Learning Management System Technologies and Software Solutions for Online Teaching:
Tools and Applications

Yefim Kats
Ellis University, USA & Rivier College, USA

Information Science REFERENCE

INFORMATION SCIENCE REFERENCE

Hershey · New York

Director of Editorial Content: Kristin Klinger
Director of Book Publications: Julia Mosemann
Acquisitions Editor: Lindsay Johnston
Development Editor: Elizabeth Ardner
Typesetter: Gregory Snader
Production Editor: Jamie Snavely
Cover Design: Lisa Tosheff
Printed at: Yurchak Printing Inc.

Published in the United States of America by
Information Science Reference (an imprint of IGI Global)
701 E. Chocolate Avenue
Hershey PA 17033
Tel: 717-533-8845
Fax: 717-533-8661
E-mail: cust@igi-global.com
Web site: http://www.igi-global.com/reference

Library of Congress Cataloging-in-Publication Data

Learning management system technologies and software solutions for online teaching : tools and applications / Yefim Kats, editor.
p. cm.
Includes bibliographical references and index.
Summary: "This book gives a general coverage of learning management systems followed by a comparative analysis of the particular LMS products, review of technologies supporting different aspect of educational process, and, the best practices and methodologies for LMS-supported course delivery"--Provided by publisher.
ISBN 978-1-61520-853-1 (hardcover) -- ISBN 978-1-61520-854-8 (ebook) 1. Internet in higher education. 2. Education, Higher--Computer-assisted instruction. 3. Organizational effectiveness. 4. System analysis. I. Kats, Yefim.
LB2395.7.L43 2010
371.33'44678071--dc22
2009040623

British Cataloguing in Publication Data
A Cataloguing in Publication record for this book is available from the British Library.

Chapter 15
Developing Student e-Portfolios for Outcomes-Based Assessment in Personalized Instruction

Kam Hou Vat
University of Macau, Macau

ABSTRACT

This chapter investigates the pedagogical issues of student electronic portfolios (e-portfolios) in the context of personalized instruction for undergraduate education. The discussion elaborates on the educational potential of an e-portfolio system in facilitating an outcomes-based assessment of student achievements. The chapter illustrates practical examples of integrating theory and practice aimed at assisting a meaningful investigation of an e-portfolio system with a focus on inquiry-based student assessment. The objective of such an inquiry is to enhance and encourage student learning, especially learning by doing. Key issues and the necessary institutional support for an outcomes-based and personalized model of education in support of a portfolio learning system are identified. The interrelationship of portfolio assessment to curriculum and pedagogy and required changes to teaching and learning are described. The relevant learning theories that underpin the portfolio form of assessment are deliberated to caution how best to manage the use of e-portfolios for student learning and assessment. Looking beyond, it is expected that the e-portfolio system is an important element to support outcomes-based education involving collaboration from both faculty and students in pursuit of a quality learning experience.

INTRODUCTION

Interest in assessment for student learning at colleges and universities has skyrocketed in the late twentieth century and continues to grow. Today there emerges an imminent need on the part of many a university to learn how to do student assessment, and do it the right way to empower student learning. The idea of outcomes-based assessment (OBA) is not new, and it is related to an educational model in which curriculum and pedagogy and assessment are all focused on student learning outcomes. It is an educational process that fosters continuous attention to student learning and promotes institutional

DOI: 10.4018/978-1-61520-853-1.ch015

accountability (Driscoll & Wood, 2007). Simply put, the OBA model emphasizes such important practices (Larkin, 1998) as: Faculty publicly articulating assessment information in advance of instruction; students being able to direct their learning efforts to clear expectations; and student progress and acquisition of learning being determined by evidence demonstrated in achieving the learning outcomes. So, the key component in the OBA model of education is outcomes which inform curriculum, teaching and assessment. Maki (2004, p.60) describes a learning outcome as what students should be able to demonstrate, represent, or produce based on their learning histories. Huba and Freed (2000, pp.9-10) describe learning outcomes as teachers' intentions about what students should know, understand, and be able to do with their knowledge when they graduate. For obvious reasons, university faculty is the most appropriate source of student learning outcomes. The issue is how faculty should be empowered in the process of assessment to enhance student learning. One of the most important conclusions about the effect of outcomes on student learning comes from the studies of John Biggs (1999). Biggs found that student achieve deep learning when they have outcomes on which to focus. If students do not know what is important to focus on in their studies, they try to cover all the information, so they skim, they cram, and they stay on the surface. If they have a priority or focus, they are able to dig, to expand, and to achieve depth of understanding. According to Derek Rowntree (1987), if we wish to discover the truth about an educational system, we must look into its assessment procedures. What student qualities and achievements are actively valued and rewarded by the system? How are its purposes and intentions realized? To what extent are the hopes and ideals, aims and objectives professed by the system ever truly perceived, valued, and striven for by those who make their way within it? The answers to such questions are to be found in what the system requires students to do in order to acquire the expected learning outcomes. It is convinced that the electronic transformation of student portfolio assessment, coupled with the context of personalized instruction, with the advent of the Internet technologies should define the de facto curriculum, and promote sustained institutional dialogue about the OBA impact in a learning-centered education.

