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STUDENT WEBFOLIOS AND AUTHENTIC ASSESSMENT IN INFORMATION SYSTEMS

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Abstract:

The article describes the incorporation of assessment and assurance of learning features in a WWW webfolio system containing student artifacts produced over a fifteen year period by cohorts of students in response to course assignments and program learning objectives. The webfolio system maintains the artifacts; associated assignments; program and course learning objectives; faculty formative comments to students about the artifacts; rubrics; artifact evaluation scores, standards and levels of knowledge along with course information. The data can be maintained indefinitely allowing tracking of trends in assessment results.

The relationships among the previously mentioned categories of data as they appear to the users (students, faculty, and administrators) are shown and use of the data to support authentic assessment, assurance of learning, and program improvement is described. Although the data categories are presented in the context of a system built by the authors, similar data would need to be maintained by any system supporting authentic assessment based on student work samples. The paper should be of interest to those involved in using educational technology for assurance of learning and curriculum assessment purpose; those involved in maintaining authentic student work samples for accreditation purposes; and those interested in the use of authentic work samples for professional certification.

Keywords: webfolios, portfolios, authentic assessment, educational technology and assessment, assurance of learning, accreditation, certification

I. INTRODUCTION

This article describes the incorporation of program assessment and assurance of learning features in a WWW webfolio system containing student artifacts produced in response to course assignments and program standards. The system, originally created fifteen years ago and now containing at least partial data for thousands of students, has benefited from revisions resulting from the collaboration of both Business Information Systems and Teacher Education faculty. The artifacts; associated assignments; program and course learning objectives; faculty formative comments to students about the artifacts; rubrics; artifact evaluation scores; standards and levels of knowledge along with course information can be maintained indefinitely allowing tracking of trends in program assessment results.

The relationships among the previously mentioned categories of data as they appear to the users (students, faculty, and administrators) are shown and use of the data to support authentic assessment, assurance of learning, and program improvement is described. Although the data categories are described in the context of a system built by the authors, similar data would need to be maintained by any system supporting these activities.

The paper should be of interest to those involved in using educational technology for assurance of learning and curriculum assessment purpose; those involved in maintaining authentic student work samples for accreditation purposes; and those interested in the use of authentic work samples for professional certification. The paper begins with descriptions of student and faculty webfolio system interfaces and then shows how student artifacts produced in response to faculty member assignments or stated learning objectives are linked to standards, goals, and assessment scores. The use of these related data for purposes of assurance of learning, program assessment, and individual certification is then explored.

II. WHAT'S A WEBFOLIO? – STUDENT VIEW

A student's webfolio is a collection of multimedia artifacts interwoven during a multi-year period of formal course assignments, student life activities, and career planning to demonstrate mastery of program learning objectives. The learning objectives, course competencies, and guidelines to enhance co-curricular activity experiences are automatically organized as resources for students and appear with the student's artifact for the viewer to see. The webfolio supports professional development and career progression. Faculty can place professional standards/competencies in the system along with associated assignments or activities.

Figure 1 shows a student's webfolio table of contents (left frame) opened to a video artifact (right frame) where the student describes the contents of her webfolio for a particular course. Instructions for this "What's in my webfolio" assignment encourage the student to speak in a conversational tone as if she was telling a friend or recruiter about what she did in the course and describes various assignments she completed. Instructions for this activity encourage the student to describe and reflect on a subset of course assignments, ones that she liked or took particular pride in completing.

The video artifact produced in this activity as well as each of the many other artifacts the student produces has multiple uses. From the instructor's vantage, an artifact is the student's response to an assignment that can be graded (i.e. measure of student performance in the course). Pedagogically, the teacher has the option of providing formative comments that the student may use to revise the artifact before the artifact is locked by the teacher. The webfolio system contains a comment log that allows the instructor to comment about the artifact and for the student to respond to those comments both in the log and by enhancing the artifact. In this way, formative student assessment is supported.

From a program administrator's viewpoint, the locked artifacts can be evaluated using academic program rubrics. Analysis of scores from multiple students provides evidence for program assessment and assurance of learning. Often, one artifact collected from multiple students can provide evidence for more than one learning objective. For example, the content of the "What's in my webfolio" video not only provides evidence of the student's mastery of specific learning objectives related to the course assignments she describes, it also provides evidence of the student's general oral communication skills. Similarly, artifacts from more than one assignment can provide evidence about a specific learning objective.

From the student's view, the artifact is not only used to satisfy a course assignment, it also can be incorporated with other artifacts in a showcase portfolio that the student can use as a marketing tool when searching for an internship or a job. A business card CD with the student's exported webfolio also is shown in Figure 1.

The challenge for the webfolio system is to interface with the various data categories in such a way that each of these uses, and others, is supported.

