the access by employers still requires an agreement between both parties.
5. **Authentic evidence as authoritative evidence for assessment, evaluation, and reporting** – at this level of portfolio reaches the highest point of development, it evolved to being the key element of learning process. In general, this level is similar to the previous one, with the difference that at this stage the portfolio must

meet specified national, state, and program standards.

As it can be seen from the above maturity levels, the portfolio may perform different roles, ranging from a collection of documents and to the guiding star which helps in self-assessment, establishing of the goals and in providing methods for self-development, as well as to help the individual to demonstrate himself as a potential employee. From that we can conclude that a competent approach in the conduction of the portfolio has a lot of advantages for a student to be useful both in the present time and in foreseeable future.

In this paper, we would like to investigate the last point, a portfolio as a tool to help students in finding an employment at the point of reaching his graduation.

# 3 CONDUCTED STUDY

## 3.1 List of requirements and constraints

Let's decide what are the requirement which should be met by the software platform.

First of all, primary requirements:

1. **Ease of use** – like it happens for introduction of any new system, first of all the parties need to get familiar with the system and learn how to use it so they could utilize full potential of it and actively use after that. Since it is fairly common that not all users are well experienced with usage of information systems, sophisticated platform will likely look not user-friendly for some users. Even if they learn how to use it, the inconvenience of the platform will have a strong negative effect on its popularity, thereby undermining the whole idea.
2. **Integration with educational systems** – as it has been mentioned earlier, students during their studies take a variety of courses, write papers, conduct presentations, get grades for their work and so on. All these artifacts of learning process are in fact a good source of information about students' abilities which employers need to know in order to evaluate candidates.
3. **Privacy** – this research paper is carried out with the idea of being utilized in an institution of European country, where a great attention is paid to the matters of privacy and personal data protection. By that we mean the ways of being able to control access to personal data by unauthorized persons. From the viewpoint of the software platform it means that we require the availability of means that allow the students to decide which of their personal data – like names, study artifacts, grades and so forth –, to which extent and by whom it can be accessed for reading. In particular, it aims to protect the privacy of students' personal data from unauthorized access by people outside the institution.
4. **Availability** – because our platform is designed to help two side of stakeholders to communicate with each other – between employers and institutions with their students – who initially don't have common platform for interaction except for the most basic means, like using electronic and physical mail or telephone, our platform is required to behave that way. The most efficient

platform in present time would be an information portal which connects parties through the use of the Internet.

5. **Support for being operable within institution network** – in some cases it can be very important to have complete control over the platform. For that the resulting solution must support deployment within institution network and operable autonomously (with no access to external networks).

The secondary requirements which are desirable but not critical, are the following:

1. **Export and/or access after graduation** – as the basic idea of the platform is to support the students during their studies, that is, while they are still listed as student of their institution, by the point of graduation in most cases they lose the privileges to use any institution services. In this regard, there is a need to give the individuals an opportunity to continue to use its established portfolio even after graduation, or have means to export collected data in a convenient form.
2. **Limited operational access to students' accounts by institution staff** – the idea is that the institution staff would have some degree of access to students' portfolios for contribution purposes. These features include the ability to add courses, gained grades, being able to provide notes and feedback and other similar operations.
3. **Low development and platform supporting costs** – here we are investigating the matters of how costly it will be to introduce such a platform. By that we means the selection of tools (programming languages, licenses for proprietary applications and hardware) supported runtime environments (operating systems, system components) and the actual process of building such platform (time and financial resources). Established system should strive to use the best of popular solutions and simple architecture to support risk reduction. For example, the use of hardly known programming language or framework may result in difficulty to find experts capable of maintaining the system with system updates, bug fixes and further development in case of needs for extra features. Or the complexity of the architecture could lead to greater costs of time and increased risk of bugs and vulnerabilities.
4. **Customization** – many software platforms at some point reach the situation where there is a necessity to introduce new features or provide some modifications. If the

system is built in monolithic way, not utilizing modular structure or configuration files, or the architecture complexity makes it hard to expand, it may negatively affect the use of it the long run, which in the worst case may lead to the decision to abandon current solution and develop a new platform from scratch, which is highly undesirable for obvious reasons. Therefore, we are interested in the platform architecture which supports extensibility in some form.

5. **Scalability** – as the platform is expected to grow over time due to increasing number of users – for example in the case if it support to keep old data for users to be able to access it after graduation – it should be taken into account the possibility to scale the system. In bad scenario, it will impose restrictions on the size of the platform, or cause a decrease in the efficiency of the platform.

So, we listed all primary and secondary. What about limitations?

1. **Single institution** – by that, we mean that at the initial stage the platform will be used strictly for the single institution. This means that we are not intended to ensure that the platform will be used for a larger number of institution. If the platform already supports multiple institutions, this restriction may be skipped.
2. **Portfolio as a showcase of knowledge** – during investigation of what a learning portfolio is, we came across the matter of possible levels of maturity models. As the maturity level of portfolio develops, it evolves from being just a manual set of artifacts to being a tool, which guides and assists students in forming their skills and knowledge, becoming a key figure in the educational process. In this paper we do not attempt to use the portfolio at high levels, striving for the second or third level of maturity. In case if platform supports higher portfolio maturity levels, this restriction may be skipped.

Now that all the requirements and restrictions were defined, we can proceed to the next step – development of key use-cases.

## 3.2 Key use-cases

As noted earlier, the system has three main stakeholders: employers, institutions and their students. Each party can use the platform, but each of them will have different ways of

interaction with it. In order to define them in an understandable form, we will resort to the creation of use-case diagrams, which will describe the key features of the system.

### 3.2.1 Use-case "User"

The main actions available to users of all three groups and can be seen in Fig. 1:

1. **Register** – depending on the degree the system is integrated with other systems, it can perform differently. If the platform is not mandatory to use, this action is used to create an account where the user will provide basic information about himself, such as personal data and other information. If the platform is mandatory, this action can be renamed to "initialization" which initialize or activate the already prepared account. The information required for registration may depend on which group the user belongs to.
2. **Log-in** – in order to start using the system, the user is required to log into the system. Being an unauthorized user, he will have access to the profiles and relevant information according to the permissions which those users agreed to provide for reading access.
3. **View/Edit personal information** – in this section, the user can review his personal information and make changes to some degree. By "some degree" we mean being able to edit the information which will not cause issues. As example of editable information can be phone number, e-mail or other contact details, and by not editable information – names, birthdate and similar, something that is not supposed to change during the course of using the platform.
4. **View/Edit permission settings** – as it was already mentioned, we want to give the user the ability to control who, and to what extent it is possible to view the information for the current user. As an example access parameters for users of "Student" group, allowing access to view the list of courses and grade points received by all users, viewing resume only for "Educator" and "Employer" group users, and viewing study artifacts only for users of group "Educator" and manually selected users of group "Employer". The user can provide the extended access rights to individual users at the request of the user. Among other things, this section can be used to specify permissions to view other information, such as personal data.
5. **Request permissions** – because the platform is designed for system access rights,

it will be convenient to be able to make a request the other user to grant extended permission to view his information. Depending on the implementation, this may be just a personal message with the request or something else.

6. **Add/Remove permissions** – allows you to add or revoke permissions, which can be platform global, group ones or personally issued to selected users.