BACKGROUND

Today, the use of portfolios have fast become a desired tool for assessing student learning (Zubizarreta, 2009; Johnson, Mims-Cox, Doyle-Nichols, 2006; Banta, 2003) because they are designed to provide authentic evidence of what students know, believe, and are able to do. Assessment for student learning is considered authentic when it focuses on real performance and mastery of a field of knowledge. If instruction is the means by which content, standards, and outcomes are made known to students, then assessment measures the degree to which the standards and outcomes have been achieved. As instructors in higher education, we realize that using portfolios with our students is increasingly transforming the way in which we interact with and engage them in the learning process. This is the kind of appraisal that engages teachers in the process of developing, reviewing, and evaluating portfolios of student work based on explicit criteria and procedures called scoring rubrics. The portfolio is to document what students know and are able to do. Students collect and select pieces of their own work over a period of time as evidence of completing their learning objectives or targets. Usually, students also write a rationale to explain why they think the selected pieces are their best work. Teachers exercise their advising and mentoring roles in the process, recognizing that when instruction is personalized, only authentic forms of assessment can appropriately characterize student performance. Student portfolios may include artwork; essays and other writing samples; logs or journals; notes and reflections;

observation checklist (student and/or teacher); peer evaluations; photographs related to projects; reading inventories and lists; reports (personal or of group work); self-evaluations; solutions to problems; tests and quizzes; video and audio recordings of presentations and performances; and worksheets (Case, 1992; Ryan & Miyasaka, 1995). In a personalized learning environment, the use of electronic student portfolios (Vat, 2009, 2008) to encourage active learning on the part of students is getting more and more popular today. An electronic portfolio (or e-portfolio) could be considered as an extension of the paper-based portfolio, bringing with it the obvious benefit of making a portfolio of evidence portable and shareable anywhere that we have Internet access. In fact, an e-portfolio has a much broader scope as an online collection of reflections and digital artifacts (such as documents, images, blogs, resumés, multimedia, hyperlinks and contact information). Students can use an e-portfolio to demonstrate their learning, skills and development and record their achievements over time to a selected audience.

According to Linda Suskie (2009), authentic assessment for student learning constitutes an ongoing process of learner-centered activities including: a) establishing clear, measurable expected outcomes of student learning; 2) ensuring that students have sufficient opportunities to achieve those outcomes; 3) systematically gathering, analyzing, and interpreting evidence to determine how well student learning matches the expectations; and 4) using the resulting information to understand and improve student learning. Tellingly, the four steps enumerated above do not represent a once-and-done process but a continuous four-step cycle. Namely, in the fourth step, assessment results are used to review and possibly revise approaches to the other three steps, and the cycle begins anew. In fact, portfolio-based assessment is often viewed as part of an integrated, collaborative learning experience. It is convinced that students learn better when their college experiences are not collections of isolated courses and activities but are purposefully designed as coherent, integrated learning experiences in which courses and out-of-class experiences build on and reinforce one another. Understandably, when students can see connections among their learning experiences, their learning is expected to be deeper and more lasting. More importantly, when students are engaged in the consistent production of learning evidence to demonstrate progress completion of different sets of learning outcomes for a course, for a major, or as a comprehensive summative assessment for meeting graduation requirements, the mission of the portfolio is to facilitate the organizing of such evidence to serve as a reflective way of assessing student learning. As mentioned earlier, portfolios are collections of student evidence accompanied by a rationale for the contents and by student reflections on the learning illustrated by the evidence. In her review of literature on portfolios that appeared in Assessment Update, 6:4 (1994), Janet E. Boyle says (Banta, 2003, p.1):

The portfolio, as an element of authentic assessment, has captured the interest of many instructors who want a more comprehensive way to assess their students' knowledge and skills, to have students actively participate in the evaluation process, and to simultaneously develop students' skills of reflective thinking. These latter features make portfolios an attractive alternative to traditional summative testing.

