# VERSATILE TOOL FOR COMPETENCE MANAGEMENT
## *An e-Portfolio Management System for Higher Education in Applied Sciences*

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Abstract: In the line of outcome based education and transferability of credits, we study a Higher Education case and propose an e-Portfolio solution as a versatile tool for assessment tasks. The solution tackles the problems firstly, of accreditation of prior achievements from both institutional and experiential learning. Secondly, the developed tool carries the process of learning outcome definitions management (derived from the real employment world), and the learner self-assessment and self-reflection as well as the guidance and support for these. From the areas where the tool is applied, we present the learning unit *Project management* given at the ICT department in a university of applied sciences. The e-Portfolio management system, *ePofo*, supports the identification, assessment, recognition and accreditation of prior learning achievements and learning outcomes. Additionally, it is a tool to present the sectoral qualification requirements to the students, to derive learning needs and define the learning outcomes, thereby structuring the teaching. It also provides support for the learner's own management of achievements and competences, and finally for presenting the profile to potential employers.

## 1 INTRODUCTION

The change towards the European Union Bologna agreement requires attention not only on the philosophies but also on practices and tools to be used to enable the Higher Education Institutions (HEIs) to attain the centric Bologna goals. The competences acquired and striven for should be captured in such information systems that support the teachers in their task to appraise achievements attained in both the formal education setting and prior to enrolment to a HEI.

The importance of accrediting prior learning achievements is growing in higher education. This is shown clearly in the strategies and decisions in the European Parliament and the Council of the European Union on the European Qualifications Framework (EQF). (European Commission 2005; 2006; European Parliament Council, 2008). The emerging agenda of lifelong learning promotes the idea of life-wide learning processes, which take place everywhere, in all paths of life and are based on various sources of formal, non-formal and informal learning. Understanding this leads us to understand the fundamental idea of APL. The focus in APL process is on competences. It is based on comparing the existing knowledge and skills against the requirements of the curriculum or programme. (Lepänjuuri, 2010). Accordingly, APL sets a request to build support for teachers' activities such as definition of the competences to be learned as well as assessment, accreditation, and validation of these learning outcomes. In turn, students should get

support and guidance in self-assessment, management of learning outcomes and career plans, and in building a professional identity. (Keurulainen, 2010; Niskanen and Lepänjuuri, 2006).

This paper reports an effort to develop supporting system and electronic tool with the help of which students could self-assess their prior learning through reflecting their achievements required against the competences as described in curriculum. We present a solution called ePofo, an e-portfolio management system, aimed for both teachers and learners. The system supports also the student both in studies and in the pursuit of employment career. S/he may have gained his/her competence either in formal education or in informal settings as work practice or on-the-job training. The developments of the ePofo described here is related to wider development of the recognition and accreditation of prior learning (APL) system for the higher education sector done in JAMK University of Applied Sciences during the last decade (JAMK, 2011).

The paper is structured as follows: In the next section (Section 2), firstly (2.1) a brief account is given on the *competence based education* and its consequences at the HEIs as the driver of the challenge to which the presented development is an answer. Secondly (2.2 and 2.3), as further background, we take on some discussion of the meaning of *assessment and judgment* in HEI, since this is the main function the ePofo tool supports within the HEI activities. We explain what *portfolio and e-portfolio* mean in the context of this paper. Section 2.4 presents the case organization and the steps to develop the tool: requirements, the solution, and the technical implementation details. In Section 3, the study method is discussed, and Section 4 accounts the experiences with the tool this far. In Section 5, we discuss the implementation and the changes induced and opportunities opened by the tool in the activities of learners and teachers. Section 6 concludes with remarks to further research opened by this initial work.

## 2 BACKGROUND

### 2.1 Competence Driven Education

Identifying and recognition of prior learning is a big issue in education in Europe. The European strategies have been developed to increase mobility and to acknowledge the competences and learning outcomes provided by vocational education (the Copenhagen Process) and by higher education (the Bologna Process) (Commission of the European Communities, 2005). There has been a numerous research and development projects going on in different European countries which aim is to get better understanding about identifying and recognition of formal and informal learning (e.g. Duvekot et al., 2007a; Laitinen, Nurminen and Soininen, 2007; Soininen, Niskanen and Lepänjuuri, 2010; Stenström, Niskanen and Lepänjuuri, 2010; Duvekot, Pukelis and Fokiene, 2010).

