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Virtual Portfolios

Lessons Learned from Four Years of Implementation

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Abstract: We have developed virtual portfolios as structures that help students organise knowledge and the knowledge-building process in virtual environments. These online portfolios allow learners to easily navigate their virtual learning space, collaborate at many levels, and acquire a heightened level of awareness of (inter)actions in the virtual learning environment. We report our experiences over the last 4 years in using virtual portfolios for enhancing the learning process in an American university course in global environmental change. Examples are given of how students respond to different functional capabilities offered within the virtual portfolio and to different requirements for evaluating student performance.

1. INTRODUCTION

The Internet is being used more frequently for educational support, not only in continuous and lifelong learning, but also as an alternative method in higher education (Bates 1999, Harasim 1999). The obvious advantages of this platform include enhanced flexibility and time and space independent organization of the learning process within higher education (Harasim 1999).

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The availability of this promising and flexible potential as a platform for design and management of virtual learning processes, does not, however, guarantee that it will be used, – or the quality of its use. The need for a significantly enlarged range of design and delivery structures has become evident (Kaye 1993, Collis 1996). Implementation structures that support learners' navigation, interaction and collaboration at many levels in the virtual world (Sorensen 1997) are both possible and essential. The virtual portfolio is an example of one such structure that helps the organisation of knowledge and knowledge building (Stahl 1999) for the learner in supporting the process of awareness and the processes of (inter)-actions in the virtual learning space (Sorensen et al. 2000).

This paper addresses the structuring potential of virtual portfolios for web-based learning. It reports on 4 years of experience in using this tool in a web-based American course on global environmental change, as a means of creating and structuring collaborative and individual spaces throughout the learning process.

In section 2 the virtual portfolio and its potential for supporting web-based learning are described. We also provide a brief summary of the course context in which we have implemented the portfolio. Section 3 provides a description of the various types of portfolios we have used, and section 4 gives some quantitative results documenting student performance characteristics under different implementations. We summarise our experiences in section 5.

2. CONTEXT FOR IMPEMENTING PORTFOLIOS

We first provide our definition of an online portfolio and give a brief outline of the context in which it is implemented.

2.1 Definition

A general short definition of an online portfolio is: A structured image over time of a process of development (Sorensen et al. 2000). In more specific terms, an online learning portfolio may be viewed as a structured collection of items and functionalities developed under a reflective process that represents and demonstrates knowledge, skill, abilities, personality, processes, and learning experiences that may be used to serve various learning and professional purposes.

A virtual portfolio, therefore, may serve as a structuring tool for managing a growing multitude of components of the learning processes. It may have the form of an individual portfolio, built and functioning from the

perspective of the individual learner or the learning assistant (instructor, teacher, mentor, curriculum advisor). Or it may be deployed as a group portfolio for structuring the collaborative activities of a group of learners (collaborating students in a course or team of researchers). Any instructional approach in learning can be implemented in the portfolio. Consequently, the extent to which an online portfolio enhances learning is, to a large extent, dependent on the implemented instructional approach and its assumed criteria of quality in the learning process.

2.2 Context of experience: 'Global Change'

The Global Change (GC) course has been taught for 12 years at Iowa State University and has been on the web with interactive dialog since 1995. The course addresses environmental changes of global and regional scale that threaten to disturb and degrade natural and managed ecosystems and ultimately human health and welfare. Although presently an on-campus course, GC was established with the vision that ultimately it should be delivered globally to address environmental problems that span national and continental borders. This would require engaging students asynchronously over the web from a wide range of cultures, languages, and educational traditions, to search for multi-national solutions to global environmental problems. Therefore, the course was structured from its onset with a vision toward virtual interactions in support of learning environments.

Student virtual portfolios (see Figure 1), introduced into the course in 1997 (Taber et al. 1997), allowed students to better manage their interaction in and through the course. An instructor portfolio introduced the same year allows the instructor to more intensively interact with the student as guide in the learning process. The course, including materials entered by the instructor and materials and public discussion entered by students, was structured to be an organically growing database (much of which is contributed by students) that offers students an increasingly rich body of learning resources for each subsequent offering of the course.