Portfolios are considered best when they are planned and purposeful and contain evidence of student efforts, progress, and achievement. When portfolios are used effectively in assessment for learning, students should become active participants in the evaluation process. Indeed, learners must have an intense say in the development of portfolios: selecting evidence, connecting and explaining evidence items, and describing how the evidence illustrates learning. The process of developing a portfolio is full of possibilities for self-assessment and reflection, and the potential for

extended and enriched learning. Student portfolios are thereby a good partner with outcomes-based assessment.

The Context of Authentic Assessment

In many a university around the globe today, faculty are hungry for alternatives to traditional summative testing that will provide more comprehensive ways to assess students' knowledge and skills. They recognize that no single instrument can measure all that student know about a concept or issue, that not every student will be up to giving their best performance on any specific occasion, and that the important element of growth over time cannot be assessed with a single measurement. Thus, assessment as the process of gathering information about student learning, with an attempt to improve the same, must be authentic, regarding the range of students' knowledge and skills. In this light, portfolios can demonstrate a learner's accomplishments, and reveal the range of his or her abilities, talents and learning styles, using a variety of artifacts and media in collections of his or her work completed over a period of time, say, a semester, a year or two, or an entire college career. Another characteristic of authentic assessment that distinguishes from the traditional summative assessment is that too often summative assessment is developed by faculty and administered to students without their involvement – involvement that could deepen and strengthen student understanding. Using portfolios, students are expected to actively participate in the evaluation process, selecting materials to include and combine as evidence of specific learning. Many students take portfolio development very seriously because they plan to use some of the contents to convince potential employers that they have unique skills and talents. Also, since an essential feature of preparing a portfolio is reflecting on the content and explaining how components fit together to illustrate what has been learned, portfolios simultaneously develop students' skills of reflective thinking. Indeed, portfolio assessment as an instance of authentic assessment is adaptable to the needs and intentions of individual learners and the expectations of individual faculty members, programs and degree requirements. It could go beyond the potential of a single piece of evidence of learning in that portfolio provides a holistic picture of the learner's achievements. For example:

- assessment can be structured to include evidence produced early in a course or program, evidence produced midway, and evidence produced at the end.
- assessment can be structured to include drafts of evidence, feedback about the drafts, and final finished evidence.
- assessment can be structured with both required evidence (determined by faculty) and evidence submitted by the learner, with both sets of evidence demonstrating achievement of different sets of learning outcomes.
- assessment can be structured around learning outcomes with evidence generated by varied learning experiences, in varied learning contexts, and in varied forms (e.g., written, video, graphics).

Thus, the versatility of portfolios as a form of authentic assessment, as described above, enables us to see not only what students are learning, but also how they are learning. In fact, besides documenting student learning, the use of portfolios in authentic assessment often reveals the strength and gaps in our curriculum and pedagogy as well as strengths and gaps in student learning.

The Meaning of Personalized Instruction

Personalized instruction (PI) is often understood as a systemic effort on the part of a school to

foster student success (Keefe & Jenkins, 2008; Keefe, 1989). It is an attempt to achieve a balance between the characteristics of the learner and the learning environment. It typically begins with the identification of performance goals and criteria that describe what students should be able to do upon completion of their education. Sequenced instructional materials are then developed to provide a variety of ways for students to accomplish the school learning goals. At its best, the PI context is a management system designed to help students progress in an orderly fashion, taking time and failure out of the learning equation. Yet, PI must begin with learner needs and interests, and fashion the learning environment to meet those needs. It might take place in supervised study, in small groups and in electronic support environments. Students typically work alone, with one other or a few others, in scheduled seminars. Teacher coaching of students occurs on a one-to-one basis, but more often in a cluster of students working in the same area and topic of the curriculum. Since students will necessarily come to any learning experience with different prior experiences – and thus with different starting points for the material to be learned – successful teachers must know how to create experiences that let students access ideas in a variety of ways, yet always press for deeper and more disciplined understanding (Darling-Hammond, 1997, p.12). A personalized approach to education requires, on the part of the instructor, a strong knowledge of subject matter, substantial pedagogical skill, a commitment to helping individual students succeed, and a deep desire to make instruction both thoughtful and interactive. The teacher, acting as adviser and coach (Glasser, 1988; Carroll, 1975), must help students attain a sense of balance in the learning environment between what is challenging and productive and what is beyond the student's present capabilities. Yet, there are two essential aspects for personalized instruction according to Keefe and Jenkins (2008): the culture and the context, that must be put into proper perspective, if a school wishes to develop effective teaching and learning for student success. The cultural aspect establishes the foundation of personalization and ensures that the school prizes a caring and collaborative environment, student diversity, and individual development. The contextual aspect promotes and supports student engagement, thoughtful growth, and proficient performance. The combination of these two aspects should produce a challenging, integrative, learner-centered environment that is interactive and meaningful, but with reasonably structured learning activities, flexible use of time and space, as well as authentic, performance-based assessment of student progress. This conception of personalized instruction is somehow consistent with the blueprint for ongoing improvement in school organization and good practice, rendered by Darling-Hammond (1996): 1) Structures for caring and structures for serious learning, that enable teachers to know students well and to work with them intensely, through such means as smaller school size, student inter-disciplinary clusters, multi-year advisories, and extended time with individual students; 2) Shared exhibitions of student work which makes it clear what the school values and how students are doing. Teachers set standards, create authentic assessments, and display student work in every way possible to provide a basis for what works and what needs to be improved; 3) Structures that support teacher collaboration with a focus on student learning, especially teacher teams for curriculum planning, student advisement, and accountability for student success; and 4) Structures for shared decision making and dialogue about teaching and learning with other teachers, students, and perhaps larger communities. Teachers, often in collaboration with students, should agree on professional development, formulate curriculum, and design evaluation systems. These structures support a workable decentralization of authority and operation.

