Open source eportfolio: development and implementation of an institution-wide electronic portfolio platform for students

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This article provides a general overview of how portfolio is used in education and then goes on to discuss the development of a generic, institution-wide portfolio for students. We further provide a succinct summary and critical analysis of the educational principles underlying the use of portfolio in higher education. This is followed by an overview of the growing number of portfolio initiatives currently underway at the Vrije Universiteit Brussel. As the use of portfolio is a natural complement to competence-oriented educational innovations, the Educational Innovation and Educational Service Centre (OSC) of the Vrije Universiteit Brussel is developing a generic electronic portfolio system. The functional and technical requirements for implementation of eportfolio have been established on the basis of the lessons learned from practical experience. The choice of an open source development environment made it possible to get a prototype up and running relatively rapidly, thanks to the availability of built-in tools such as user management, security management, content management and plug-ins. The open character of the system offers the best guarantees for its future development, flexibility and the possibility of linking it to other projects and databanks. The article concludes with a description of the portfolio system at its present stage of development together with an exploration of the future possibilities of eportfolio.

Le e-portfolio en accès libre: le développement et la mise en place à l’échelle d’une université d’une plateforme de portfolio électronique pour les étudiants.

disponibilité d’outils incorporés tels que gestion d’emploi, gestion de sécurité, gestion du contenu et plug-ins. Le caractère ouvert du système offre les meilleures garanties pour le développement futur, la flexibilité et les possibilités de raccordement à d’autres projets et banques de données. Une description est donnée du système portfolio tel qu’il est actuellement en développement, ainsi que des perspectives d’avenir de l’eportfolio.

Die offene Informationsquelle ‘E-Portfolio’: Entwicklung und Umsetzung einer institutionsbreiten elektronischen Plattform für Studenten


Portfolio in higher education

Portfolio is a concept taken from the world of architecture and the fine arts, where portfolio constitutes an extensive curriculum vitae with which the artist or architect presents his or her work. Portfolio is a collection either of a number of actual pieces of work or representations of pieces of work. In the financial world portfolio is a spread of investments or a block of shares. In business the term portfolio denotes a range of products and services offered. The connecting thread running through all this diversity of specific meanings is the idea of a portfolio first and foremost as a collection or inventory. In education portfolio, in its most basic form, is a collection of exhibits relating to the abilities of students or pupils.

Since the early 1990s portfolio has taken the educational world by storm. Two tendencies in contemporary education underlie this phenomenon. The first of these is the rise of constructivism, a pedagogical school of thought which emphasizes learning by experience and self-discovery. Portfolio is a tool which is particularly well suited to these forms of learning (Meeus & Van Looy, 2002). A second factor is the rise of information and communication technology (ICT). Through ICT, assembling a collection or, to put it in computer terms, the ‘creation’ of a database acquires possibilities which until very recently were unimaginable.

Portfolio is being progressively hyped in European higher education. There is a positive frenzy of experimentation resulting in a large number of projects enjoying differing degrees of success. So far, however, the pedagogical and didactic knowledge base for use of portfolio in higher education is still insufficient. At this stage we need to maintain an open attitude to the potential applications of this tool, while giving full reign to our critical faculties. At all events, there is broad agreement, at least, on a number of the defining characteristics of portfolio.
Characteristics of portfolio in higher education

It is impossible to give a simple and unequivocal description of portfolio in education as the characteristics of this tool vary according to how it is used. To put it another way: there are as many descriptions as there are applications. This manifests itself *inter alia* in the multiplicity of nomenclatures and classifications which it has accumulated (Meeus & Van Looy, 2005). Portfolio is a very flexible tool which can be tailored to specific educational contexts. In this very flexibility lie both the strength and the weakness of portfolio. The general characteristics of portfolio are reviewed below. Portfolio in education is:

1. student-centred;
2. competence-oriented;
3. cyclical with regard to action and reflection;
4. multimedia-oriented.

In the following paragraphs we offer a concise review of these characteristics and point to possible pitfalls. We will then go on to examine the strategic choices made at the Vrije Universiteit Brussel with regard to the development and implementation of an electronic portfolio platform.