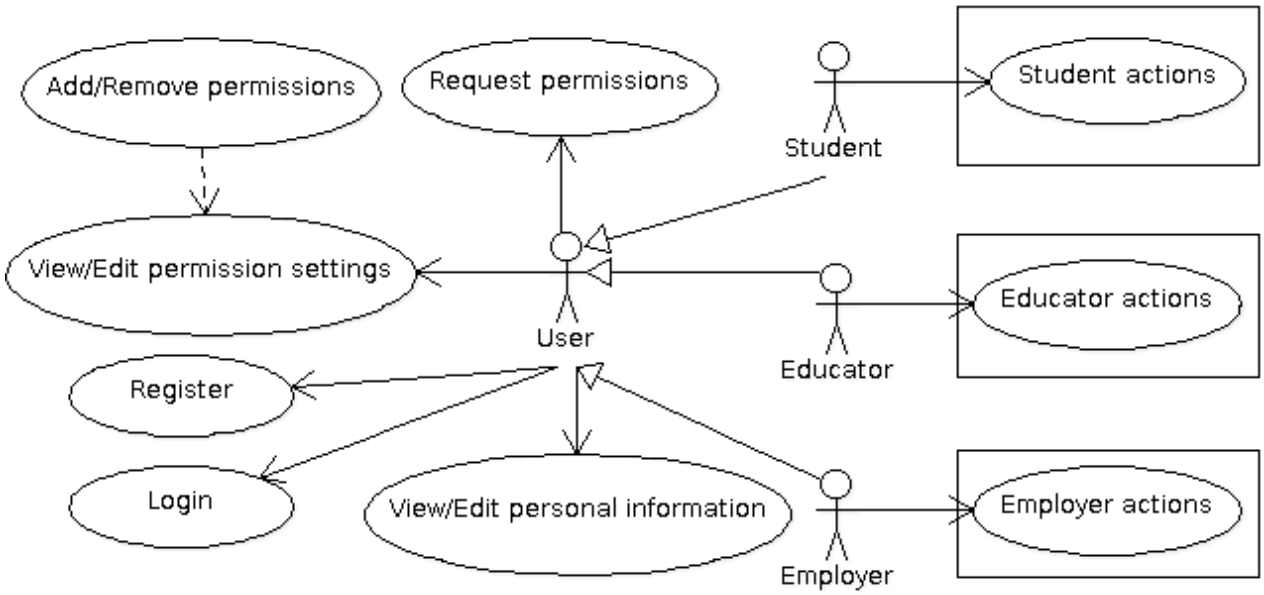


**Fig. 1.** Use-case "User".

Supergroup "User" is a generalized group of users. This supergroup has access to a set of actions that are available to users of all inherited groups, with possible slight differences in implementation. These differences can be methods of identity verification during registration or fields which are available for editing in personal information page.

Since the "User" is a supergroup, the following three are inherited from it: group "Student", group "Educator" and group "Employer". Each group has a number of unique features that will be reviewed in more detail in separate use-cases.

### 3.2.2 Use-case "Student"

Here are the key actions available for user of "Student" group which can be seen in Fig. 2:

1. **View/Edit personal resume** – aside the fact that the user will have a portfolio or

list of study artifacts, he can also maintain a separate page for his resume which in a sense would have similar functionality like a portfolio (attaching documents and others).

2. **View/Edit course list** – here the user can see the list of courses that he finished and taking at this point of time. In addition to the list of courses, optionally there could be seen a summary on that course, its content, the teachers, years and so on. Also it would be possible to see grades for courses which were completed at this point. Finally, the user can access section with his course artifacts.
3. **View/Edit list of course artefacts** – in this section, the user can get familiar with this study artifacts, which he generated during those courses. These artifacts can include documents, video and audio files, images, archives, links and so on.
4. **Add/Remove courses** – allows the user to add or remove courses from the list.
5. **Add/Remove course artefact** – allows the user to add or remove artifacts for selected courses.

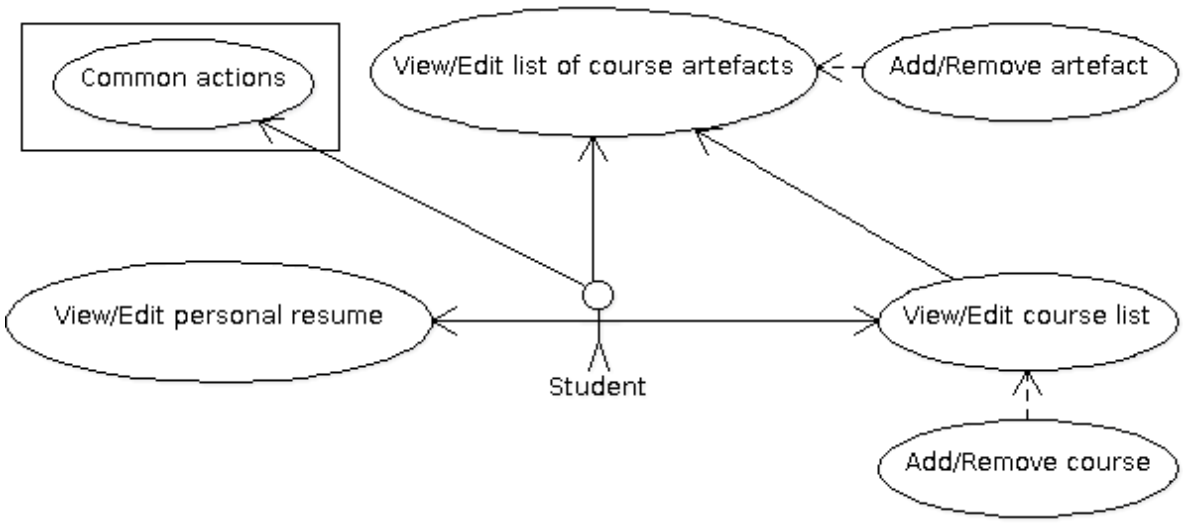


**Fig. 2.** Use-case "Student".

### 3.2.3 Use-case "Educator"

Here are the key actions available for user of "Educator" group which described in Fig. 3:

1. **View/Edit course list** – here the user can view and manage the list of courses, which he is teaching.
2. **View students of course** – this section allows the user to view the list of all

students who have added that course to their portfolio.

3. **View/Edit course information** – through this menu, the user can edit the information about the course. Such information can be brief description, materials used during the course, assignment notes and other useful information.
4. **Add/Remove course** – allows the user to manage the list of courses, adding or removing selected ones.
5. **View/Edit student course grade** – when users of group "Student" completed the course, the "Educator" user can provide grades which those users earned during the course.
6. **Add/Remove notes for student's course** – in addition to grading, the user has means to leave notes, comments or feedback on the course taken by selected "Student" user.

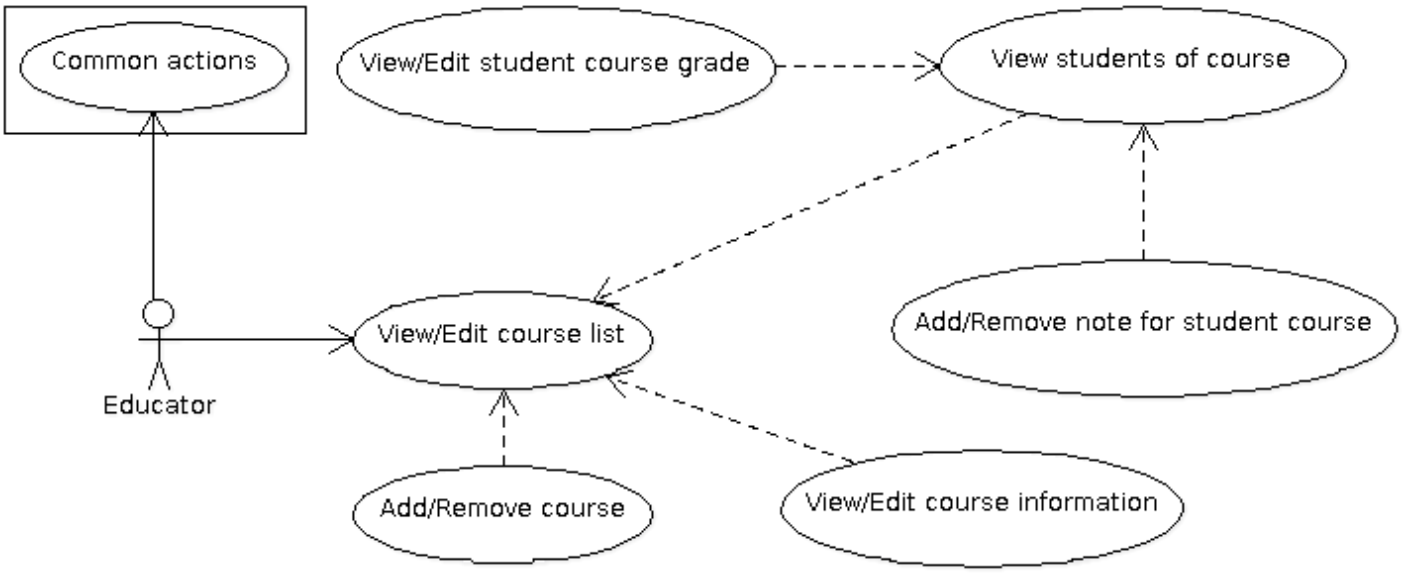


**Fig. 3.** Use-case "Educator".

### 3.2.4 Use-case "Employer"

Here are the key actions available for user of "Employer" group and can be seen in Fig. 4:

1. **Search** – the key function of this group, which is responsible to provide means for finding "Student" users which met specified search criteria. Search can be carried out using information stored as plain text, covering all information the users provides and available for reading such as resume, completed courses, acquired

grades and other criteria.