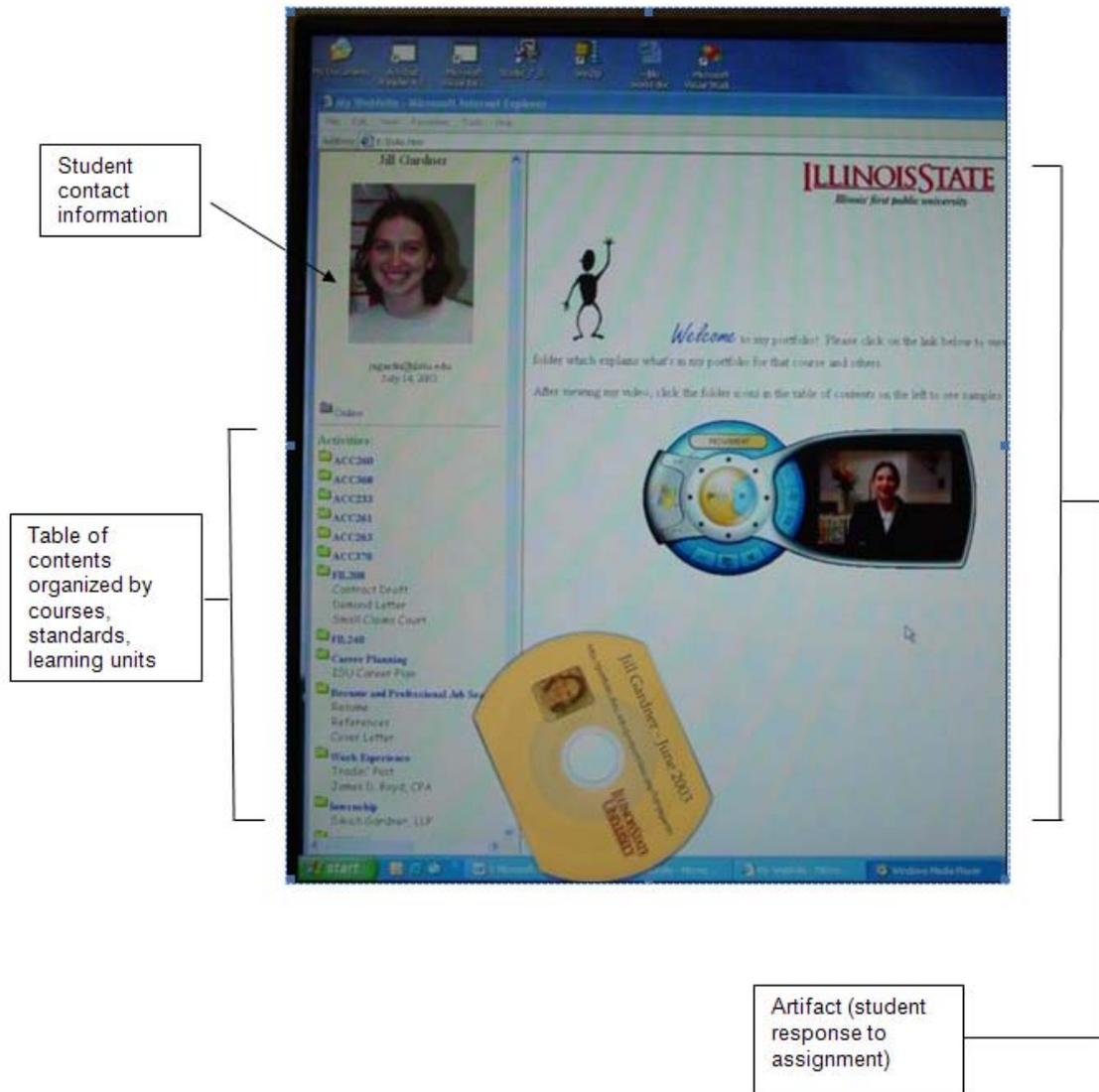


Figure 1. Student Artifact Page Layout: *What's in my webfolio*

Figure 2 identifies the various parts of a student webfolio page. The left frame contains a folder for each course section, currently and previously taken by the student. When the student clicks on a course folder icon, she expands the folder's contents showing each of the assignments or activities. For example, course ACC 260 has ten webfolio assignments. Next to the descriptive phrase for each assignment is a small notepad/pencil icon that the student clicks to bring up the editor where she can enter her response for the assignment. The instructor can set dates for when the various assignments should appear in the students' webfolios and also can set due dates that automatically prevent additional editing. Clicking an assignment caption in the left frame will display the student's work in the right frame. The right frame of figure 2 shows the student's response to the "Use Cases" assignment that is part of the ACC 362 Advanced Business Systems Analysis course.