### Student-centred

Just like the artist, the student is also the owner of, and the person ultimately responsible for, his/her portfolio. Students manage their own portfolios: they decide on the objective, content and format of their portfolio. Even so, the student, again like the artist, has to take into account the target group. The student puts his/her portfolio together with the intention of presenting it to people connected with him/her in the course or discipline. The student may make right or wrong decisions in doing so, but these decisions are, at all events, of the student’s own making, which is why portfolio fits in so well in student-centred educational formats.

The artist enjoys autonomy in putting together his/her portfolio. The gallery owner, on the other hand, looking for artists wanting to exhibit also has his/her preferences. The work shown has to match the gallery’s house style. Yet it is up to the artist to decide to what extent he/she wishes to go along with this house style. A similar rationale applies with respect to the student and his/her course. That the student is the person who bears the ultimate responsibility for his/her portfolio does not relieve the course teachers from their responsibility of determining whether or not the student fits within the professional profile concerned. Therefore course tutors may, and indeed must, mark out the scope within which the student can operate with regard to the objectives, content and format. From a student-centred perspective the course tutors give the student as much room as possible. Allowing a student to put together a portfolio thus needs to be conceived as an open assignment. A collection of results stemming from a closed assignment cannot be called a portfolio.

The issue of ownership also determines the difference between portfolios and student monitoring systems (Meeus et al., 2005). With respect to the latter, management is in the hands of the course tutors. They collect materials from their students (e.g. work experience placement reports) and then record the learning progress their students have made on the basis of observation and testing, by awarding points or through their comments. We are not opposed to systems of this kind as such, but we take issue with student monitoring systems of this kind being sometimes mistakenly described as ‘portfolios’.
Competence-oriented. An examination of the concept of competence (Van Merriënboer et al., 2002) clearly demonstrates that there is currently a good deal of confusion with regard to the exact meaning of the term. For these reasons we have stripped it to its essential components: i.e. the capacity to function effectively in specific contexts.

Working with competencies has a number of advantages. In the first place competencies are rooted in practical situations, also known as ‘authentic contexts’, and are linked to the professional practice for which the student is being trained. Second, it is only possible to talk about effective functioning if the necessary knowledge, skills and attitudes are applied in an integrated way. Competence involves all aspects of a student’s functioning. It is equally pointless to try and summarize all the constituent aspects of a particular competence in a succinct concluding paragraph. The multiple interaction effects involved make this an impossible task. As part of an evaluation it is possible to work with indicators (Van Petegem & Vanhoof, 2002), where it is clearly understood that the whole is not the same as the sum of its parts.

The student wants to use portfolio to show his/her competence. Competencies which have been or are still to be acquired are the point of departure of portfolio. Portfolio can be a representation of all the competencies with which the course aims to equip the student, but this is a very ambitious undertaking. It is better to focus on a limited number of competencies. Whether the selection is made by the student or the course tutors depends on where the course stands in the continuum of student-centred to teacher-centred education. In many cases the decision is made in mutual consultation.

At all events the intention is that the student should learn from the experience of using a portfolio: the student works on those competencies which he or she has still not fully mastered. Before starting work on his/her portfolio a strengths/weaknesses analysis of the student should be carried out to identify just what these are. It is also important that the student approaches his/her portfolio with the necessary personal motivation. A precondition in this regard is that he/she acknowledges that the competencies concerned require further practice and that working on these competencies is a worthwhile activity.

Action and reflection. If a student wishes to use portfolio to show his/her competence, he/she must give an account of the activities in which this competence is demonstrated. In an educational context this means that the student draws up a personal learning plan (PLP) containing a series of activities with which the proposed competence can be practised.

In principle every activity stimulates reflection. The fundamental idea is that students must learn to reflect on their functioning so that after they have completed the course they are in a position to continue to work on their own development in a conscious manner (Van Looy et al., 2000). These reflections reveal how the student perceives the difference between the actual and the desired situation. He or she can then adjust his or her activities accordingly.