2. **View/Edit job offers list** – if desired, the user can publish vacancies which "Student" users can apply for.
3. **Add/Remove job offers** – allows the user to add or remove job offers.

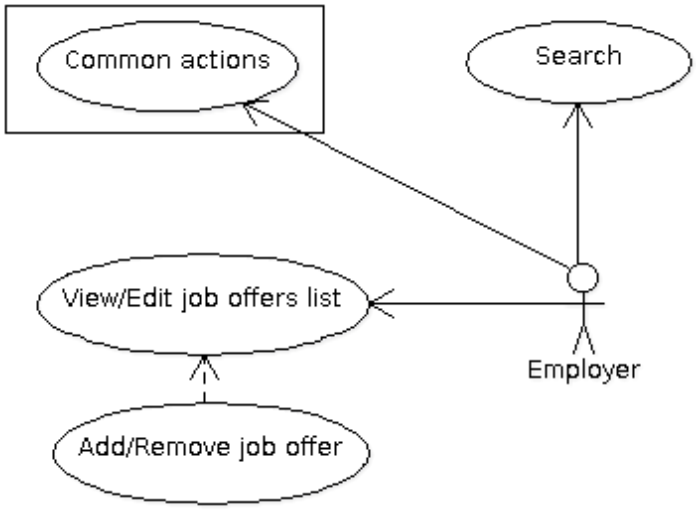


**Fig. 4.** Use-case "Employer".

## 3.3 Evaluation of existing solutions

The idea of the use of ePortfolio for studies were known for a relatively long time. The most of used solutions to carry out that task based on the use of personal websites/pages where a student puts text information about his previous works, as well as attaching files and links.

Before it can decided if there is a need to build a new platform from a scratch or there are existing works that are close enough to fit the specified criteria and requirements, it is necessary examine some of the most promising solutions known for the current day.

These solutions are the following:

1. **Pathbrite** – the easiest way for people to showcase their abilities and achievements via beautiful and compelling Portfolios.
2. **Mahara** – fully featured web application to build your electronic portfolio. You can create journals, upload files, embed third-party resources from the web and

collaborate with other users in groups.

3. **Drupal** – free open-source content-management framework which provides a back-end framework for about 2-3% of all Web sites worldwide, ranging from personal blogs to corporate websites.
4. **LinkedIn** – business and employment-oriented social networking service that operates via websites.

Let's have a better look for each of them in detail.

### 3.3.1 Pathbrite

This portfolio platform was created with the idea of full support of educational process. Students can maintain their personal portfolio, and institution staff can create courses, provide assignments, set grades and so on. On the Fig. 5 you can see an example of portfolio which can be created in this platform.

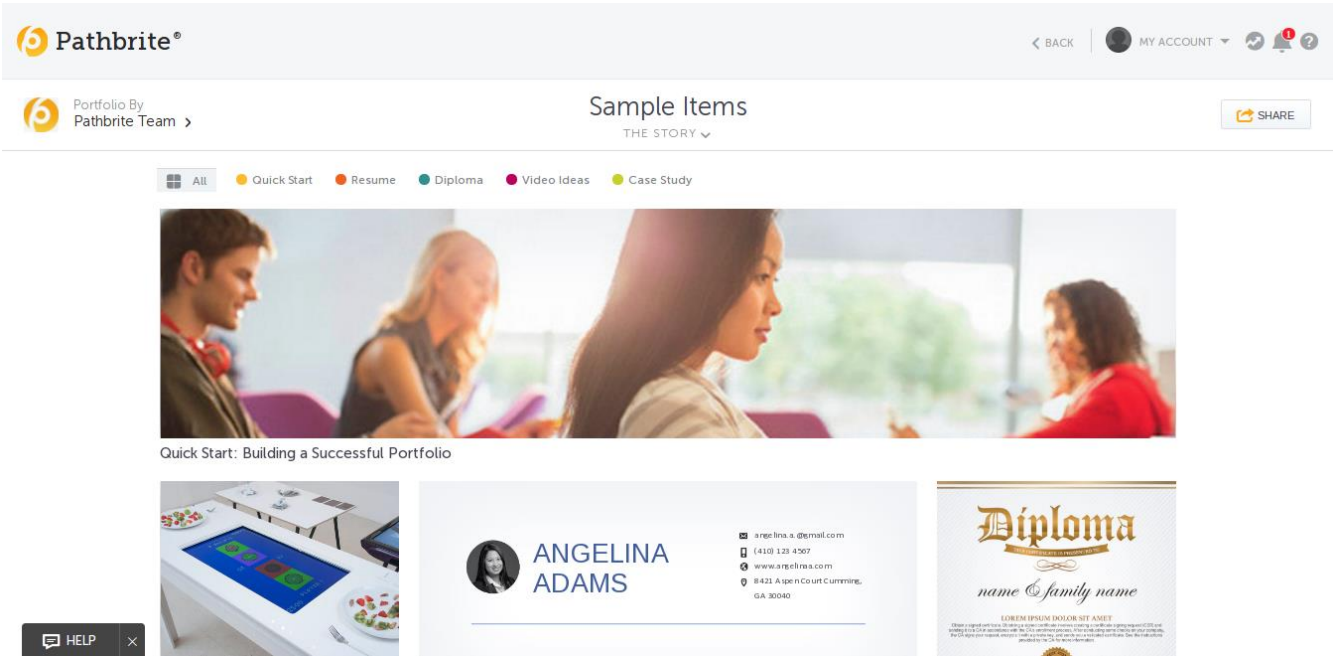


**Fig. 5.** Sample portfolio in Pathbrite.

From the perspective of students, this system supports creation of reference portfolio, independent of each other, and which are divided between personal and study groups. Initially, all works which were carried out within the selected course are associated with

study portfolio, but they can easily be duplicated to the personal section, where they can be used stored as they are or edited (see Fig. 6). Each work/artifact is a self-contained unit, which can consist of multiple documents, links and files, it can marked for public or private use where the latter can be bypassed by personal links which the owner can generate on request.

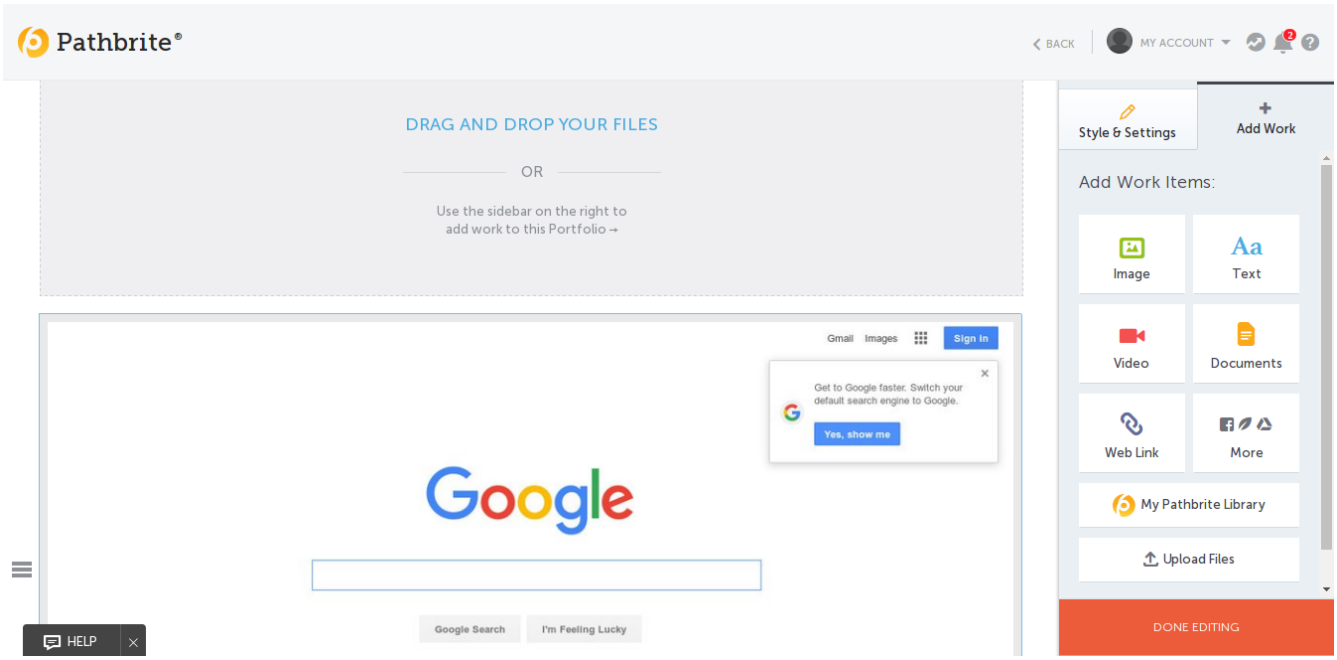


**Fig. 6.** Editing form for student portfolio unit in Pathbrite.

For academic staff, the platform provides tools to conduct educational process. The teacher can create courses – like it can be seen in Fig. 7 –, make assignments, check completed works and set grades for them. After the course was created, the user can send invitations to other users to join it, where they can get assignments and other information. Among other things, some subset of data can be exported in Comma-Separated Values (CVS) format.