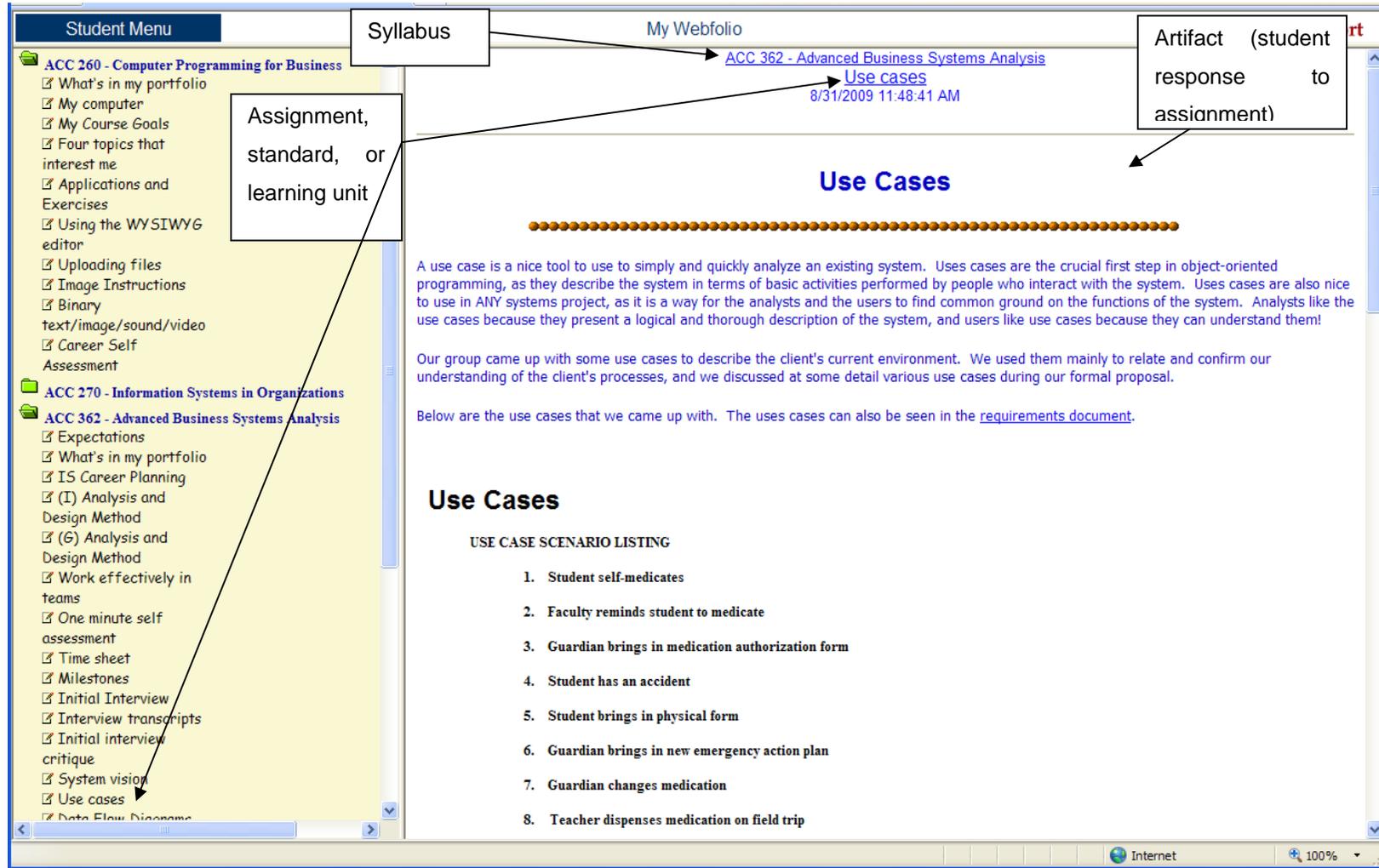


Figure 2. Student Artifact Page Layout

Often when given an assignment, students want to see examples of previous students' work. The authors eagerly oblige knowing that display of exemplary work establishes a benchmark for current students. Similarly, students can benefit from a review of their own classmates' work upon assignment completion. Since the system maintains all data over time, the student produced artifact shown in the right frame of figure 2 as well as the associated assignment as it existed when the artifact was produced can be accessed and shown to other students (current and future). The links at the top of the right frame take the viewer to the course syllabus and assignment as they were when encountered by the student whose webfolio is being viewed.