WHAT IS ENTAILED IN OUTCOMES-BASED ASSESSMENT?

Based on our discussion in the Background section, there are mainly four iterative stages in outcomes-based assessment (Suskie, 2009): 1) establishing clear, measurable expected outcomes of student learning; 2) ensuring that students have sufficient opportunities to achieve those outcomes; 3) systematically gathering, analyzing, and interpreting evidence to determine how well student learning matches our expectations; and 4) using the resulting information to understand and improve student learning.

Establish Intended Learning Outcomes

As faculty, the first element in the assessment process is to establish a set of intended leaning outcomes (ILOs), representing our intentions about what students should know, understand, and be able to do with their knowledge when they graduate. In fact, ILOs reflecting the discipline should be developed for each academic program and for each course in the program. ILO statements typically beginning with the phrase, "Students will be able to (SWBAT) …" are meant to be learner-centered, and developing such statements should reflect a systems approach to teaching in the program. When faculty collectively decide what graduates of an institution or program should know, understand, and be able to do, we are working as a team, rather than as individuals. We are collectively confronting an important question in higher education (Plater, 1998, p.12): What does the degree or certificate that we award mean and how can we prove it? Still, it is worthy to note that learning goals at the institutional level are likely to be more broadly stated than those at the program level, and those at the program level are likely to be more broadly stated than those at the course level. Just as Huba and Freed (200) point out, achieving the more specific learning goals that we develop for a course or even for a particular class period should nonetheless help students make progress toward achieving our program and/or institutional goals.

Provide Learning Opportunities Leading to ILOs

The second element in the assessment process is to ensure that students have sufficient opportunities both in and outside their courses that help them achieve the intended learning outcomes (ILOs). Namely, if we expect students to achieve our ILOs, we must provide them with learning experiences to acquire what they need to learn. Students' learning is largely affected by the way courses and other required experiences like independent studies, practicum, and internships are organized in the curriculum and the order in which they are taken. Thereby, it is conducive to designing the curriculum as a set of interrelated courses and experiences that will help students achieve the ILOs. Indeed, designing the curriculum by working backward from learning outcomes should help make the curriculum a coherent story of student learning (Plater, 1998, p.11). Consequently, as faculty develop or revise the curriculum, we should scrutinize each of the activities and experiences that we create in our courses and programs and ask ourselves this question: How will this help students achieve the intended learning outcomes of the institution, program, or course?

Develop Assessment Measures for Student Learning

The third element in the assessment process is to design, or select data gathering measures to assess whether or not our ILOs have been achieved. This element brings to a culmination the previous step of determining learning outcomes because the process of designing assessment measures forces us to come to a thorough understanding of what we really mean by the ILOs (Wiggins & McTighe,

2005). As we develop our assessment measures, we may find ourselves fine-tuning the learning outcomes. Typical assessment measures should include both direct and indirect assessments of student learning (Palomba & Banta, 1999). The former include projects, products, theses, exhibitions, performances, case studies, portfolios, interviews, and examinations. The latter include self-report measures such as surveys distributed to students which can be used both in courses and at the program and institutional levels. In all of these assessments, we ask students to demonstrate what they know or can do with their knowledge, such as to address enduring and emerging issues and problems in their disciplines. Yet, assessment measures (Wiggins, 1989), chosen to provide accurate and useful information for making decisions about learning, are referred to by different names, such as naturalistic assessment because of their intrinsic value; as performance assessments because they require students to demonstrate their learning; and as portfolio assessments because they allow us to evaluate the nature and quality of students' work over time. Whatever they are called, these assessments are effective tools for assessing mastery of factual knowledge, but more importantly, for finding out if students can use their knowledge effectively to reason and solve problems. And any evaluation must be based on subjective judgment using criteria we as faculty collectively develop.