This phenomena is located in frameworks of Lifelong learning, Life-wide learning and European Qualifications (EQF) which all highlight the meaning of assessment of learning outcomes (skills, knowledge and competences). Recognition of learning outcomes means to acknowledge those competences that have been acquired in formal and informal learning environments. Competences can be mapped out (identified), assessed and acknowledged (certified). The acknowledgement can take place in a more formal (e.g. through certification) or in a less formal way (e.g. to check what has been learnt by the individual). (Niskanen, Lepänjuuri, and Rautio, 2006; Niskanen and Virtanen, 2008). Recognition of informal and formal learning concerns both young people and adults, and it should be an established practice of provision of higher education.

The European Qualifications Framework (EQF, European Commission 2006) outlines the underlying principles and benchmarks the criteria for educational judgment. In EQF, educational achievements are described in terms of knowledge (factual and theoretical), skills (cognitive and practical deployment of knowledge) and competence (including responsibility and authority).

The achievement of these is valued with criteria for seven distinct achievement levels (European Commission, 2006). The concept of *competence*, translated in an institutional education context to '*learning outcome*' (European Parliament Council, 2008; Simon et al., 2011), is a point of focus and drives the planning and development of ICT based tools and systems to support educational activities. The learning outcome based education means a shift from teaching and curriculum centred paradigms to learner focus emphasizing achievement (Burke, 1995, p. vii). These targets are equally striven for in the European Commission guidelines.

Following the Bologna process outline, there are two-fold targets the HEIs aim at when developing the approaches towards *competence and learning outcome based education*. It is changing, firstly, the

administrative attention to the educational offering. The definition and appraisal of the relevant knowledge, skills, and broader competence constitute the targeted and acknowledged achievements. Achievements accredited by HEIs in many fields mean official qualifications to professions (European Parliament Council, 2008). Thus, the governments delegate the judgment of a person's qualification for a profession to the HEIs as in the EQF definition of *qualification*: "a competent body determines that an individual has achieved learning outcomes to given standards".

Secondly, both structuring the teaching arrangements, e.g. to units (curricula, modules, courses), and the appraisal of the achievement of the learning outcomes are aligned along the competences targeted at. Following the EU rationale, improved performance in economy and society, the source for the information on competence requirements is the employment market. As stated in the EQF documentation, professional bodies in the respective fields shall provide this information. European Parliament Council (2008) puts this in the EQF definition: "'international sectoral organisation' means an association of national organisations, including, for example, employer and professional bodies, which represent the interests of national sectors.

## 2.2 Assessment of Competences Achieved

Concerning *recognition and accreditation of competence achieved* there are different concepts used that may take slightly different stand: *Learning*, APL (Burke 1995, p. 4), for assessing and validating result of learning prior to enrolment to an institutional program. To this, concept of APEL adds 'experiential' for learning in non-formal (e.g. work practice) context. Canadians use the concept *Prior Learning Assessment and Recognition*, PLAR, (Conrad, 2008) which combines learning results from both formal (education) and non-formal (practice) context for appraisal and validation process.

Within EU, context assessment of prior learning is often referred as validation. It includes three processes: i) identification, ii) assessment, and iii) recognition and accreditation of competences (Colardyn and Bjørnåvold, 2005; Niskanen and Lepänjuuri, 2006; Lepänjuuri, 2010.) In turn, Duvekot (2007b) prefers using word valuation of prior learning to emphasise raising awareness and motivation of a learner and the meaning of the

process - not only for the development of an individual but of organisations and society.

The profile of a student enrolling to a curriculum or syllabus is established for required achievements that s/he might already have covered previously. Prior learning achievements in the case of HE may come either through former institutional education, professional development (PD, e.g. courses by commercial education and training providers, staff training on-the-job), or through work practice. Appraising PD outcome as part of institutionally accredited qualification is inline with the lifelong learning idea. As an example in the specific area of ICT, there are tightly supervised certification programs with very detailed learning outcomes for e.g. some frameworks and models (e.g. ITIL, CMMI). It is the task of the HEI quality assurance to position and appraise such achievements as a part of a qualification.