All this may sound simple, but in practice it is beset with pitfalls. The requirement for reflection has to be approached with great care. There is, after all, something potentially counterproductive about asking the student to reflect on the weak points in his or her functioning for the purposes of later evaluating him or her on this aspect. The risk of insincere reflections in a situation of this sort is very high. One should only ask for student reflections if the portfolio system can guarantee their authenticity. Where this is not the case one will have to be content
with a description or contextualization of the activities by the student without any very penetrating analysis of the quality of their execution.

*A variety of materials and multimedia.* The student demonstrates his or her competence via the portfolio. He/she thus has every interest in devoting sufficient attention to its compilation. The proof of his/her competencies can take a wide variety of forms. The most usual format is the written account, but in these days of multimedia other materials may also be considered, such as drawings, photographs and illustrations, sound recordings and video material, software programs, etc.

Portfolio only informs us about the student’s competencies in an indirect way. There is no direct observation. The indirect nature of this representation raises the question as to the validity of portfolio. To what extent is the picture painted by the student a correct representation of his or her real competencies? Students who possess a high level of media competence may gain an unfair advantage from an attractive packaging. It is the responsibility of the course tutors to use an evaluation system which prevents such practices as far as possible.

The use of media is not just a frivolous extra, but requires a great deal of time and organization. The student has to select the media, prepare them, use them and then tidy up afterwards. Processing multimedia materials requires many more skills than processing text does. This is therefore an opportunity to promote the student’s media competence (Kommer & Meeus, 2001), but the course must take this into account when allocating study time. Many students underestimate the time investment which is required when using media (Meeus *et al.*, 2004b).

In the last decade the range of available media has increased hugely. This is particularly true in the area of ICT, where the number of media has increased exponentially and the nature of these has undergone a profound change (Van Ryssen, 2001). Putting together a digital portfolio and publishing it on CD-Rom or on the Internet is a challenging option (Van Tartwijk *et al.*, 2003) and makes portfolio easier to read, attractive and compact. If course tutors require their students to compile a portfolio they should provide them with the necessary tools. For example, a generic electronic portfolio platform may be offered. Such a platform must offer students the greatest possible degree of flexibility however.

**Educational innovation at the Vrije Universiteit Brussel**

Educational innovation is not the same as following fashion. Genuine educational innovation is aimed at benefiting students in one way or another. In 2000, partly as a response to current social challenges, the Vrije Universiteit Brussel adopted a revised educational concept. In formulating this educational concept we used the mission statement of the Vrije Universiteit Brussel, which emphasizes free research, the development of critical faculties and social responsibility, as a basis. We also built on what was already standard practice at the Vrije Universiteit Brussel in the area of educational innovation and in the application of ICT.

Core concepts in this revised educational concept are student focus, activating education, independent and permanent learning and the acquisition of academic competencies. This also involves a further shift of emphasis from the role of the course instructor as conveyor of knowledge towards the course instructor as coach and supervisor.
Academic competencies

Until recently interest in competence-oriented education came from profession-oriented courses, the principal motivation being that this approach was thought to be better suited to the rapidly changing requirements of the professions concerned than the traditional structure based around educational objectives and final attainment levels. At universities, and especially for degree courses which did not lead to a particular profession, competence-oriented education was frowned upon. However, at the Vrije Universiteit Brussel we took the view that competence-oriented education is just as important in university education as in other educational institutions, although it is used in a different way because of the emphasis placed on the acquisition of conceptual competence. The focus in this case is on ‘the capacity to analyze unstructured, complex situations in an academically sound manner in order to arrive at a creative and critical problem formulation and in order to find ways of working on defined problems’ (Derks, 2000, p. 40). Academic competencies extend to a variety of different areas, such as: study and career competencies; research competencies; professional competencies. The precise form that this takes differs with each course and is to a greater or a lesser extent oriented towards the exercise of a specific profession.

Portfolio initiatives at the Vrije Universiteit Brussel

Competence-oriented education requires that the student takes responsibility for his/her own learning process. Educational models, didactic work modes and test formats are aimed at creating an active study attitude and helping the student to acquire the capacity to operate in complex situations. The reformed educational supervision methods developed make extensive use of portfolio. The following section gives a brief sketch of the various practices which are currently being developed.