In addition to being a system to assist students and institution staff, this service also provides functionality for employers. Unfortunately, the service does not provide open access to test its functionality and no detailed information on features of this category, it makes it difficult to evaluate its possibilities to know if it can handle the expectations which were described in this work.

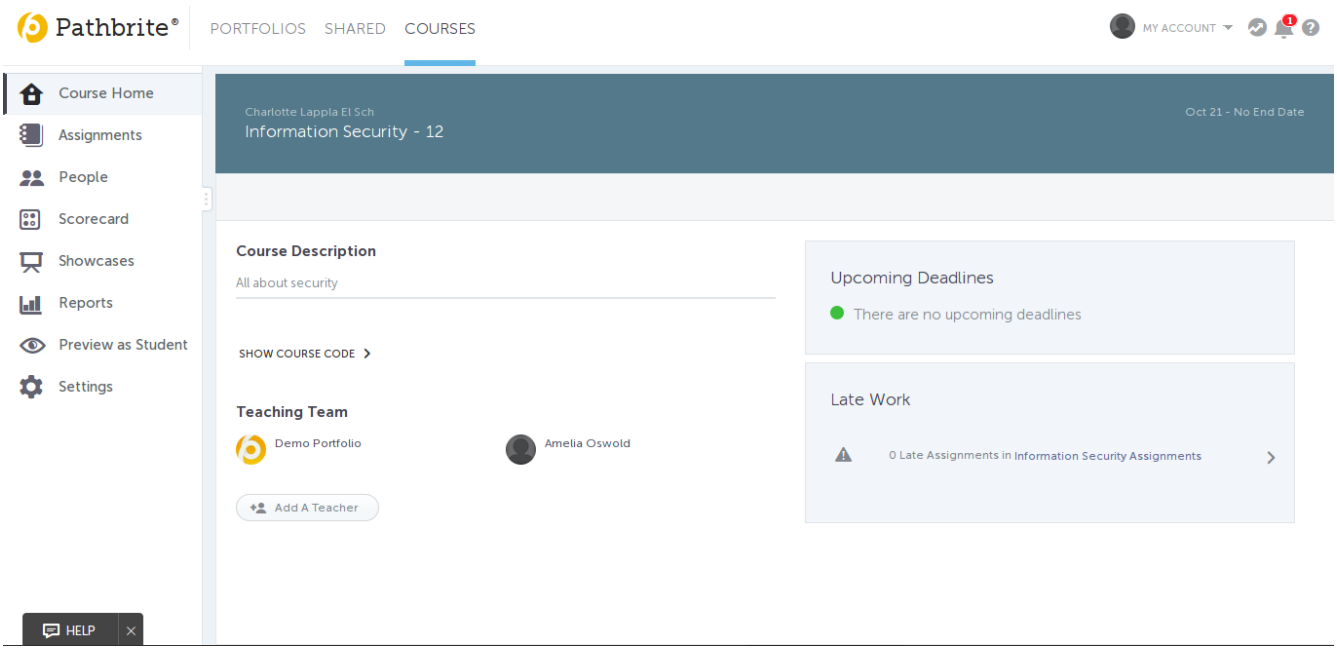


**Fig. 7.** Course management from educator's point of view in Pathbrite.

Let's have a look at this platform in terms of our expectations.

**Primary requirements**:

1. **Ease of use** – system interface is quite intuitive and visual.
2. **Integration with educational systems** – the system does not support integration with external systems, relying on its autonomy and self-sufficiency.
3. **Privacy** – platform supports the management of portfolio visibility, both globally and individually.
4. **Availability** – this system has full support for web technologies and is accessible from anywhere in the world through the Internet.
5. **Support for being operable within institution network** – due to the fact that this platform is a cloud-based service, it does not provide a version for local deployment.

**Secondary requirements**:

1. **Export and/or access after graduation** – the system is not restricted to be used solely for educational process, allowing the user to duplicate his study works under personal portfolio category.

2. **Limited operational access to students' accounts by institution staff** – institution staff has some degree of access to the students' accounts where it is related to the courses the students are taking, like setting grades, leaving comments and so on.
3. **Low development and platform supporting costs** – the platform is free of charge and is supported by its own developers.
4. **Customization** – because the platform is available as a service, it does not provide means for customizations.
5. **Scalability** – just like many other cloud services, scalability is presented fully.

**Constraints**:

1. **Single institution** – the service was originally created to support multiple institution around the world, so it does not have this constraint.
2. **Portfolio as a showcase of knowledge** – platform supports a high maturity level of portfolio by default portfolio so there is no need for this constraint.

Coverage in terms of **key use-cases**:

1. **User** – all cases are covered.
2. **Student** – the system covers all expected use-cases. Personal resume can be implemented as a portfolio in personal category.
3. **Educator** – all expected cases are supported on this platform.
4. **Employer** – due to difficulties in obtaining access to demo version for this category and the lack of detailed documentation, it's not possible to evaluate it.

Based on collected information it can be concluded that the platform fulfills most of the requirements, as well as has full coverage of key use-cases. Among the unrealized requirements we can distinguish the lack of integration capabilities to use with existing systems which can be already used in the institution, and the absence of local version of the platform. Finally, due to the lack of access to employer category of users, we don't have means to decide if it can assist our expectations in this area.

Overall, this platform is an example of high-quality portfolio system for studying purposes

to be used for its purpose, or provides a good reference model for building own solution.

### 3.3.2 Mahara

As previously reviewed Pathbrite, Mahara is also a management system for electronic general-purpose portfolio of with elements of social networking service. The key features of this platform is its open-source nature, expandability through the use of multiple plugins which are available for downloading, as well as being capable to have independent modifications, aided by the fact of being locally deployable system and the use of PHP Hypertext Preprocessor (PHP) programming language. Among other things, the biggest advantage of this platform is the integration support with Moodle – the famous open-source solution for educational process management. One of examples of how it can be customized to look can be seen in Fig. 8. For these reasons, this platform covers a large part of the expected functionality.

For students, it is possible to create and modify portfolio (see Fig. 9) using both plain text notes or adding images, audio and video, file attachments, journals and so on. Portfolio has support for permission settings which can be applied globally, group-wise, individually to specified users or by generation access links for external access.

For institution staff, despite the fact that Mahara doesn’t provide some required functionality on its own, the presence of integration with Moodle solves most of that issue. Thus, the teachers can conduct courses, provide assignments and grades for courses.