The left frame of figure 2 contains a capstone course, ACC362 Advanced Business Systems Analysis, in which student teams draw upon their learning from the other courses to develop a new information system for an organization. In addition to the team project, each student develops a two year professional development plan for the first two years after graduation. This is identified as the "IS Career Planning" assignment under ACC362 in Figure 2. One part of this assignment requires the student to update the self assessment that he or she did in a prerequisite course using the needed knowledge and abilities for working effectively in information systems identified in IS2002 [AIS, 2002] (see "Career Self Assessment under ACC260 in the left frame of figure 2 and 3). The ACC362 "IS Career Planning" assignment requires the student to update the self assessment done in ACC260 and then to create a two year post graduation professional development plan that will strengthen weaknesses that were found when updating the self assessment.

Similar folders containing program learning objectives or containing core competencies identified by professional organizations also can be added by the student to her/his webfolio table of contents. For example, the American Institute of Certified Public Accountants [AICPA] has adopted a set of core competencies that accounting students at the authors' institution have readily identified artifacts from homework, projects, and co-curricular activities that demonstrate their level of mastery for the various competencies. As explained below, our information systems students have presented artifacts related to entries on the exit characteristics and needed knowledge and abilities lists resulting from the industry and academia model curricula collaboration.

Notice that figure 3 shows the content of a particular course section (ACC260 section1) as it existed in spring 2008. As mentioned previously, course content data (e.g. assignments, syllabi) are maintained for each course section over time. As a course is revised from semester to semester the data for all previous course sections are available. Similarly course sections for different instructors are individually maintained. Notice, for example, the minor differences in assignments for ACC260 in the left frame of figures 2 and 3. Figure 2 shows a student view and figure 3 a faculty view, but they have slightly different assignments because they refer to different course sections.