Assignment portfolios in the multidisciplinary sciences. For first year students in the multidisciplinary sciences portfolio supervision is done on the basis of assignments, a mode of working which involves close cooperation between teaching staff in physics, mathematics, chemistry and biology. Lists of competencies have been compiled and the intention is to provide students with continuous information with regard to their progress in these competencies, to build in reflection as part of the study experience and to initiate remedial steps where necessary. It is hoped that this approach will be successful in dealing with the problems associated with the transition from secondary to university education and that it will also result in improved academic achievement.

Language portfolios in Romance and Germanic language courses. For some time now we have used a supervision approach for the purposes of revealing students’ progress with regard to their oral and written command of the various languages being studied in which portfolios play an important role. Audiovisual material is used, with an increasing emphasis on electronic communication formats and distance learning platforms. This way of working places a great deal of emphasis on self-evaluation. The student’s portfolio plays a role in
the oral examination as the student uses portfolio to show his or her competence development.

Portfolio as an alternative to the classic work experience placement report in medical/social sciences. A characteristic of this course is that it is exclusively attended by working students. Portfolio development already has a place in the work experience placement supervision, with the aim of stimulating reflection on the work experience placement practice and to make it easier to identify personal development.

Portfolios compiled from the first year onwards for students of pharmacy. In the programme ‘Integrative competence-oriented line project for students of pharmacy’ the compiling of a portfolio is the key element which reveals students’ development and mastery of competencies over the entire duration of the course.

Physical education. In the ongoing projects ‘Broad offer versus specialization’ and ‘Student-assisted teaching’ the intention is to show students’ strengths and weaknesses in the area of (sporting) competencies in order to assist students in attainment of their personal goals. Portfolio also plays a role in the supervision of first and second year students by third and fourth year students in the area of movement education. Portfolio thus helps realize the learning objectives of both the junior and the senior years of the course.

Portfolio compilation for students of engineering and architecture. Within the concept of integrative education the emphasis is on the integration of disciplines and on helping the student develop competencies, in which the portfolio plays a role. The course component ‘design methodology’, which is studied in each year of the course, is of particular importance in this regard.

Portfolios in teacher education. In teacher education the optional course ‘Portfolio’ was introduced for the academic year 2004–2005. This is a learning portfolio which serves as an evaluation tool for assessment of the student’s learning competence (Meeus et al., 2004a). The course tutor can see from the learning portfolio if the student is able to:

a) recognize educational competencies that he/she lacks or has not sufficiently mastered;
b) draw up an effective personal learning plan to bring these competencies up to standard;
c) carry that out effectively;
d) reflect independently and in sufficient depth on his/her educational practice;
e) visualize his/her learning process in a creative way.

Portfolios and the doctoral student. For the doctoral student portfolio forms in effect the final piece of work. It is seen not only as a supervision tool but as an online repository for the researcher within the broader context of knowledge management. Ideally portfolio could also continue to play a role in life-long learning after the student has obtained his/her Ph.D.
Development of a generic electronic portfolio platform

The Educational Innovation and Educational Service Centre (OSC) of the Vrije Universiteit Brussel started the ‘Generic Electronic Portfolio Platform’ project in early 2003. In order to ensure an optimal tie-in with the needs of educational practice the OSC organized platform meetings for teaching staff interested in using portfolio in the future. The meetings served to clarify the educational and learning functions of portfolio and the eportfolio use functions. The meetings also yielded pointers for the further development of the eportfolio platform as a tool for progress supervision and evaluation.

Functional requirements

The features which an institution-wide portfolio would need to have were largely established on the basis of the experiences and requests of the eight portfolio user groups. Four features were regarded as indispensable: broad applicability, student-centredness, user-friendliness and the possibilities of linking it to other systems.

It was apparent that the portfolio concept is applied in very different ways among the eight portfolio user groups. For this reason we decided to opt for a broadly applicable portfolio system. The system should not exclude any applications and, as a toolbox, it has to contain a range of tools which can be used or not in accordance with the wishes of the course tutors or the student. One component which everyone wanted was an archive centre for the storage of reports, summaries and similar documents. There was a wide variety of requests on the issue of precisely how to deal with student reflection. This could take the form of comments on uploaded files, personal learning plans, strength/weakness analyses, overviews of competencies or logbooks. Logbooks could also be interactive, with contributions from portfolio supervisors or even other students.