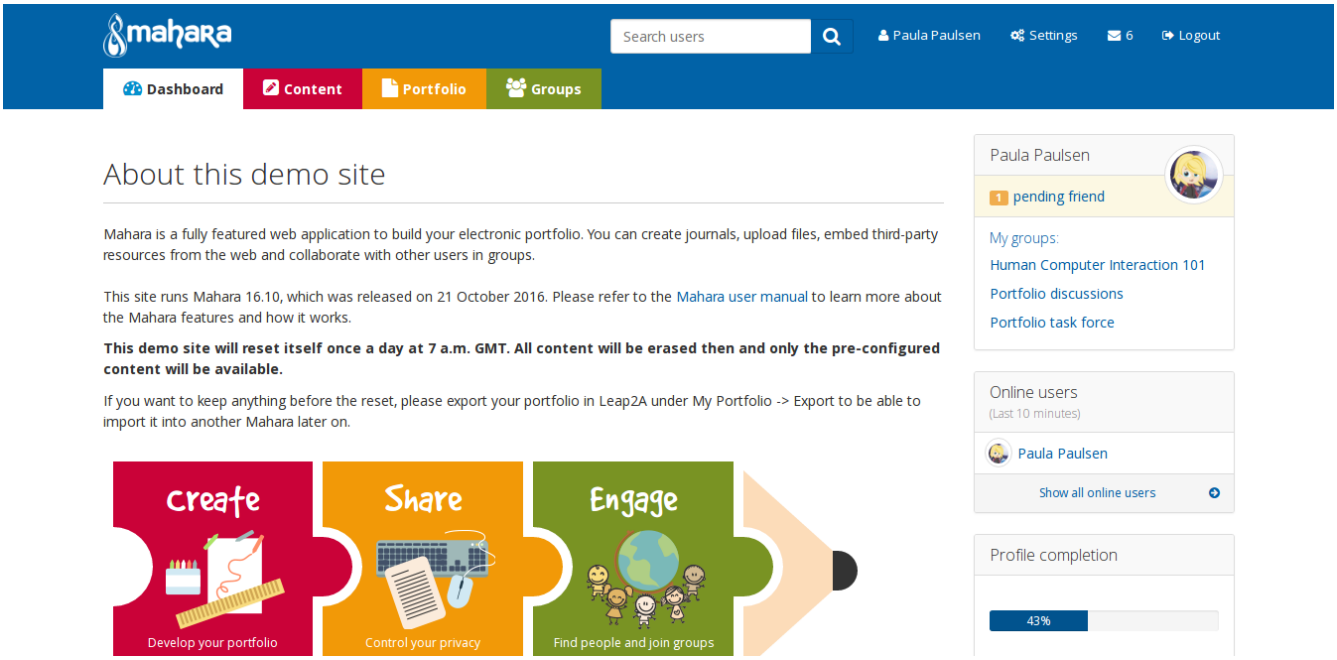


**Fig. 8.** Sample dashboard page in Mahara.

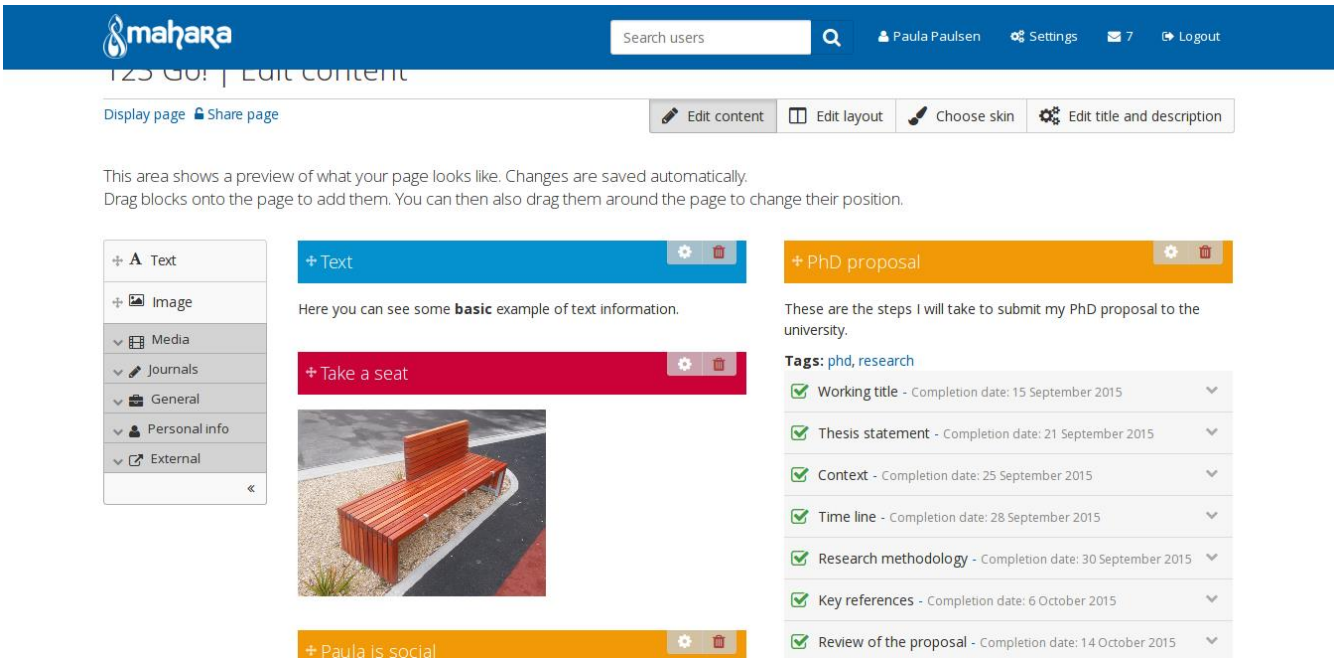


**Fig. 9.** Editing a portfolio in Mahara.

As for employers, by default this platform also lacks the necessary functionality. But due to the fact that Mahara is an open source project, it is possible to extend it to add missing required functionality.

Let’s consider this platform in terms of our expectations.

**Primary requirements**:

1. **Ease of use** – the platform has a relatively simple interface that does not require a lot of time to get familiarize with.
2. **Integration with educational systems** – the system has support for Moodle integration which provides a great opportunities in educational process.
3. **Privacy** – the system provides sufficiently rich possibilities for permissions management to user's resources.
4. **Availability** – the resource designed as a web service that is capable of working both locally and through the Internet for external access.
5. **Support for being operable within institution network** – the system is designed as a locally deployable project that does not require external resources.

**Secondary requirements**:

1. **Export and/or access after graduation** – when necessary, the user can take advantage of the fact that the system provides means to export user's data, in HyperText Markup Language (HTML) format or in Leap2A format, where the latter option can also be used to import the data back into the system.
2. **Limited operational access to students' accounts by institution staff** – a hierarchical system of users present in the platform, where the administrative users have some degree of freedom to manage user accounts.
3. **Low development and platform supporting costs** – a platform is actively supported by its developers, plus it is built using PHP which is very common in web development.
4. **Customization** – project is designed for local deployment and freely editable to introduce modifications.
5. **Scalability** – based on the provided documentation, the project has a certain degree of scalability which should be sufficient to support a typical institution under normal operating conditions.

**Constraints**:

1. **Locality** – the platform was originally created to be used by a single institution.

2. **Portfolio as a showcase of knowledge** – in its default form the platform is designed to be used as a tool for portfolio showcasing which consists of student's study artifacts.

Coverage in terms of **key use-cases**:

1. **User** – most of the functionality is implemented in the way that is required from this kind of project. Among the differences which can be highlighted, user registration is carried out by the system administration, which is typical for such platforms.
2. **Student** – because this platform is more focused on being a portfolio-oriented social network, it lacks the required functionality for educational process, but that lack of functionality can be filled through the integration with Moodle platform.
3. **Educator** – similar situation as for the Student group.
4. **Employer** – this platform doesn't provide support for employers, but being an open source product makes it possible to extend the existing functionality to add that missing support for this category.

According to the analysis results, it can be concluded that despite the fact that the system doesn't provide rich functionality to assist portfolio management in educational process, the availability of open source code and integration with the popular learning platform Moodle allow to fill the gap in the absence of tools. In terms of requirements, the solution covers all stated expectations, and the only presented problem is in the absence of functionality for employers.

And so it can be concluded that the system is a good compromise between being open and functionality, and code base can be used as a basis for building own solution.

### 3.3.3 Drupal

Unlike other portfolio solutions, this system initially has no functionality to accomplish the task, but in return it provides other features. As we remember, in its basic form the ePortfolio is a collection of students' artifacts which he created during the course of educational process, and they are usually presented in the form of personal websites/pages

to showcase user's achievements, skills and knowledge. And this exact property of the electronic portfolio is what this system can be used to present.

This platform is an open framework for the development of Content Management System (CMS) driven web applications. It is a popular choice for the creation of blogs, which, to some extent, is what electronic portfolio is. While Drupal is not a portfolio solution, this system provides a rich opportunity for building a portfolio using its features, where among those there are themes designed to work like portfolio, like in Fig. 10. In addition to that, this platform has a huge community, numbering more than a million users, 30 thousand of developers and 33 thousand of modules to use. Putting all these factors together leads to the conclusion that Drupal is a good starting point for the construction of virtually any web service from scratch, and therefore for creation of ePortfolio. Also, this platform currently has a number of solutions to build a personal portfolio in a form of single-page websites.