Be it prior learning, or learning during education, assessment is the key to establishment of achieved learning outcomes and thus qualifications. Joughin (2009) derives from an extensive review of literature a definition of assessment that is well suited to both cases:

"From these definitions, the irreducible core of assessment can be limited to (a) students' work, (b) judgements about the quality of this work, and (c) inferences drawn from this about what students know. Judgement and inference are thus at the core of assessment, leading to this simple definition: *To assess is to make judgments about students' work, inferring from this what they have the capacity to do in the assessed domain, and thus what they know, value, or are capable of doing.*"

As said, European Commission (2005) defines validation as the process of assessing and recognising a wide range of knowledge, know-how, skills and competences, which people develop throughout their lives within different environments, for example through education, work and leisure activities. This process can very well be supported by a portfolio tool. A portfolio not only provisions the technical and administrative process support, but also provides an expedient for social aspect of the learner's self-reflection, identity building, and the learner-teacher interaction e.g. in learner guidance and supporting the self-assessment (Barrett, 2001). The learner gets assistance in developing their judgment (Joughin, 2009) of their own expertise, profile, and development needs. The teacher has a tool for judging prior achievements with qualification profiles from authoritative professional bodies that help to sustain assessment criteria consistent in the appraisal of the achievements. This

is enabled by storing in the tool international sectoral organization qualification profiles that comprise the learning outcome definitions to be aimed at.

In order to recognise learning which may occur in diverse environments, educational institutions are challenged not only to develop their curricula to be competence-based but to describe the criteria based on what the assessment of learning can be done. Accreditation of prior learning challenges in a very profound way our understanding of assessment and methods used but also guidance of students. (Niskanen and Lepänjuuri, 2006; Keurulainen, 2006; 2010) Accordingly, it is important to notice that the student makes an initiative on assessment of prior learning. It starts from learner's willingness to show his/her prior learning and ask it to be identified and recognised by the educational institution. (Niskanen, 2010.)

## 2.3 Assessment Tools

As Joughin (2009) points out, assessment is a task for both teachers and students. For both, there are quite negative connotations with assessment in education. Assessment is however, a core in the HEI function: as we stated, there lies the responsibility of establishment of qualifications. Joughin's review of assessment studies shows that the student approach to learning can be influenced by the assessment towards a deeper (more reflective) learning. Through electronic tools, the assessment function can, however, be enhanced to encompass self and peer assessment, motivation and professional profile building, to support the modes of assessment that pursue deeper learning goals.

Electronic tool enables, firstly, the management, presentation, and sharing of information between the stakeholders, here students and teachers. This information includes the focus area and learning unit information, learning content, and student data. The system retains information specific to each learner, so that his or her personal learning plans can be followed through over the study career. HEI learning management systems should therefore follow all legal requirements for the storage and processing of learner specific information. Using an electronic tool enables an assessment and APL process transparent to the student.

Portfolios have been in the focus of educational developments over the past decades (Kankaanranta et al., 2007; Barrett, 2001; Grant, 2008). A *portfolio* means a collection of pieces of work of an individual (professional), from which sets of samples can be presented as proof of the competence of the individual. With portfolios, diverse educational goals can be pursued: assessment in its various forms as the general summative, in some cases also formative, or peer assessment. Further, the portfolio augments the assessment processes with self-reflection and self-assessment and a learner profile construction for developing judgment (Joughin 2009) that is also according to the EQF a part of professional competence. Judgment is a part of qualifications granted at HEIs, essential in expert or leadership roles.

Cumulating work achievements, and the task to select and sample work achievements for establishment of qualification leads to reflection and insights into one's capabilities. With a portfolio, the students can enquire their own strengths and weaknesses. Aiming at a qualification, an electronic portfolio augments the process with pre-established qualification profiles from the labour market that enable a gap analysis (comparison to one's own profile) and thus guides in selecting the learning opportunities to cover the achievements still needed.