Unlike teaching staff or course-centred learning platforms, a portfolio system has to be student-centred. The student must be the manager and owner of his/her portfolio. To this end the student must be able to decide for himself/herself about rights of access to the portfolio. For every component or object the rights of access can be established as ‘private’, ‘selective’ or ‘public’. Public access can act as an extra motivation for the students to make work which has been submitted internally accessible to a broader public. Student-centred also means that students only have to keep one portfolio. Having to put together a number of separate portfolios, for example one per course instructor or one per subject, has a demotivating effect. Rigid format or content specifications per course are also undesirable. It is perfectly possible to use minimum requirements or portfolio templates.

The system must be user-friendly and intuitive, of course, and also web-based. Everyone must be able to work on his/her portfolio when and where they want. The system should not require specific computer knowledge, such as the creation of html files. It has to include a wizard tool for the creation of pages and it must be possible to include files in a range of different formats in the portfolio platform.

Above all it must be possible to link the portfolio system to other databases belonging to the university for authentication of the various users and their roles (students, teaching staff, system managers and the public) and also to able to link students to their course instructors. Other
desired functions were *inter alia* templates, notifications of relevant changes, quotas for upload, language choices and discussion boards.

**Technical requirements**

In addition to the functional requirements for the portfolio system referred to above, further technical requirements were drawn up before making any decisions with regard to implementation. In view of the specific functional requirements and rapid evolution in the field of educational technology, there is a need for a system that is readily adaptable by the educational institution. The best guarantee for this is Open Source software with a free software licence. This means that the educational institution concerned can use the program source code and that it is entitled to use and adapt the program on an unrestricted basis.

The program has to be scalable. This means that it must be able to accommodate a very large number of users, both technically and administratively. In the case of the Brussels University Association this means the involvement of various institutions and a total of around 15,000 users.

Due to the great diversity of both users and their computer systems, complete platform independence with respect to the end user is an absolute must. It is essential therefore that the system supports open standards. The best way of guaranteeing this is with a web-based system, which can be used without the need for specific software, apart from a W3C compliant web browser (World Wide Web consortium, http://www.w3c.org). A high degree of platform independence at the server end is also desirable.

**Choice of the Zope/Plone development environment**

The choice of software for the development environment obviously has a crucial influence on the success of the project and for this reason we gave this a great deal of thought. Numerous possibilities were explored. The first option considered was the implementation of a portfolio system with the Blackboard learning platform (http://www.blackboard.com), which at the time was the platform used at Vrije Universiteit Brussel (the current platform is now Dokeos, http://www.dokeos.com). Although there is an extension system for Blackboard with so-called ‘building blocks’, we decided that this was not flexible enough for our purposes. It was also quite expensive (developers’ licence and developers’ network fee) and offered few guarantees with regard to the future. Ready-to-use commercial portfolio software has been on the market since 2003. This software is often still somewhat immature and was most often ruled out for our purposes due to lack of flexibility and platform independence.

We therefore decided to develop our own system on top of a layered open source and a platform-independent development environment. That environment consists of the following: Python (program language), Zope (web application construction kit), CMF (content management framework) and Plone (content management system, http://plone.org). Plone is the top layer on which the portfolio system is built. It contains many built-in facilities which a portfolio system requires, such as user management (different roles with different permits), security management, content management, file folders, database interfaces, etc., all of which are available in 30 languages. As well as the built-in tools, there are also numerous plug-ins, such as...
discussion forums and web logs, often contributed by members of the very active user community. Zope/Plone is widely used in educational environments (Plone in Educational Settings, mailing list, http://plone.org/contact) and an Eduplone learning content management system (http://eduplone.net) is being developed. There is also the professional support of dozens of companies. We believe that the Zope/Plone-based portfolio system ensures:

1. rapid prototyping;
2. a good fit with the wishes expressed by the users;
3. maximum flexibility;
4. optimal guarantees for the future (open source, but professional support available);
5. possibilities of linking it to other systems in the institution due to its open nature.