3. USE OF PORTFOLIOS IN GLOBAL CHANGE

Students register for both individual and group portfolios in support of their interactions in the course.

3.1 Individual student portfolios

Students manage their interaction with the course through their personal portfolios. The portfolio has a calendar function that gives students the assignments that are due each day and a record of their assignments submitted. Quizzes they are required to take with each learning unit are accessed from the portfolio. Students use personal portfolios to archive all their electronic submissions, instructor's grades and comments, and responses of other students, faculty, or others to electronic dialog comments. Students' reviews of research papers are posted on the web and linked where appropriate to learning narratives. A 'message of the day' allows the instructor to quickly communicate with all students through their personal portfolios. From their individual portfolios, students manage their interactions (a) publicly in the general dialog, (b) privately with other students in group portfolios they share with other members of small groups, and (c) privately with the instructor through which they submit their self assessments and dialog with the instructor on the evaluation and assessment processes.

The course was divided into three five-week blocks with each block having nearly identical elements to be assessed (e.g., quizzes, response to ethical question, response to a broad-topic question, self assessment of writing quality, etc.). By observing student performance on three successive and identical assessment blocks, the instructor can observe the student's learning *process* as well as individual learning *products.* The individual portfolio structure is replicated for each block to provide the student with a "new slate" from which to begin anew after having reflected over and having been assessed by the instructor on the previous block.

3.2 Group portfolios

The Global Change course has used two implementations of group portfolios, serving two different purposes.

3.2.1 Group portfolio for collaborative knowledge building

The first type of group portfolio provides workspaces for small groups of students to interact privately and write a common document summarizing various elements of a particular learning unit (e.g., lecture and its supporting online materials and student discussion on the topic). Teams of 3-4 students were established to take notes of class discussion and instructor comments during the regular 50-minute class meetings. These students met electronically through a group portfolio and produced a document

summarizing all materials relevant to that topic. This document is subsequently was posted on the web, with contributing group members as authors, as a contribution to the growing database for that particular topic. Group portfolios were private to the group and even the instructor did not have access to them. Only those students of the group that participated in the construction of the online document are acknowledged on the web as co-authors.

3.2.2 Group portfolio as laboratory for collaborative experiments

A second type of portfolio was used in conjunction with an experimental laboratory for the course. This portfolio provided an electronic workspace from which teams of students could collectively design and run experiments, archive results and develop reports summarizing results from numerical experiments of authentic simulation of plants interacting with atmospheric and soil environments. For this implementation, teams of 3-4 students were assigned portfolios for sharing results of numerical experiments and collectively (albeit asynchronously) analysing, interpreting, and reporting results. In this way, students act in roles of professional researchers working as a research team, a time-honoured method for creating new knowledge. The students met physically to get started on the experiments and then managed their interaction remotely. Interpretation and report writing were done as a team effort and submitted electronically.

3.2.3 Instructor portfolio

An instructor portfolio was designed to enable the instructor to view student records of quiz scores and dialog submitted under various topics. The instructor had the option to view entries of all students for a given assignment or chronological entries of a single student for all assigned tasks. The latter form of display was particularly useful for two reasons: an overview scan of the entire record gives a complete picture of a particular student's contribution over the evaluation period. This allows the instructor to see the range of topics on which the student had written and gives a general overview of the student's writing capabilities and interests. Secondly, the concatenation of all writing for the evaluation period allows the instructor to observe progress in achieving stated goals for the online dialog. The instructor can observe the impact of recommendations to the student by having permanent and shared access to 'before' and 'after' products of the student. Space also was provided for instructor-student dialog on student self assessment and instructor evaluation thereof.