Use Assessment Results to Improve Learning

The fourth element in the assessment process is to use the assessment results to improve student learning. At the course level, discussions between students and instructors should take place continually with a focus to improve individual student performance using the assessment results as indicators. At the program or institutional level, ongoing review of student achievement should take place among the faculty as a whole. Through discussion of assessment results, faculty should gain insights into the type of learning that is taking place in the program, and be better prepared to make informed decisions about needed program changes. As a result, our school should understand what students can do well and in what areas they have not succeeded. We should also raise questions about the design of the curriculum, about the teaching strategies in use, and even the ILOs. Furthermore, we should develop a better understanding of how better to assess student learning in a way that could build trust for our institution of higher education in the community, especially through sharing summaries of the assessment process with key stakeholders (students, alumni, and advisory groups) to seek additional perspectives. This is indeed an act of public accountability not to be ignored.

WHAT IS ENTAILED IN PERSONALIZED INSTRUCTION?

Based on Darling-Hammond's (1996) formulations of ongoing improvement in school organization and good practice as described in the Background section, it is believed that any school pursuing the philosophy of personalized instruction should include at least three essential components: teacher dual role as coach and as adviser, student learning characteristics, and collegial relationships.

Dual Teacher Role

It is believed that the teacher, as the instructional specialist who is closest to the learning situation and best understands the needs and interests of students, must be the indispensable catalyst in the PI environment. Personalized instruction demands that the teacher assumes the dual roles of subject-matter coach, consultant and facilitator on the one hand, and of teacher adviser to mentor selected group of students on the other. As learning

coach, the teacher is expected to collaborate with other teachers, student peer tutors, and community resource persons to guide student learning. As teacher adviser, the teacher provides advice, counsel and guidance to students on academic and school adjustment issues.

Teacher-Coach

The needs of today's students are quite different from those of their counterparts two or three generations ago as our world has experienced several social revolutions and knowledge explosion over the Internet in the past decades. Cognitive and problem-solving skills, also called meta-cognitive skills, are more important today than any particular piece of knowledge. Therefore, the teacher-coach in the school environment must be a facilitator of learning, a learning guide who helps students find appropriate resources and engage in suitable learning activities. Members of the LEC International (Georgiades, et al., 1979; http://www.lecforum.org/) describe such a teacher as not so much educational broadcaster as academic troubleshooter. He devotes fewer hours to lecturing and more to working with students individually and in small groups. He spends a good deal of time preparing basic instructional objectives, analyzing the specific strengths and weaknesses of individual students in relation to those objectives, and investigating and making available a wide range of learning activities and methods that will facilitate student success. He recognizes that each student is a unique human being with his own personal learning needs and style, and he knows that what works well for one may not work at all for another. Indeed, the teacher-coaches must be focused on whether, how, and what students learn, in the environment. They must get outside themselves and inside the minds of students (Lasley, 1998; Perkins, 1992). They must participate in the learning process with their students, in its planning, and its organization, concerned with how students are motivated to learn. Nonetheless, coaching requires time to interact with students, to connect with them, to understand their needs, to provide needed information, advice, and feedback about targeted skills, ideas, or issues. Bransford and Vye (1989) summarized befittingly the role and responsibilities of the teacher-coaches along these lines:

- Coaches monitor and supervise student attempts at problem solving both to give them experience in real problem solving and to keep them from going too far into flawed solutions;
- Coaches help students reflect on their own problem solving, encouraging them to think out loud or even modeling strategies for them;
- Coaches identify what students can already do by letting them solve problems and by providing feedback;
- Coaches help students experience new ways of thinking as guides to their own thinking, to compare and contrast their own ideas with other possibilities;
- Coaches help students comprehend and construct meaning in their experiences using resources related to their needs and interest (not unrelated exercises);
- Coaches use whatever resources are useful to engage students in learning including: presentation, discussion, learning packages, computer-based learning systems, and personal tutoring.