There are many alternative portfolio tools and systems. The challenge is to choose the best combination and integrate them in a meaningful way. In addition, visualizing the connections between competencies and courses is important for two reasons: it helps understanding of the structure of the curriculum and it facilitates finding potential omissions or inconsistencies.

In the Case at the JAMK University of Applied Sciences, the creation of the electronic portfolio solution started with developing APL procedures in HEI. The main objective of the first two projects coordinated by Teacher Education College in 2004-2007 called Taituri (Niskanen et al., 2006) and AAKE (Laitinen et al., 2007) was to develop theoretical background and pedagogical grounds for APL in universities of applied sciences. This development was followed in 2008-2010 with a line of three smaller projects called @mk-Tieturi, Anturi and Säihke (Niskanen and Virtanen, 2008) especially focusing on development of methods for identification, assessment, recognition, and accreditation of prior learning. These methods yet included development of theoretical principles and practical guidelines, but also ICT tools such as web-based e-Portfolio management system, self-evaluation questionnaires, and skill tests. The @mk-Tieturi project was a kind of a feasibility study phase. During that phase, existing e-Portfolio management systems were examined such as FSU Career Portfolio. (Lumsden, 2011). Although we

found many promising open source tools or systems such as Mahara (http://mahara.org/) and Elgg (http://elgg.org/), none of them met all the requirements (see section 4). Later on, the development of e-Portfolio has been continued in the project called KORSI (Peltola, 2011).

## 2.4 Case: APL in Project Management Course

As an example, we take an area of competence the institution chooses to offer in their program. The case under study is project management. The use of an e-Portfolio management system (ePMS) (Ravet, 2007) is illustrated here with this example.

Project management is a subject area commonly taught especially in higher education for ICT and other technology and business related study programs, but also in professional development offered by various commercial education institutions.

The starting point is a competence description that is normally presented at achievement levels and competence components. Description of targeted competence, both generic descriptions (EQF), and with subject area specific descriptions, is entered to the database. For the project management, the specific authoritative descriptions and detailed competence descriptions are available through the web pages provided by the international institutions representing the area:

- The International Project Management Association, IPMA, http://www.ipma.ch/
- Project Management Institute, PMI http://www.pmi.org/

The teacher enters to the portfolio database the detailed competence description, with the given levels of knowledge, skills, and competence. The teacher also maps the provided learning opportunities (courses) in the institution (in this case the School of Technology), with the detailed descriptions of competence. This means following the learning outcome driven approach in structuring and presenting the educational offering.

Through comparing to the descriptions of target profiles (IPMA/PMI and competence descriptions provided by the teachers), the student can fill in the elements of the competence for their own achievement profile. If they have documentation, e.g. achieved through accomplishment of education provided by an institution, the respective school report, diploma or certificate can be scanned and stored into the student's own portfolio area for proving the achievement and its evaluation.

If a student wants to have informal learning outcomes (e.g. acquired through work practice) acknowledged as part of the competence required for a degree, (s)he enters a description of the prior achievement, and a self-assessment of the achievement. Student compares and matches the given descriptions of the levels and elements from project manager's competence profile and returns a self-assessment based on the IPMA Competence Baseline (Caupin et al., 2006) to the ePMS or to a learning environment. This has been a mandatory task in the Project Management course. This helps students to see the competences needed in project management and evaluate their current level of knowledge and skills. The teacher can then utilise this valuable information in order to give individual guidance, suggest APL process (including the use of ePMS), and make the acknowledgement decisions.

The atomistic approach chosen has been found a good choice in the user experiences. It is significant in self-assessment and motivation. When enrolling into a curriculum, the student is motivated through the parts of the competence area (s)he already covers through some previous experience or training, even though the prior learning achievements do not suffice for whole learning units or modules.