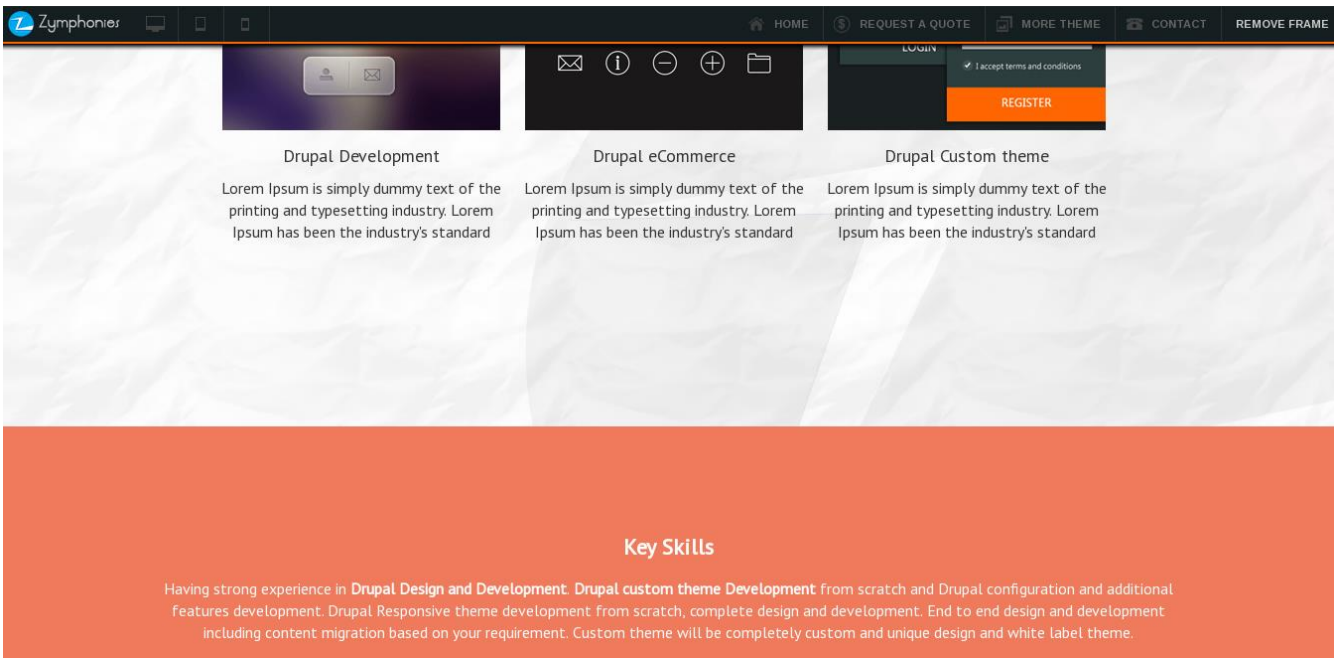


**Fig. 10.** Example of portfolio theme for Drupal (Portfolio Zymphonies Theme).

Due to the fact that there is no ready solution for creation of ePortfolio, most of requirements can't be applied at current stage, including the implementation of key use-cases, because their fulfilment or absence of fulfilment depend on the final result which can be built on the base of this solution. However, some of expectation can be evaluated

even now.

**Primary requirements**:

1. **Ease of use** – cannot be determined at current stage.
2. **Integration with educational systems** – cannot be determined at current stage.
3. **Privacy** – cannot be determined at current stage.
4. **Availability** – as the platform is entirely focused on the creation of web services, it fully meets this requirement.
5. **Support for being operable within institution network** – the system is designed as a locally deployable project that does not require external resources.

**Secondary requirements**:

1. **Export and/or access after graduation** – cannot be determined at current stage.
2. **Limited operational access to students' accounts by institution staff** – cannot be determined at current stage.
3. **Low development and platform supporting costs** – because of the lack of ready solution on the one hand, but the presence of a large community of users and developers, as well as the rich base modules on the other hand, the use of this solution for creation of electronic portfolio system can be assessed as having medium-high difficulty.
4. **Customization** – the project is entirely based on modularity and open nature of the code base, allowing the developers to make any changes for their needs.
5. **Scalability** – according to the assurances of the solution developers, this platform has been built with the scalability support of any complexity level.

**Constraints**:

1. **Single institution** – cannot be determined at current stage.
2. **Portfolio as a showcase of knowledge** – cannot be determined at current stage.

Based on these results, we can conclude that while this platform is missing a lot to be a ready solution, it's a good base for creating own web services from scratch. The modularity, open source, a huge community of users and developers, a good support for

this platform, the rich features of the framework – all of that is a good factor for choosing it for building portfolio solution.

### 3.3.4 LinkedIn

While all previously reviewed solutions are the platforms for creation or usage of ready solution which are accentuated on the creation of portfolio and don't have a clearly defined means to aid in job hunting, this platform is entirely devoted to this matter. LinkedIn is a professional social network, aimed at setting business contacts and help in finding employment (or prospective colleagues for employers). For this reason, this platform does not provide functionality in terms of the interaction between students and academic staff, but instead provides a well-defined connection between potential employees/students and employers. On the Fig. 11 can be seen an example of dashboard page for user profile.

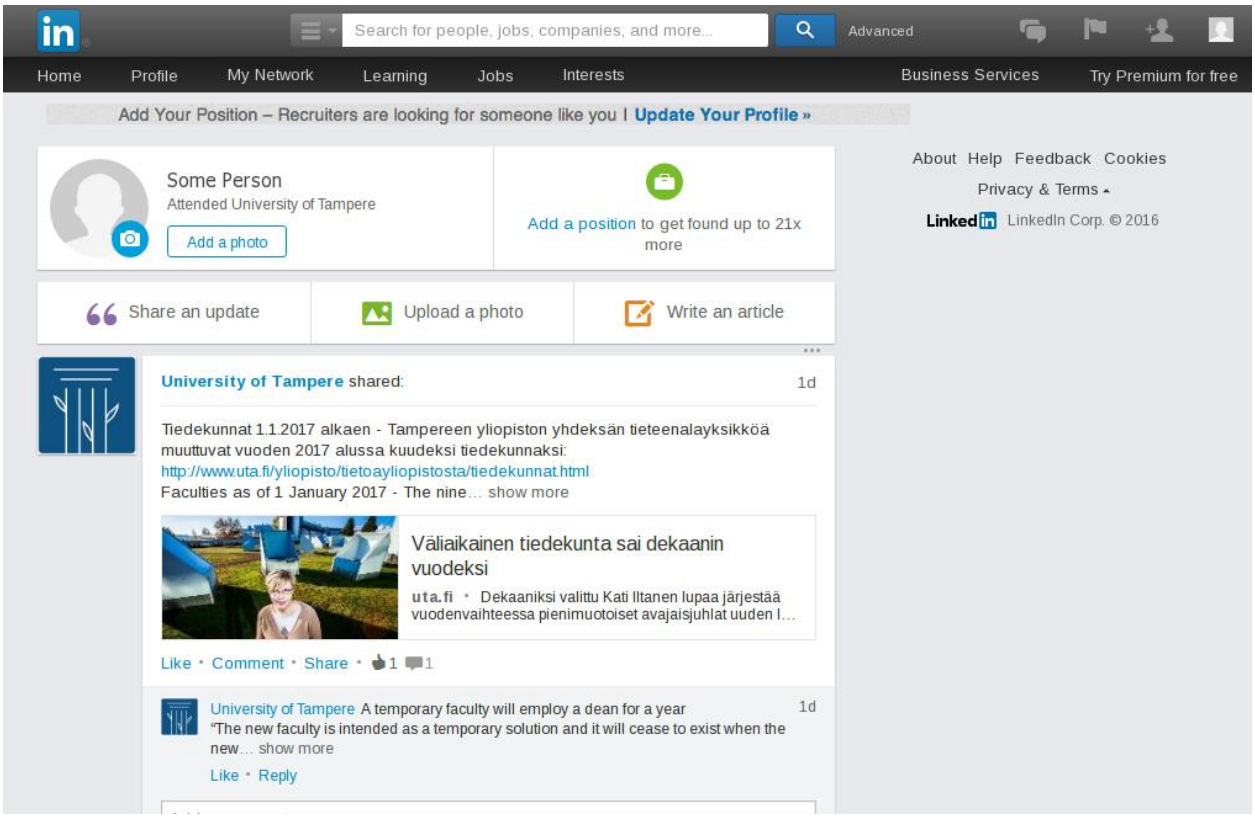


**Fig. 11.** Sample user dashboard in LinkedIn.

The main focus of this network is to aid in demonstration user's skills. Users of this

network can publish materials, like it is shown in Fig. 12, that demonstrate their knowledge, skills, previous work experience in any field, participation in projects and other kinds of information. All of that can be the supporting documents, links, video materials, images and so on. At the same time, in addition for utilizing passive job hunting, the users can conduct their search on the own by checking published positions based on the defined criteria.