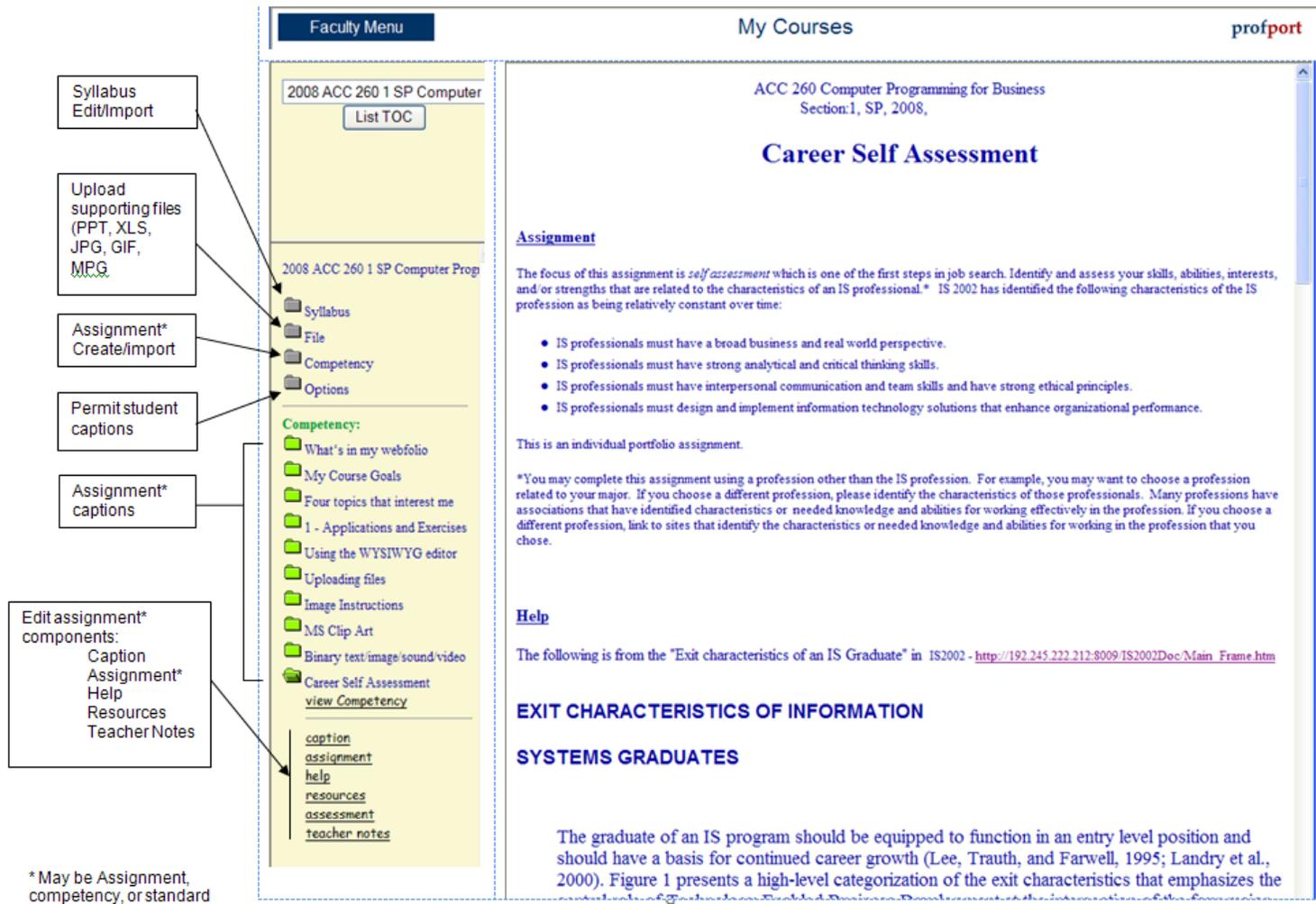


Figure 3. Faculty Member Course Section Interface

III. FACULTY VIEWS

Faculty select from a variety of views of the data in the webfolio system depending on the task. For example, the instructor may want to view and comment to a student about an artifact or may want to maintain course related data. The faculty interface for maintaining course section data is shown in Figure 3. Similar to the student view, the left frame contains a table of contents, but in this case it is for one of the faculty member's course sections. In the top of the left frame, the instructor selects which of her course sections she wants to work with and then sees that course section's content displayed in the rest of the left frame. There are folders for syllabus operations (e.g. importing or modifying), uploading files, and creating or importing competencies; and allowing student to create their own captions for special supplemental artifacts.

In figure 3 an instructor is viewing the course ACC 260 Computer Programming for Business. Notice that the term "Competency:" is used in the table of contents. This term is institutionally chosen and here "Assignment" might be more appropriate since the teacher created assignments rather than competencies. All of the competency or assignment captions listed in the left frame were created by the instructor. For example, there are the captions "My Course Goals" and "Four Topics that Interest Me" that the instructor assigns at the beginning of the course. In actual practice, the instructor of this course section emails these two assignments to the students prior to the first day of class and on the first day of class students new to the webfolio system are shown how to place their work in the webfolio system. The "Four topics" assignment asks the student to look at the first page of each chapter in the text book and then identify four topics in the text that are of interest to the student. Incorporating this assignment in this manner has been found to be an efficient way of engaging the student and establishing student expectations about the course content.

In the left frame list, the folder for the "Career Self Assessment" caption is open and the instructor can choose to edit the properties associated with that caption or can edit the assignment, help, resource, and assessment sections shown in the right frame. Each of the other assignment folders can be opened to reveal the same choices (caption, assignment, help, resources, assessment, teacher notes).

IV. INCORPORATING STANDARDS AND GOALS: METHOD 1

Referring to figure 3, suppose the instructor would like to associate an assignment (e.g. "1 – Applications and Exercises") with program standards or goals (or learning objectives). To do this, the instructor expands the "1 – Applications and Exercises" webfolio assignment by clicking its folder in the left frame of figure 3. After expanding the folder, the instructor can click on its "caption" link and will be taken to the screen shown in Figure 4 (Step 1) where she can modify properties associated with this assignment including the standards and goals that the caption is associated with. At the bottom of the Step 1 screen the instructor selects from various sets of standards and sets of goals that have been preloaded by the institution's webfolio system administrator. After selecting a specific standard or goal, the instructor is presented with the specific members of the set. In step 1 of this figure, the instructor selected *IS2002 Course learning Unit Standards/Goals Selected Standard(s)* and is presented with the goals listed in Step 2. The instructor selects each of the IS2002 goals (one or more) that he or she wants to associate with the assignment. The instructor repeats this process for other course assignments as do his teaching colleagues for their course assignments. In practice, it works well for instructors teaching different sections of the same course to meet and classify their assignments. This can be beneficial even if the instructors don't give the same assignments.

For each assignment, the instructor also associates (see Step 1 *Learning Taxonomy for Competency*) a depth of knowledge using a learning taxonomy scale (e.g. Bloom's taxonomy).

The activities shown in figure 4 produce two mappings. One maps course assignments to internal program learning goals and the other maps the assignments to externally generated competencies or learning objectives.