Teacher-Adviser

In a school geared to foster student success, advisement is an important responsibility of the teacher-adviser who plays a helping role to aid students plan and achieve appropriate career and personal-social goals. In a typical advisement setting, teachers, counselors, and other adults work as a team to promote student adjustment and success in school. Oftentimes, professional

counselors serve as advisers to a group of teacher-advisers and help them learn their role and function. School guidance functions that are of concerns to teacher-advisers generally include such areas as: 1) academic program planning, 2) career information, 3) school adjustment issues, and 4) personal-social guidance. To help students personalize their education experience, the teacher-advisers' tasks typically include the following (Keefe, 1983):

- plan student group activities, work with individual students in schedule planning, and counsel students on academic and school adjustment problems.
- collect information about each advisee and provide information as needed on personal and school adjustment, and career planning. Maintain personal folders (portfolios) on each advisee.
- help students recognize their personal aptitudes and interests. Meet with students regularly to discuss their goals, behavior, and academic progress. In particular, serve as a "friend-in-court" for students experiencing adjustment problems.
- function as home-base teachers and chief in-school contact for all persons and agencies concerned with the student. Talk to parents, community persons, prospective employers, and career counselors on behalf of their advisees.

Student Learning Characteristics

If the goal of personalized instruction is to build a learning environment suited to the aptitudes, needs, and interests of each student, any attempt to provide personalized instruction must begin with knowledge of the learner. Namely, some form of diagnosis is needed to determine what the learning-related characteristics of individual learners are. Indeed, many dedicated teachers spend a lot of time in observing students to find out where they are in the learning process, in checking student progress, and in prescribing learning resources and interventions for more successful performance. This kind of direct feedback and various types of diagnostic assessment are among the principal tools of instruction viewed as coaching, mentoring, facilitating, and advising. Three types of student learning traits that are of interest here include: developmental characteristics, student learning style, and student learning history.

Developmental Characteristics

Developmental characteristics are those specific stages in individual maturation when certain capacities for learned behavior appear, such as cognitive thinking skill. These characteristics tell us when a student is developmentally ready to learn something. It is understood that if teachers were to personalize student instruction, they must have a good understanding of the learner's developmental traits. Darling-Hammond (1997) called for developmentally attentive schools whose organization and student work must build on student developmental considerations. Learning activities should be based on student needs and legitimate interests rather than, arbitrarily, on generic curriculum guides or the contents of approved textbooks. Diagnosing student developmental characteristics and observing the demands of developmental attentiveness are not to be neglected in today's schools if we are to provide a personalized approach to education. Their importance in program planning and instruction can hardly be overstated.

Student Learning Style

Learning style encompasses information-processing habits, attitudinal tendencies, and biologically based responses that are typical of the ways a given student learns and prefers to learn. There are three broad categories of learning style characteristics: cognitive, affective, and physiological behaviors

that serve as relatively stable indicators of how students perceive, interact with, and respond to the learning environment. They can be measured by a variety of assessment techniques, including the *Learning Style Profile* developed by NASSP (http://www.nassp.org), which assesses 24 independent scales representing four factors: perceptual responses, cognitive styles, study preferences, and instructional preferences. The *Learning Style Profile* and other comprehensive style instruments help teachers identify student style strengths and weaknesses and organize instruction more efficiently and effectively. Learning style diagnosis is now considered as a key element in any attempt to provide a more personalized approach to education.

Student Learning History

Student learning history (Bloom, 1976, p.69) is a term used to describe the aggregate of personal learning that a student brings to a particular course, class, or school program. A learner's history characterizes his or her instructional readiness which is another broad area of diagnosis. Learning history tells us what a student knows at a given point in his or her learning career – the knowledge and skills the student possesses before beginning a new learning experience. Diagnosis of a learning history involves the determination of what has occurred as a basis for what should occur. Tellingly, existing student knowledge and skills define the expected ground for student success in subsequent learning. Observation, surveys, inventories, and curriculum-referenced tests could best assess these knowledge or skill levels. Indeed, information about student learning history must be made available to teachers in cumulative record folders (student portfolios), in teacher and counselor reports, and from student questionnaires, inventories, and various diagnostic tests.

Culture of Collegiality

The idea of collegiality is closely related to a school culture of collaboration where teachers and students work together in a cooperative social environment to develop meaningful learning activities. It is considered as an important ingredient of a school advocating personalized instruction. According to John Goodlad (1984, p.242) in his landmark work, *A Place Called Schoo*l, we found students sitting passively in class, listening to lectures, and doing seatwork. The climate of the school was largely nice and pleasant, but teacher-student relationships were perfunctory or cordial but antiseptic. We cannot help but wonder about the flat, neutral emotional ambience of most of the classes observed. Boredom is a disease of epidemic proportions. Of course, students took every opportunity to talk to one another, and were very social, but had little opportunity to actively participate in their schoolwork. Glasser (1986) tells us that if what is being taught does not satisfy the needs about which a student is currently most concerned, it will make little difference how brilliantly the teacher teaches – the student will not work to learn. Wolk (2007) commented that passive schooling creates passive people. If we want people to think, learn, and care about the many dimensions of life, if we want neighbors who accept responsibility of tending to the world and making it a better place, then we need schools and curricula that are actually about life and the world. In personalized environment, students are empowered to pursue work that is meaningful to them; they can satisfy their needs. A constructivist environment and collaborative learning arrangement are found to characterize such a collegial culture:

Constructivist Environment

The constructivist view of schooling (O'Neil, 1992; Perkins, 1992) holds that people learn by actively constructing knowledge. They weigh

new information against their previous understanding, thinking about and working through discrepancies on their own and with others. Finally, they come to a new understanding. This perspective of constructivism borrows from various movements in other disciplines, including social construction of reality in sociology, phenomenology in philosophy, and constructivism in psychology. It is believed that learners can make meaning of what they are learning, and they construct that meaning in light of their prior knowledge and experiences. In a classroom faithful to constructivist views, students must be afforded numerous opportunities to explore phenomena or ideas, to conjecture, to share hypotheses with others, and to revise their original thinking. Time and opportunity for reflective dialogue are critical elements of such a learning environment. Constructivist teachers typically build instruction on student learning styles and skills, and involve students in self-directed learning and in collaborative approaches for a specific topic of study. Students work with their teacher-coaches to improve their cognitive skills and to expand their current experience through reflection, seminars, and other group projects.

Collaborative Learning Arrangements

Today, numerous evidence exist that students learn better in cooperative groups than when alone (Slavin, 1991, 1995). Cooperative small groups encourage collaboration and afford better socialization than traditional classrooms. Collaborative learning calls for positive inter-dependence among learners, face-to-face interaction, individual responsibility for mastering the target material, and interpersonal skills fostering cooperation and effective working relationships. Collaborative learning arrangements provide an opportunity for students and teachers to work together to verbalize their ideas, to sharpen their thinking, and to capitalize on differences. Students at different levels of school achievement are expected to work together for some good reasons (Glasser, 1986):

- Students gain a sense of belonging by working in small teams;
- Belonging provides the initial motivator for students to do the work. As they achieve some success, they will want to work even harder;
- Stronger students find it need-fulfilling to help weaker students toward a high performing team effort; weaker students find it need-fulfilling to contribute to the team effort. Alone they are able to do little.
- Students do not depend only on the teacher, but also on the team and their own creativity;
- Learning teams provide needed structure to avoid superficiality and support in-depth learning; they have flexibility in the kinds of evidence they present about the knowledge learned or skills achieved;
- Teams can be changed to give all students a chance to work together and to serve on high-scoring teams.

Overall, collaborative learning arrangements are a requisite for a personalized learning environment. These arrangements promote interaction, dialogue, and thoughtful reflection. Together with an enhanced teacher role, and a strong diagnostic component, a culture of collegiality sets the stage for the practice of personalized instruction.

DEVELOPING STUDENT ELECTRONIC PORTFOLIOS IN EDUCATION

The use of electronic portfolios (e-portfolios) in education for learning and assessment is becoming increasingly popular today (Jafari & Kaufman, 2006; Barrett, 2004; DiBiase, et al, 2002; Cambridge, 2001; Johnson, Mims-Cox,

Doyle-Nichols, 2006). Initially, an e-portfolio may appear as simply a collection of work that has been compiled over a period of time. It is sometimes compared to a scrapbook because it contains artifacts that are selected over time. Yet, the contents of an e-portfolio are often organized to assess competencies in a given standard, goal, or objective and they focus on how well the learner achieves in that area. Through the use of artifacts, which are concrete examples of the student's work, e-portfolios contain evidence of knowledge, dispositions, and skills (Batson, 2002; Brown & Irby, 2000). In particular, an e-portfolio that is used for assessment and evaluation requires the learner to engage in higher levels of thinking through the use of inquiry and reflection (Acosta & Liu, 2006). Inquiry involves a process of collecting, sorting, selecting, describing, analyzing, and evaluating evidence to answer questions on how well the evidence represents the learner's accomplishment of a standard, goal, or objective. The learner is involved in a personal type of action research that entails continual reflection or questioning and resorting of the selected work. The e-portfolio is an ideal tool for meeting the needs of reflective learning which is a form of mental processing applied to gain a better understanding of relatively complicated or unstructured ideas. In the process, the learner is expected to answer how he or she must improve personal practice in order to acquire learning. That way, an e-portfolio is often understood as a user-centered, personalized learning space allowing the user to shape the way an individual presents him or herself to the world. Content and layout can be personalized to create multiple views which meet the specific, differing or changing requirements of the user. This connects well with one of the key tenets of personalized instruction, that students become key partners in the design of learning to suit their needs. Personalized instruction involves thinking about knowledge as an active process. Students get to be informed, active participants in their own learning, they contribute to decisions about what learning can work best for them, and they have a much better understanding of how they are progressing in a specific field of work. Oftentimes, an e-portfolio carries with it the element of being reliably and swiftly updated, as well as easily accessible in terms of the data being tracked. Thereby, an e-portfolio model of education (Vat, 2009, 2008; Platter, 2006; Flanigan & Amirian, 2006; Herbert, 2001) implies a system of empowering the individual to learn and to demonstrate his or her learning acquired over a period of time through an electronic medium of ongoing support. More befittingly, e-portfolios could be considered as personal online spaces for students to access services and store work. They will become ever more useful as learners grow up and start moving between different types of learning and different institutions. They have the potential to provide a central, linking role between the more rigid, institution-led learning management system and the learners' social online spaces.