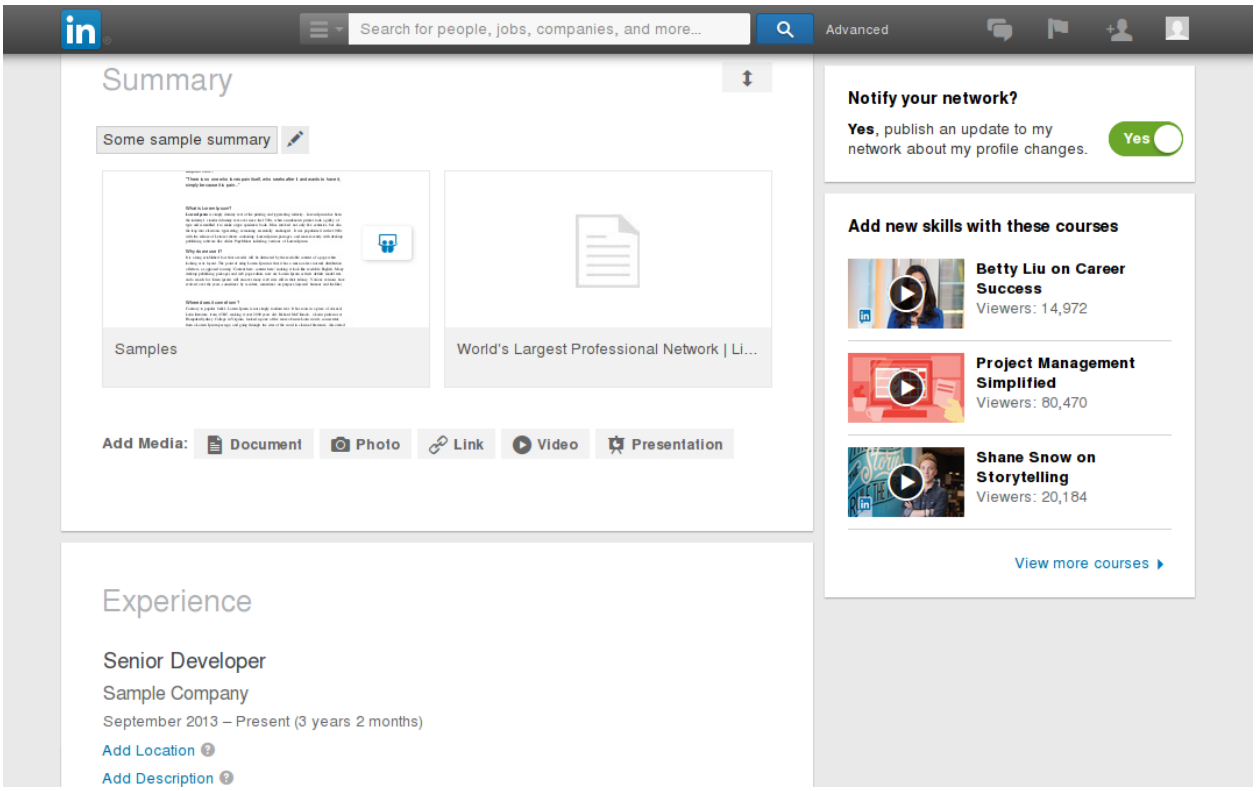


**Fig. 12.** Portfolio and its creation tools in LinkedIn.

In turn, the employers can engage in searching for employees among the users (see Fig. 13). Basing on keyword search, the place of residence and a number of other criteria, they can conduct an initial filtering of profiles and then proceed with manual examination of published materials of remaining users one by one. Also, the network provides additional opportunities for staff hunting but this service is paid and so isn't taken into account for this research.

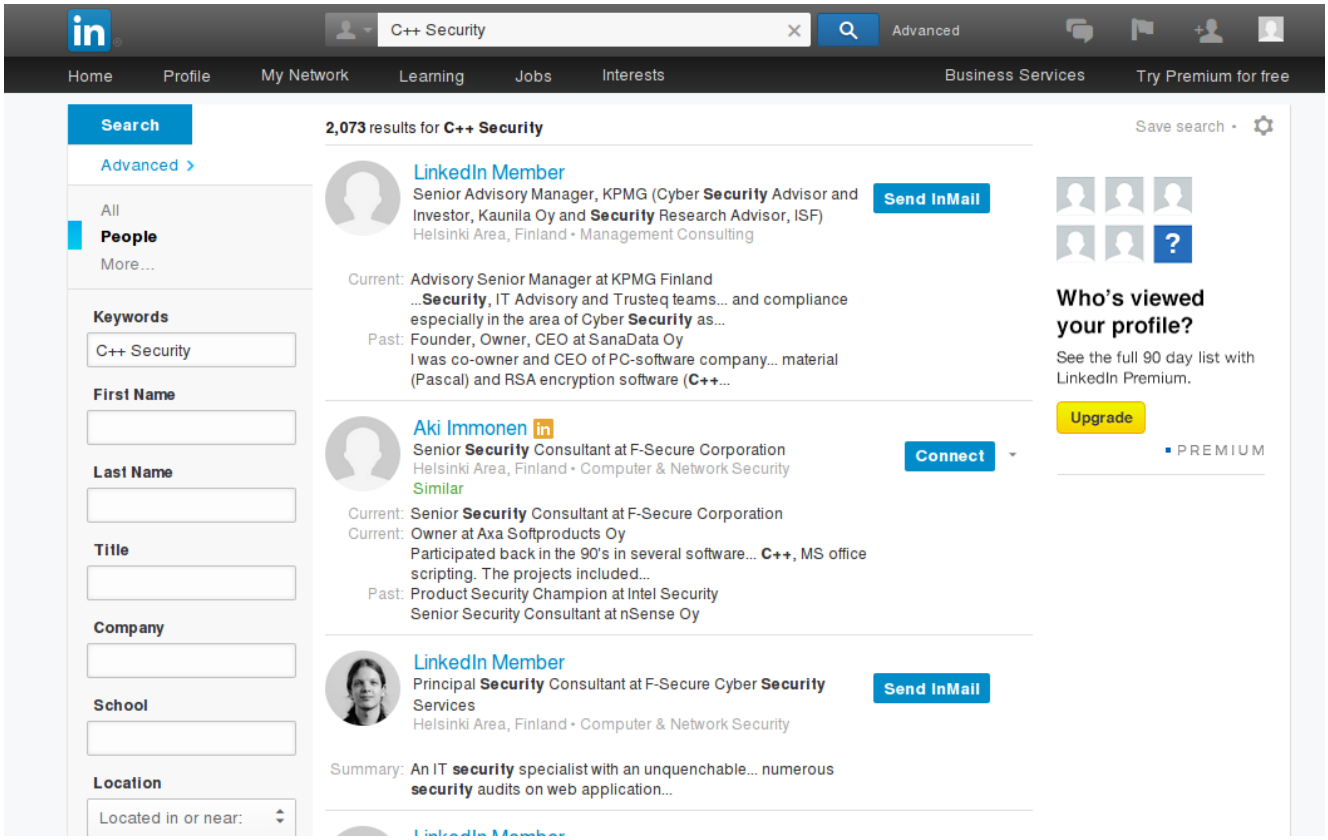


**Fig. 13.** People search in LinkedIn.

What is the situation with the fulfilment of the requirements?

**Primary requirements**:

1. **Easy to use** – this platform has relatively simple interface that does not require a lot of time to get acquainted with to be able to use its main features.
2. **Integration with educational systems** – the system has no support for integration with external systems.
3. **Privacy** – absolutely all of the published information is open for public view and can't be restricted.
4. **Availability** – this resource was designed as a cloud service to be used through the Internet.
5. **Support for being operable within institution network** – cloud nature of the service does not allow to use it standalone in local network.