ACC 260 Computer Programming for Business
Section: 1, SP, 2008,
1 - Applications and Exercises - (Caption) Section

A caption/title is required. Click [Save] when finished with changes

Caption/Title

Caption/Title order (1-999)

Competency will appear in Webfolio

Artifact/Content lock date

Learning Taxonomy for Competency

Competency type

Educational Standard(s)

Program Goals

Figure 4 Step 1. Assigning IS 2002 Learning Unit Goals to Course Assignment

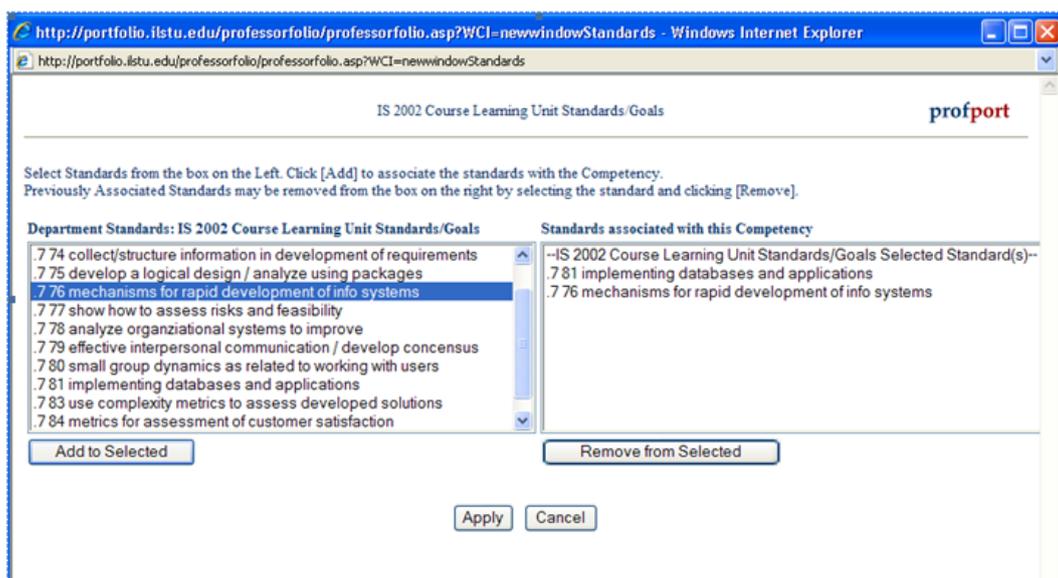


Figure 4 Step 2. Assigning IS 2002 Learning Unit Goals to Course Assignment

V. INCORPORATING STANDARDS AND GOALS: METHOD 2

Figure 5 shows another way that standards may be integrated in the system. Here course learning unit goals associated with *IS2002.7 – Analysis and Logical Design* are listed as they appear in the IS2002 report. A webfolio system administrator or assessment coordinator can create a “course” containing these goals. The term “course” is used because the student adds the folder to her portfolio the same way she would add a course and because IS2002.7 does represent a model course in IS2002. The right part of the figure shows how the *IS2002.7 – Analysis and Logical Design* and its associated goals appear in the student’s webfolio table of contents. Even though IS2002.7 is not a course at the authors’ institutions, a student can still address each of the learning units by adding one or more artifacts from other sections of the webfolio. For each caption (learning unit in IS2002.7), the student can paste one or more artifacts that the student believes demonstrates achievement or mastery of the learning unit. This artifact might come from any course. Done this way, the *student* is mapping the institution curriculum to the model curriculum. One benefit of allowing the student to select the artifact that she feels demonstrates mastery of a learning unit is that faculty members sometimes discover students are learning in unintended but desirable ways. An assignment designed to address one learning objective may also be assisting in developing another in ways not initially envisioned. Discovering this can assist the faculty in recognizing and strengthening this relationship when revising the curriculum.

| IS 2002.7 – Analysis and Logical Design (Prerequisite: IS 2002.1) | |
|---|--|
| Learning Unit Number | Learning Unit Goal |
| 72 | to present necessary concepts to provide the skills necessary to do the analysis, modeling, and definition of information systems problems |
| 73 | to give students exposure to using commercial program products to implement information systems |
| 74 | to show how to collect and structure information in the development of requirements and specifications |
| 75 | to show how to develop a logical design, and develop and analyze alternatives involving implementation using packages, tailoring of packages, constructing software, or CASE tools |
| 76 | to develop a functional understanding of rapid prototyping and other similar alternative mechanisms for rapid development of information systems |
| 77 | to show how to assess risks and feasibility |
| 78 | to show students how to analyze organizational systems to determine how the systems might be improved |
| 79 | to develop skills for effective interpersonal communication to develop consensus using classical techniques as well as computer facilitated groupware |
| 80 | to demonstrate and analyze small group dynamics as related to working with users |
| 81 | to develop application skills for implementing databases and applications by operating and testing these databases |
| 82 | to present and use complexity metrics to assess developed solutions |
| 83 | to develop quality metrics for assessment of software development and project control of software development |
| 84 | to develop quality metrics for assessment of customer satisfaction at all phases of the life cycle |
| 85 | to explain the use of a professional code of ethics to evaluate specific IS actions |