## 3 METHOD (DSRM)

Design Science is recognized as the mainstream Information Systems research methodology for constructive efforts (March and Smith, 1995). A generic process model for DS type research endeavours has been defined (Peffers et al., 2008) as the Design Science Research Methodology DSRM (Figure 1). The process is iterative. The entry to this process is possible at any of the first five phases: a) Problem Definition, b) Definition of the objectives of a solution, c) Design and Development, d) Demonstration (of a functioning solution prototype) or e) Evaluation. A full research cycle includes all these as well as the last phase, f) Communication that is done through discipline specific ways and means in presenting the constructed solution to the scientific community of the field.

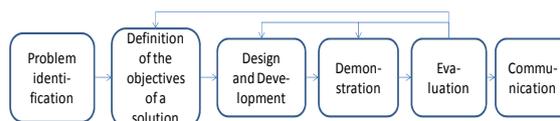The construction of the solution presented in



Figure 1: Iterative process of design science research (Peffers et al. 2008).

this study followed iteratively and incrementally in sequential projects, abided with the study of the topical literature. After the problem identification, five iterations (see Section 4), each resulting to an implemented system or an increment to the system are conducted. With each iteration, stakeholder input to the objectives, requirements, and constraints is taken in. The demonstration is undertaken in practical use. In this paper, one of the user domain experiences is reported. Evaluation follows through user feedback collection with surveys and interviews. A collaboration environment (wiki and ning) is used for management of the pre- and post-development user information.

# 4 E-PORTFOLIO MANAGEMENT SYSTEM - EPOFO

## 4.1 Definition of the Objectives

One of the aims was to develop a web-based, theoretically and pedagogically well-founded e-Portfolio management system, which besides normal learning and assessment portfolio functionalities, supports also identification, assessment, recognition, and development of prior learning achievements. This is based on the idea that it is the responsibility of the individual student to invest in personal growth, development of professional judgment (Joughin 2009). The e-portfolio system facilitates this development.

One of the main requirements for the solution was to create a database structure and a competence matrix, which help in describing and visualising competences, both from the institute's and the student's view. The solution is based on generic and subject-specific competencies, as described in the EQF (The European Commission, 2005). The system should be modifiable so that any institute or organisation could define their competencies. Therefore, it is possible to add the key competencies (DeSeCo, 2005), project management competencies based on the IPMA Competence Baseline (ICB) (Caupin et al., 2006), or any other list of competencies to the system.

One of the main requirements was the integration to the student register system. For example, the documents and other files that provide evidence about student's competences should be easily achieved. In addition, the courses, student groups etc. could be imported and/or linked to the system.

To develop a solution, the activities of the

stakeholders and the requirements for a tool to support the stakeholders at a unit (a college or a school at the University of Applied Sciences) were analysed and listed. We present here the tasks for the learning facilitator (with sub-roles of teacher, tutor, content administrator), and the student, who are the main user groups of the solution.

For accounts of learner achievements, learning facilitators are involved in

1. Reviewing the items students are adding as their existing personal achievements (knowledge, skills, competencies);

2. Appraising and acknowledging learner prior achievements as learning outcomes e.g. to be part of required achievements for a certificate or diploma;

3. Providing tutoring to guide the student on their path through the program at their present learning institution (what is / should still be achieved, at what level and on what area to attain qualification);

4. Presenting the educational offering according to the outcome orientation principles to the students (i.e. how can the student cover missing learning achievements and qualifications through the courses given in the program of the institution); and

5. Managing the competence profile descriptions (e.g. qualification for a profession) coming from societal and professional bodies.

The student activities include:

1. Creating an account of their personal learning achievements, together with stored data and information on the achievement for valuation and proof (i.e. for judgment of their quality by institution staff), the students post documentation (certificates, job descriptions, letters of recommendation, produced files) into the portfolio tool;

2. Presenting their existing knowledge, skills and competences, i.e. prior achievements to the learning facilitators;

3. Comparing their achievements to the required qualification profiles of their desired learning targets that is provided in the system; and

4. Presenting their qualifications in the form of a sample portfolio to peers for peer support and review, and to other stakeholders, e.g. potential employers.

There are two approaches to competence evaluation, holistic and atomistic (i.e. the elements that together comprise the competence). The chosen approach is atomistic, i.e. the student has the opportunity to have small units or elements of prior achievements acknowledged as part of their personal achievements profile.