One alternative which deserves a mention is ‘The Open Source Portfolio Initiative’ (http://www.theospi.org). This group is building an open source generic portfolio system based on the University of Minnesota’s eportfolio. The first downloads have been available since August 2003, which came just slightly after we had chosen Zope/Plone and after we had agreed with the other project groups in our institution to use the same development environment.

The portfolio system within the ‘PointCarré’ elearning environment

PointCarré (http://pointcarre.vub.ac.be) is the Vrije Universiteit Brussel’s umbrella elearning environment, which now includes the Dokeos-based, course-centred learning platform, the Zope/Plone-based generic student portfolio, the architecture knowledge management system and the doctoral portfolio. The architecture knowledge management system (ARCHeMEDES) is another ongoing project, the primary objective of which is to give students access to knowledge and allow them to use learning objects (in this case on architectural topics) contributed by teachers and previous generations of students. It is intended that this project will be extended to other courses at a later date. The doctoral portfolio is one of the eight portfolio user groups, but it is a somewhat special case due to its specific function, which is to share data with the Vrije Universiteit Brussel’s Research and Development databank. The student and doctoral portfolios and ARCHeMEDES are being implemented and integrated into the same Zope/Plone environment and server. This permits the distribution of technical knowledge about the system across the various groups and has the advantage that the end-users are not required to use multiple systems.

At the time of writing (2005) the portfolio system is still in the process of development in the direction of the ideal generic portfolio as described above in the functional and technical requirements. Additional specific functions are described below.

Each portfolio has two versions: a ‘public version’ (Figure 1) and an ‘editable version’ (Figure 2) which can only be consulted by the author of the portfolio.

The editable version is designed as a folder in which the student can keep files. These files can be stored in any format, but there are different predefined file types (web log, personal learning plan, etc.). This means that there may be different metafields depending on the file type concerned (which may or may not have to be filled in) and that searches can be carried out by file type, as well as by keyword and date. The accessibility status of each file can also be set in the editable version: private, for portfolio supervisors only, intranet or public. Local roles can
also be allocated for each (sub)folder specifying who, for example, is to be granted access to strengths/weakness analyses or with which group areas can be created. Everyone starts out on the system with a template portfolio. Web pages can be created online in three different formats: (1) with normal text; (2) with structured text (automatic interpretation of links, e-mail addresses, summaries, etc.); (3) with a user-friendly WYSIWYG (what you see is what you get) html editor. A drop-down table of contents is automatically generated. The author can decide for each object entered whether he or she wants to allow discussion about that object or not. Portfolio supervisors can also enter their comments.

The future
The basic functions of the portfolio system were set up during the academic year 2003–2004 and were tested using students and teaching staff from different portfolio user groups. During
the academic year 2004–2005 the platform was made available to the entire university. Pedagogical and technical support is provided centrally, but each course has to decide for itself with regard to how they wish to organize the portfolio supervision and monitoring, for which the teaching staff of the course concerned are also responsible.

What will be the significance of the eportfolio in future years? With higher education in Europe becoming ever more flexible, the traditional system of degrees done in one place and over consecutive years is receding and more individualized learning pathways will soon become possible. In the future a student will be able to register for an entire course in one place, if desired, but will also have the option to register for one or more specific course components only. A flexible educational system will also attract other groups of students, such as working students. It is expected that fewer students will opt for the traditional ‘x years in one place’ courses. They will increasingly want to combine subjects from different courses and will study these in various different educational institutions. It is essential that students learn to see courses as dynamic learning pathways for the development of their own competencies. In order to get a flexible study system off the ground a new type of supervisor is needed: the pathway supervisor or student counsellor who can look beyond the confines of his or her own institution and can
advise students on broader, strategic problems of pathway choice. At the Vrije Universiteit Brussel every faculty now has its own learning pathway supervisor. In the future it will be possible to correct an inappropriate choice of courses more rapidly, thanks in part to the new ‘European Higher Education Area’. In the higher education of the future we can also expect to see eportfolios function in a cross-course context in order to take account of competencies acquired previously and elsewhere and in order to tailor learning pathways to the needs of the individual student.

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**References**


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