| |
|--|
| <ul style="list-style-type: none"> ACC 260 - Computer Programming for Bus ACC 270 - Information Systems in Organi ACC 362 - Advanced Business Systems An ACC 368 VB - Developing Business System ACC 468 MIS - Organizational and Techn ACC 166 Business Information Systems IS2002.7 – Analysis and Logical Design <ul style="list-style-type: none"> 72 Analyze/Model/Define 73 Comercial Program Products 74 Requirements/Specification 75 Packages (e.g. Case Tools) 76 Rapid Development 77 Assess Risks/Feasibility 78 Analyze Organizational Sys 79 Communication and Consensus 80 Working With Users 81 Implementing DB and Apps 82 Metrics to Assess Solutions 83 Dev Metrics Project Control 84 Dev Metrics Cust Satis 85 Code of Ethics |
|--|

Figure 5. IS 2002 Learning Units (left) as They Appear in a Student’s Table of Contents (Right)

VI. WEBFOLIOS AND ASSESSMENT, CERTIFICATION, AND ACCREDITATION

At the outset of this section, we briefly note the distinction between assessment and evaluation. Generally, assessment refers to a process involving measurement, analysis, and feedback with the purpose of improving performance. In contrast, evaluation is focused on determining the level of quality based on standards. Evaluation addresses to what level the standards have been met and is not concerned with how the level was attained or how to improve it [Baehr, 2003] [Astin, 1991]. Both of these terms may be used to refer to students and to programs. In this section we will focus on the use of student evaluation scores (i.e. artifact scores) in program assessment. That is, we will describe the use of webfolios and associated artifact evaluation scores in the improvement of a program. We also will discuss the application of webfolios to credentialing and accreditation.

For many years, industry and academia have cooperated in efforts to improve IS educational programs by developing information systems model curricula variously referred to IS90, IS95, IS97, IS2002. This ongoing effort is now referred to as the Information Systems Undergraduate Model Curriculum Project (ISUMC) [AITP EDSIG]. More recently a vendor neutral exam has been created for credentialing entry-level professionals based on their knowledge of information technology [McKell et al., 2006]. Assessing and accrediting IS educational programs also has received considerable attention. *A panel discussion at the annual Information Systems Educators Conference (ISECON) (McKell, 2001) focused on this topic by addressing the question whether or not existing ICCP certifications could be used as a complement to program accreditation by extrapolating compliance with the IS MODEL Curriculum guidelines from individual performance scores on ICCP examinations* [McKell et al., 2006].

The Information Systems Analyst (ISA) certification created by the Institute for Certification of Computing Professionals (ICCP) is based on examination performance and completion of an IT related undergraduate degree. The examination also was designed to *provide institutional feedback on programmatic preparation of graduates consistent with the IS2002 Model Curriculum* [McKell et al., 2006]. Here we explore the use of webfolios in place of, or complimentary to, such exams.

Webfolios have received considerable attention in other disciplines as authentic evidence for assessment. Redish et. al. [2005-2006] have observed *The use of electronic portfolios has flourished in recent years—particularly in light of accreditation organizations demanding better organized and accessible student work.*

As implemented in the webfolio system describe here, instructor feedback and grades reported to students are kept separate from artifact scoring for program assessment. We already have described how faculty can provide formative feedback to the student through the comment log for each artifact a student produces. In other words, the system does provide student assessment support. In program assessment, we are interested in closing the assurance of learning loop in the sense that we want to measure the program's performance and identify ways of improving it. Aggregated artifact evaluation scores can be used to assist in program assessment.

For program assessment purposes, the system allows departments to establish a rubric with scoring categories of the department's choice. Different departments at an institution may have different assessment rubrics. Figure 6 shows the interface for scoring a student's artifact. Scoring and analysis of scoring can become unwieldy if the number of categories is more than a handful and here five categories are used. This evaluation score could be for an artifact that a student produced in response to an assignment in a particular course section or for an artifact

that the student selected to show his mastery of a standard or achievement of a goal listed in his webfolio's table of contents as in figure 5. Either way, the evaluation score is not seen by the student and is determined apart from any grade that the course teacher might assign. This score is directly tied to specific program learning objectives and standards that may have been constructed internally or externally as shown in figures 4 and 5. In these figures, we showed how the mapping to IS2002 learning unit goals was accomplished.