For the assessment, the aim was to offer a 360° perspective. The student gives his/her own evaluation, which is then commented and evaluated by the teachers or other experts from the institute. Finally, if the student has given permission, peers and external reviewers can give their evaluation and comments.

Some further requirements for the ePMS were listed in our project environment called Nest (Rintamäki, 2008). For example, it should allow 24/7 access, be based on open standards and support nationally agreed interoperability standards, and usable over mobile and wireless technologies.

## 4.2 Design and Development

The e-Portfolio management system, ePofo, is developed by using incremental and iterative approach. Each year, one project group of four to five students took the responsibility of fulfilling the requirements given mainly by the experts of the Teacher Education College in JAMK. One of the students then took the results of the development to the group of the following year. The principal lecturer in software engineering was leading the development group making sure that the requirements were understood. One of the dissemination methods was using wiki and, during 2009, a Ning environment was established. Thus, the developers received immediate feedback and some requirements for the future versions.

The ePofo is based on free and open source software running in a Web site. The technical solution of the web server was built with the "LAMP" set of open source technologies, i.e. on Linux operating system, Apache HTTP server management software, the MySQL database management system, and the PHP programming language for developing the web interface to the database. The user interface was developed with XHTML with the help of CSS and JavaScript (AJAX).

The ePofo is technically a multimedia database, where the students can store their sample achievements (voice, video, image, text). This is an important feature for different skills and abilities as e.g. design, technical professions or music. Each user sets up the structure of the database for their personal portfolio. Following the reflective aspect, (Barrett, 2001), the user decides on the number and names of the categories according to which they arrange their achievements.

An ePMS should enable the students to get familiar with the required competencies and then add proof of their individual skills and qualifications. ePofo combines characteristics of each of the typical portfolios: assessment, showcase, development, and reflective portfolio (Stefani et al., 2007).

The users store categorized descriptions of their achievements and add documents into the database as attachments to provide evidence of the achievement of the competencies or learning outcomes for the qualification (certificates, diplomas and the like). An example view is shown in Figure 2. In addition, sample files can be added to present performance in a competency area. The administrator decides the formats that are allowed, e.g. pdf, doc, jpg, mp3, avi etc.

To provide sample portfolio functionality, the solution allows the user to extract own data as a .zip file, containing an html page as a start page with the description of the user's portfolio and links to the attached files saved along to a portable .zip file to be used as a sample portfolio.



Figure 2: A student can add metadata, choose related skills, and attach documents. Other users can add comments.

The ePofo consists of four user roles, each with their own views and user rights: Learner, Teacher, Content Admin (a role that provides the target achievement profiles) and Technical Admin (a role that provides technical support).

## 4.3 Demonstration

The ePofo was first introduced into use in 2007. Total number of pilot users in separate schools of JAMK has so far been 10 teachers and about 50 students during the three years of use. In each unit of the institution, one staff member has been trained to take the responsibility of a "content admin" (teacher's functionalities, point 5, see above). However, there has been hesitation to use the solution, which is usual with new e-Learning tools. The use has not been mandatory, and there has been no reward for use of the system.

For the development that started in 2007, there has been each year a student-learning project to develop the technical solution further. User requirements and user feedback has been collected in group interviews and survey forms. Because student project groups are changing and the target for them has been learning IT project work, the system cannot be compared with commercial solutions in e.g. usability. This is why the user base in this phase is teacher volunteers "early adopter". However, the tool has been in real use, and gained both positive feedback and many suggestions to improve it.

In the beginning, ePofo was mostly used in Teacher Education College of JAMK. However, ePofo has been further developed for the needs of young students in other schools of JAMK. Teacher Education College continues to develop further the development of APL and ePofo especially in adult learning. The results of these developments will be reported in a later point in time.

## 4.4 Evaluation

The development of e-Portfolio system in parallel with curriculum development has given a valuable learning experience for both the faculty members and the students. As an example, one of the teachers sent an email on May 2010 mentioning that (free translation) "Thank you, I have been really excited to (almost "drunk" about) this ePofo tool. It is a wonderful tool for a trainer to recognise students' skills!" In addition, the faculty members argue to understand both the basic concepts and the competencies required in the curriculum much better than before using the ePofo. In the ePofo, a teacher (content admin) has to define the competencies, skills and knowledge, student groups, and courses, and link all of those in such a way that a student gets to understand their relationships. According to the questionnaires and interviews, this clarifies the competence-based curriculum for all stakeholders.