4. IMPACT OF IMPLEMENTION

Student online dialogue is a very important element of the GC course as discussed in section 2. Virtual portfolios facilitate implementation of alternative pedagogical strategies for the use of dialog. For instance, when the GC course was first established on the web in 1995 with dialog encouraged but only voluntary, the volume of comments was relatively low and the quality rather superficial (with some notable exceptions). When virtual portfolios were introduced in 1997 we began to put requirements on the dialog such as a minimum number of entries and eventually a demonstration of higher-order reasoning. Although new topics have been added over time, a sufficiently large common set of topics provides a useful database of student-generated materials for analysis of how students respond to different learning opportunities and imposed conditions. Table 1 shows how the number of comments per student in the second 5-week period of the course changed over the years in response to these changes in pedagogy. Evidently the more stringent requirements stimulated a substantially higher volume of comments.

Table 1. Number of on-campus students (A) enrolled in the Global Change course since 1995, mean number of comments per student (B) in each learning unit (covering material equivalent to one lecture), and mean number of comments per student (C) in one assessment cycle (covering 15 learning units)

Year	1995	1996	1997	1998	1999	2000
A	32	31	32	33	26	45
B	0.069	0.106	0.350	0.390	0.320	0.480
C	1.0	1.6	5.3	5.9	4.8	7.2

In the first two 5-week periods (assessment cycles) of the 2000 offering of the course, students were struggling to learn to use the higher-order reasoning requirements in their online dialog. By the third assessment cycle, students had fully grasped the intent and characteristics of these requirements and posted more and substantially higher quality comments. We took a random sample of 10 comments from dialog for three different years and made a subjective judgement of the quality of the comments and also did a word count on each comment. Mean values shown in Table 2 indicate an increase in quality and an increase by a factor of 26 in the size of each comment. The use of three assessment cycles within the virtual portfolio with all materials archived allows the instructor in online counselling of individual students to point to specific deficiencies and improvements or lack thereof from cycle to cycle.

Table 2. Mean subjective evaluation of comment quality and mean number of words per comment in 10 comments randomly drawn from dialog in three different years in the Global Change course

Year	Quality (0-10)	Number words/comment
1995	4.4	88
1997	3.2	93
2000	5.3	2,505

For the course offered in 2000, students were required to post 5 comments per cycle, including 3 responses to other student comments. Additionally, they were required to elicit 3 comments from other students to receive full credit. Table 3 shows that students went far beyond minimum requirements on number of comments and somewhat above the minimum on other categories.

Table 3. Number of comments made per student, number of comments in response to other student comments, and number of comments received from other students in the third assessment cycle for the course offered in 2000

Comment type	Number
Mean total comments per student	9.3
Mean number responses to others	3.2
Mean number responses received	3.2

From these experiences we assert that the portfolio facilitates direct implementation of desired pedagogies and adds pedagogical value to conventional teaching tools. It can be used to implement assessment cycles to allow assessment of learning *process* as well as learning *products* and promote pedagogical goals such as good writing and higher-level critical thinking skills.

5. SUMMARY

The personal portfolio provides the student with an electronic home from which to link to web course material, to archive their own learning products, to link privately to other students in collaborative learning experiences and to the instructor for assessment and feedback in the learning process. Careful structuring through virtual portfolios supports and adds quality to both virtual learning and virtual instruction through enhanced overview of the learning process and content, increased clarity of learning expectations, and individual and collaborative spaces for learning activities and self-reflection (Sorensen et al. 2000). It also helps support smooth flow and contextual organisation of ideas, despite separate and distinctly different historical educational traditions of participants.

From our experience we have gained insight on how students respond to different functional capabilities offered within the virtual portfolio and to different requirements for evaluating student performance. As a result of our aim at supporting collaborative learning among students, we have explored the challenges implied in the establishment and maintenance of peer discussion and interaction, as well as the instructional aspects of judging the quality of such group interaction and dialogue as components of the collaborative knowledge building process.

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BIOGRAPHY

Eugene S. Takle is professor of atmospheric science and professor of agricultural meteorology. His research focuses on numerical simulation of regional climate change and turbulent flow through vegetation in heterogeneous agroecosystems. He is interested in bridging the gap between scientific research using numerical simulation tools and use of authentic simulation models as tools for learning. His collaboration with Professor Sorensen focuses on carrying these interests into the virtual learning environment.