Departmental Assessment Measure Rubric

profport

Evaluate Mastery of the Artifact and enter a score in the Assessment Score box.
Click [Apply] to record the score or [Cancel] to leave the score unchanged.

| 1 | 2 | 3 | 4 | 5 |
|---|---------------------------------|-----------------------|--|---------------------------------------|
| not met | met minimally | met | above average | met excellent |
| Requirements were unacceptable or not met | Requirements were minimally met | Requirements were met | Requirements were met with some excellence | Requirements were met with excellence |

Assessment Score: Use for Assessment:

Apply Cancel

Figure 6. Assigning Score When Viewing Student Artifact. (This score is tied to the standards associated with the assignment the student responded to)

The artifact scores collected by the webfolio system can be exported from the system in a standard format so that they can be imported into graphing and analysis software packages. For example, figure 7 shows the type of graphical comparison for a particular standard that can be created using Excel. Again, such graphs reflect artifact scores that are, in turn, associated with a particular program standard or learning objective from sets composed internally or externally to the institution. Graphs and other score analysis of authentic work samples measure performance associated with a specific program learning objective. For any learning objective, sequencing of supporting assignments by depth of knowledge can be examined with associated artifact scores to identify weakness in the learning sequence. Collectively, the graphs and other score analyses provide evidence about strengths and weaknesses in program performance. Since the scores are tied to learning objectives, assignments and activities, and depth of knowledge, it is possible to identify assignments and activities that are adequately supporting mastery of associated learning objectives and those that are not. This provides a basis for improving the program.

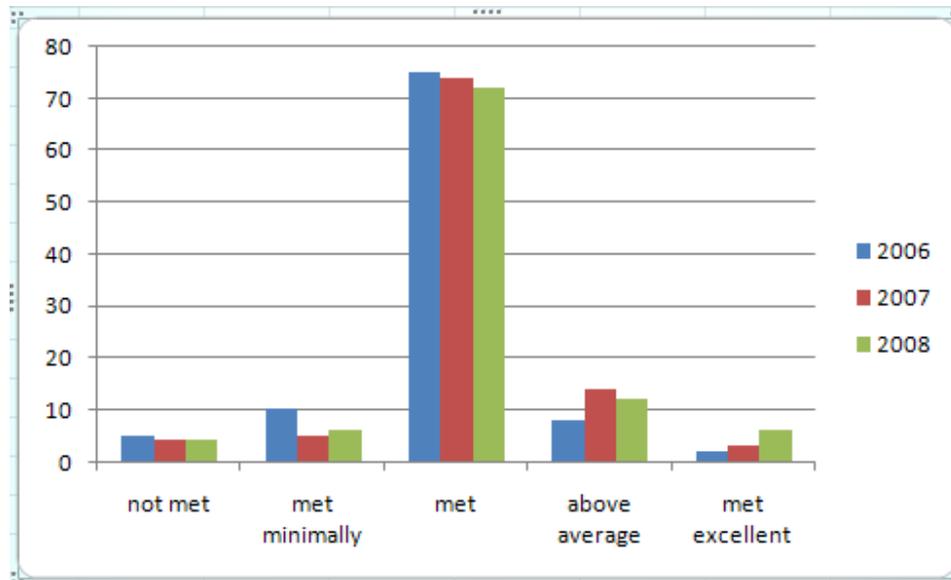


Figure 7. Webfolio System Assessment Data Exported to Excel to Produce a Chart to Show Assessment Results for a Particular Standard or Learning Objective.

Support for assessment against both internal and external standards, learning objectives, or learning goals is critical. Assessment of a program may be concerned with how well the program prepares students for external professional certification; how it compares with a model program; and what can be done to improve the program in terms of these external constructs. We already have discussed the ISUMC model curriculum and the ISA certification in this regard. In contrast, Hollister and Koppel, writing about assessment of an information technology program, have noted the importance of internally generated learning goals and assessments for meeting AACSB International's assurance of learning requirements. They indicate that AACSB expects learning outcomes, goals, and assessment to be institution specific based on the school's mission. *Business schools are now required to develop learning goals for each program, assess student's achievement of goals, and use assessment results for continual improvement in programs* (Martell and Calderon, 2005) [Hollister and Koppel, 2007]. In addition, the assessment program may be based on direct measures such as exams and assignments to assess student performance. We have shown here how webfolio artifacts scores can be analyzed against multiple sets of learning objectives or standards, both internal and external.

Tubaishat et al. [2009] report on an e-portfolio assessment system in an information technology curriculum. They observe that accreditation organizations such as the North Central Association of Colleges and Schools require institutions to have a process for assessing students' learning outcomes. A requirement for their IT college is to have students develop an e-portfolio to showcase work and demonstrate achievement of college learning objectives.

As noted in our previous reference to Redish, the use of webfolios in program assessment of education and selected other programs outside of business schools is well established. Although not yet mainstream in business schools, interest is evident. For example, Spruell and Sasse (2009) describe the use of a portfolio system in an introduction to business course to gather evidence for meeting AACSB's assessment requirements. They note that AACSB's shift to direct assessment measures will require extensive redesign in assessment tools and methodologies. Webfolio systems are tools that will assist in this shift.

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