Figure 3: Skill matrix.

The development of ePofo has helped interacting in socially heterogeneous groups (one of the key competences in DeSeco, 2005). During the development, teachers, students and administrators from different faculties learned to cooperate, understand each other's views, and manage and resolve conflicts. The decisions and ideas that emerged during the development were documented in wiki (http://epofo.labranet.jamk.fi/wiki/, in Finnish, see Figure 4). In addition, a separate ning environment (ahotat.ning.com) was created in order to help student groups sharing experiences and to answer questions.
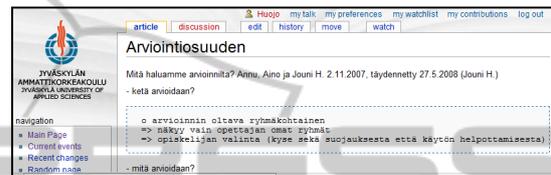
Figure 4: Wiki environment.

The focus is on individual competencies. According to interviews, the ePofo helps a student show his/her current knowledge. The different matrices in the system provide understanding about the competencies and how much evidence there already is. It also contains a dimension for different types of informal and non-formal learning categories, such as working experience, degrees, courses, and hobbies.

Students were an essential source of the development group. First, IT students have been developing the e-Portfolio system. Second, students' opinions were taken into account when defining new features. In addition, the competences required from a software engineer were recognised during the development process. Finally, students from three different subject areas formed the pilot user group and their comments were considered in improving the ePofo. During the project meetings, the experiences and comments from all three different user groups (administrators, teachers, and students) were collected and then parts of the documentation were shared by using the wiki.

According to discussions with students in the Master's Degree programme, enabling the use of an e-Portfolio can reduce dropouts. Some students, which work abroad and have the needed competencies, need a flexible way to proof their expertise. According to the students' feedback, it is technically quite easy although time-consuming to add proof about their knowledge and skills once they learn the procedure. Students face the challenge how to express themselves clearly, so that teachers and

other external reviewers can evaluate what the student's level of expertise is.

Variegated and voluntary student and teacher involvement during the development phase proved to be a good idea. We received a lot of valuable feedback for improving the e-Portfolio system. In addition, we were able to raise ICT skills and the level of understanding about recognising prior learning and validating competencies.

# 5 DISCUSSION

A significant change will take place in the ways and procedures when migrating from curriculum and course based approaches to a learning outcome based approach in a higher education institution. This induces several changes in both teaching and administrative tasks, conducted by the teacher and other institution staff. An important facet is that the learning needs should be derived from actual professional practice, which, among other things, turns into a motivational factor for students. When the learning needs are, as in the presented solution, established according to the spirit of the EQF through the qualification profiles attained from international sectoral bodies, they enhance the quality of both learning and teaching. In the presented solution, they are recorded into the portfolio management system, to be accessed by students and other stakeholders at the HEI. This alone is a factor that raises the quality and relevancy of teaching, which again reflects to student motivation.

As Ruud Duvekot (2007b) states, the focus in the lifelong learning policy is slowly shifting from formal learning environments to non-formal and informal learning environments. A focal challenge in the e-Portfolio system constructed in this study is to enable the recognition of student non-formal and informal learning. From the administrative point of view, the e-Portfolio system is also a support tool for recognition of prior learning (APL/PLAR). It serves the student as a personal tool for documentation, assessment, and development of their learning towards the targeted qualifications. Teachers can benefit from the e-Portfolio system in their curriculum work, releasing them from curriculum-bound thinking to learning objectives and learning outcomes driven thinking. Consequently, the portfolio tool supports the professional development and learning-on-the-job of a teacher.