**Secondary requirements**:

1. **Export and/or access after graduation** – the platform itself has no functionality to export data, although there are independent services which can carry out this task.
2. **Limited operational access to students' accounts by institution staff** – each individual user is completely independent and does not provide any kind of moderation.
3. **Low development and platform supporting costs** – the platform is supported by its developers and is free of charge for basic version.
4. **Customization** – as the project is a cloud-based service, it cannot be modified to suit own needs.
5. **Scalability** – the system has proven its capabilities in scalability though being able to provide access to profiles for hundreds of millions of users.

**Constraints**:

1. **Single institution** – the platform is designed to be able to operate on a global scale.
2. **Portfolio as a showcase of knowledge** – the demonstration of the skills of users is one of the key features of the system.

Coverage in terms of **key use-cases**:

1. **User** – has partial support for basic features like managing personal information and authorization, but does not provide means permissions management of published data.
2. **Student** – lacks of all cases but the control of personal resume management.
3. **Educator** – lacks realization of all key use-cases.
4. **Employer** – unlike other reviewed solutions, it has full support of all expected features.

After getting familiar with this platform, it can be said that it is a good product to provide assistance in job hunting and publications of portfolio. At the same time, there are severe issues with the usage for study process. The network itself is more directed to assist those people, who already have considerable experience of being previously employed, making it difficult for a student with no experience to start his career.

Thus, this platform is a good solution for independent job search and publishing portfolio, but has a problem for having a high entry barrier for beginners.

# 4 DISCUSSION AND CONCLUSIONS

## 4.1 Summary on the comparison of reviewed solutions

So, we reviewed four different systems that are designed to help institutions, students and employers in addressing the general problem of establishing a working relationship between them, where their brief summary comparison of key points can be seen in Table 1. Despite the fact they are trying to solve common problem, methods and means of achieving that solution are radically different between each other:

- **Pathbrite** – the platform which aims to be used for conducting of ePortfolio as a tool for educational process. On the positive side, it can be pointed out that it provides a wide coverage of the needs of institutions and students, as well as some degree of support for employers. On the other hand, the lack of possibility to integrate with existing systems, as well as the lack of opportunities to use it as a local solution results in serious issues with the inclusion of this system into existing educational infrastructure of the institution.
- **Mahara** – the system which aims to be framework for creation of ePortfolio service by extending initially provided functionality to cover the needs. On the positive side it is worth noting the open nature of the platform for making modification and extensions, fairly rich initial set of capabilities for portfolio management, as well as integration support for Moodle platform that can cover most of the needs that Mahara is missing in its default state. From the negative point of view – the lack of support for employers which has to be implemented with own resources.
- **Drupal** – the framework which aims to be used for creation and designing web services of any complexity. Among the positive features worth noting are the rich opportunities that are available to creation of services, a huge community of users and developers, as well as a large number of ready for usage modules. At the same time, the framework is not a finished product from the point of view of this research work, and is only meant to be a starting point for building a solution from scratch.
- **LinkedIn** – the network which aims to assist in establishing of business contacts

between potential employers and employees. On a positive note to mention is being a very helpful resource for finding a job and a huge database of employers, as well as being the largest online platform for job hunting to date. And still, a complete lack of support for the educational process, in addition of having a high entry barrier for people with no work experience.

Four solutions – four different approaches in solving the common problem. All reviewed solutions have their strengths and weaknesses, all have their own unique features and all covers defined requirements and key use-cases to different degrees, so in the end making it difficult to give a definite answer on which of the reviewed platform can be claimed to be the best choice.

**Table 1.** Brief comparison of solutions.

| | Pathbrite | Mahara | Drupal | LinkedIn |
|---|---|---|---|---|
| Website | pathbrite.com | mahara.org | www.drupal.org | www.linkedin.com |
| Focus | Managing personal ePortfolio | ePortfolio framework | CMS backend framework | Employment social network |
| Stakeholders | Students, educators, employers | Students, educators | Web developers | Students, employees, employers |
| Easy usage | Yes | Yes | --- | Yes |
| Integrability | No | Yes | --- | No |
| Privacy | Yes | Yes | --- | No |
| Availability | Yes | Yes | Yes | Yes |
| Deployable | No | Yes | Yes | No |
| Graduation | Yes | Partial | --- | Partial |
| Control | Partial | Yes | --- | No |
| Costs | Semi-free, none | Free, medium | Free, high | Semi-free, none |
| Customization | No | Yes | Yes | No |
| Scalability | Yes | Yes | Yes | Yes |
| Locality | Yes | Yes | --- | Yes |
| Showcase | Yes | Yes | --- | Yes |
| User | Full | Mostly | --- | Partial |
| Student | Full | Semi | --- | Minor |
| Educator | Full | Semi | --- | No |
| Employer | Undetermined | Possible | --- | Full |

Due to the fact that among all reviewed solutions there is no one, which would cover all the needs, one of the most suitable ways to decide on choosing one is conducting a mini-survey which would help to determine the solution that is best suited as a compromise. For

that, let's highlight some of the most distinct and important differences between them and evaluate their impact:

1. **Costs** – the costs of a solution depends on numerous factors, such as purchase cost, sales cost, maintenance cost, long-term and short-term costs, subscription cost and so on. If we would try to average all those factors, then the best candidate in this category would be Mahara, the solution which provides rich functionality for free. The second place is taken by Pathbrite and LinkedIn, which also have zero cost for access to basic functionality, but offer advanced features for a fee. Finally, Drupal – while it is a free solution just like other ones, it has the highest cost due to the needs for its development.
2. **Coverage** – all reviewed solutions have different coverage of the needs of different stakeholders. The best coverage by default is provided by Pathbrite, covering the needs of all three parties. Next are Mahara and LinkedIn, where the former has an excellent coverage of needs of students and educators, while the latter one provides coverage for students and employers. While the remaining Drupal initially doesn't provide anything for expected needs, it is an open-source solution, just like Mahara, making it possible to implement any missing functionality fully.
3. **Flexibility** – as it has been noted earlier, some solutions are services by nature which provide functionality and conduct development on their own, and the other half – open-source projects. Thus, if a proprietary solution does not provide the desired flexibility for customization, stakeholders are likely to have no means to affect it to improve the situation. Taking that into account, the most flexibility is provided by Drupal, due to being a solution of "clean page". The next one is Mahara, which provides a number of presets, but just like as Drupal is an open-source project, allowing the developers to freely make any changes to their taste. Finally, LinkedIn and Pathbrite are almost completely devoid of means for customization.

Thus, the following proposals on the selection of a solution can be made on the basis of the above factors:

- if the key factors are costs and coverage, the best candidates are **Mahara** and **Pathbrite**.

- if the key factors are covering and flexibility, the best candidates are **Mahara** and **Drupal**.
- if the key factors are price and flexibility, the best candidate is **Mahara**.

## 4.2 Conclusions

Most of the students are facing the challenge of finding a job after their graduation. The lack of previous work experience has a significant negative impact on capabilities for job hunting, and that can be a serious problem which is difficult to solve relying solely on own abilities. While institution are trying to assist their students in resolving of that matter, and there are organizations that provide assistance as well, those parties usually don't provide assistance in learning how to advertise assets which in fact the individual already possesses and which has a value in matters of demonstration of his skills and knowledge.

To assist with that matter we have tried to review a possibility to utilize a learning portfolio as a platform for formation of the initial asset to demonstrate student's skills using the gained results of his study activity. For that, we reviewed four potential systems in an attempt to find the one that is the most capable for assistance of students, institutions and employers in achieving their needs.

To assist with that matter we have tried to review a possibility to utilize a learning portfolio as a platform for formation of the initial asset to demonstrate student's skills using the gained results of his study activity. For that, we reviewed four potential systems in an attempt to find the one that is the most capable to assistance of students, institutions and employers in achieving their needs.

The proposed model of the system and reviewed potential platforms have shown that despite the fact that the problem of being well-known, the ways of resolving it varies. Due to that fact, after examining the positive and negative aspects of each solution, as well as their ability to assist in the task, it was concluded that at the current stage it is impossible on the basis of current data to give a definite answer in favor of choosing one solution over others. For that reason, for further progress in the study of the matter it is required to

proceed with an even more thorough analysis of the problem in order to find the best compromise.

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