An information privacy specific issue to be considered is how students can add confidential information to an ePMS. Some students work in their current or previous work career on classified projects, and therefore are not allowed to add information about them. In some cases, the teacher or supervisor has signed a non-disclosure agreement (NDA) with a company in order to keep the secrets unrevealed. The teacher might have a discussion with the representatives of a company to make sure that the student has the competencies that s/he claims to have. The summary of the discussion (a kind of an evaluation report) can then be added to the ePMS and validated with the HEI authority.

The key competences defined by the DeSeCo project (2005) are classified in three broad categories to which the ePofo contribute in several ways. In the first competence category, use tools interactively, the development and use of the ePofo has improved ICT and language skills of administrators, teachers, and students. In addition, the ability to use knowledge and information interactively is enhanced in all three user groups. For example, the ePofo helps teachers to see how (key) competencies relate to courses and student groups and thus enables evaluation of quality, appropriateness and value of that information.

The ePofo contributes in particular to the development of two key competences: digital competence, which involves use of Information Society Technology for work, leisure and communication, and learning to learn, which can be described as an individual's ability to organise their own learning. The ePofo helps students to perceive their learning needs as well as to process and analyse the development of their competences. Furthermore, it supports lifelong learning by providing knowledge of students' prior learning and encourages students to reflect their own learning.

Acting autonomously is the basis for using the ePofo. A student takes responsibility of his/her own learning and development process. It is up to a student to choose what evidence to add to the ePofo. The system helps to understand the "big picture", e.g. how the key and other competencies relate to the different curricula and courses, and how much evidence there already exists about their individual competencies.

There are many suggestions and ideas to be added to the next version of the ePMS. One idea is to integrate Mahara and competence descriptions e.g. by creating the necessary plug-ins. Another idea is to create a dedicated learning environment, which is linked to competence register. Current solution is stored in JAMK's network server, but in the future public cloud can also be utilised. As an example,

students who graduated (alumni) can continue adding evidence to the ePMS and choose courses, which match their professional development plan.

# 6 CONCLUSIONS

The ePofo solution development makes evident that the introduction of the outcome orientation in tertiary sector teaching and learning is means a thorough change in the educational institution practices. Consequently, it requires novel designs for the technological support for student, teacher, and other stakeholder processes. The solution discussed here supports the students (learner) and the teaching staff (learning facilitator) (Simon, Pulkkinen et al. 2011) and the assessment by a teacher and the institution. The teacher may assess the items in a student's portfolio at various points in the learning process: for diagnostic and formative assessment to be able to assist in planning the studies and guide the student underway; and for summative assessment to acknowledge competence and report to the institution that grants a degree. Last but by far not least, a personal portfolio developed during studies gives a head start to the professional career.

The portfolio tool appears to have the potential to be a bearing point in sharing information on competences at the institution between students, teaching staff, and other stakeholder groups. It also supports the students in planning their studies, it is a motivational factor to see the collection of personal achievements grow concretely as reflected in own database, and to get guidance from teachers how to turn prior learning in diverse contexts into units of acknowledged competence. Further, the solution provides support for various activities as guidance in study plans, searching information on existing expertise (e.g. in setting up project groups for learning projects, and to find teachers with various competences) and presenting sample portfolios to external stakeholders.

The development of the ePMS and pilots during 2006-2010 has given us valuable understanding how to give detailed descriptions about competences and linking them to the courses. This is an expedient to root the institutional learning to professional qualification defined externally. For the teachers, this enables to structure the overall learning effort in a focus area to plausible learning outcomes as detailed in the professional body description of qualification, to be targeted by the students.

If an institute implements an ePMS whether it is commercial, proprietary, or open source, we strongly recommend simultaneous development of curriculum, competences, and the ePMS. This ensures that all of them are consistent, e.g. there are no contradictions in use of concept and terms.

For further research, one could investigate implications of using an e-Portfolio system not only during studying period but also before and after the studies. This enables the student continue with his/her studies e.g. at Master's level. Some members of the faculty might develop trust in the relationship to students and be able to support them in their career planning. Thus, an e-Portfolio is not only an instrument for individual development and offering professional specialisation studies; it may help finding skilful people and give valuable feedback to the institution that the specific competencies have been acquired.

# ACKNOWLEDGEMENTS

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