The E-Portfolio Context of Student Learning

As online technologies and information resources rise in salience with the advent of the Internet, we are witnessing the emergence of a multi-faceted techno-pedagogic reality in the development of online support for student learning. The e-portfolio model of education could be considered as a result of several important converging forces. Such forces are causing the education community to re-examine where learning takes place and how it could be assessed, how work and knowledge should be managed, who we, education practitioners, really are as we present ourselves to the world, and how we use technology for teaching and learning. This idea of the e-portfolio is said to be a flashpoint "at the converging of imperatives and opportunities in the management of learning for human and social capital development" (Ja-

fari & Kaufman, 2006, p.xxvi). Technically, its context ranges from the simple conceptualization of e-portfolio as a means of capturing student progress through a program of study, involving student work, student reflection, and faculty comments related to activities of teaching and learning (Henry, 2006), to the technological potential (Plater, 2006) which allows faculty and institutions to actually enable each student to have a personally managed, meaningful, coherent, integrated lifelong record of learning that demonstrates competence, transcends educational levels, and is portable across institutions of learning. In fact, e-portfolios are more than storage devices of the learner's best work (O'Brien, 2006). They provide the means for students to set learning goals, monitor and regulate their progress toward these goals (a form of self-directed learning), as well as develop their self-assessment skills. Practically, e-portfolios should serve as the student's pathway from classroom to career.

The Personalized Aspect of E-Portfolios

As life-long learners, we are always looking for tools to transform our learning experience, to enable learners to become autonomous and enjoy a truly personalized development path. It is believed that the e-portfolio is one of the most significant tools for achieving this goal. It should support the realization of a portfolio-based career, and act as an instrument for social inclusion, allowing us to "tell our story" and celebrate our achievements (Flanigan & Amirian, 2006). In fact, the e-portfolio could facilitate a continuum in the learning space where someone starting an e-portfolio at school, college, university, or work would not have to throw away the investment of years when moving from one episode of life to another. The e-portfolio should be our faithful digital companion, reflecting our digital identity and supporting our learning, and enabling transactions with others in a variety of social networks. For instance, in the professional circles, e-portfolios could become the indispensable tools for reflective practitioners extracting learning from the workplace, and sharing their reflections with their peers to contribute to the development of different professional learning communities.

The Learning Aspect of E-Portfolios

In a typical learning environment, there are many roles the e-portfolio can play, examples of which include the means of assessing student learning, the means of showcasing outstanding student achievements, and the means of ensuring learner accountability (Acosta & Liu, 2006; Sherman, 2006). Yet, whichever role the e-portfolio might play, there is one aspect that all e-portfolios have in common: namely, the learners must create portfolio elements or artifacts to be presented within the portfolio itself. As instructor or facilitator of e-portfolio learning, the design of sample e-portfolio requirements to document and communicate the learning of skills reflected in the learning process becomes critical. Examples include a learning contract with specific lesson plan detailing what the expected learning should be and the way to demonstrate the acquired learning. Such e-portfolio requirements should delineate the specific artifacts to be created by the learners to complete the process of learning. Indeed, this act of "creation" would necessitate the learning and/or application of a variety of skills related to the learning episode. Importantly, using the e-portfolio requirements as an aid of setting personal learning goals becomes a form of instructional scaffolding. Oftentimes, learners need to articulate clearly the goals of every piece of new learning experience by demonstrating the series of created artifacts to be included in the e-portfolio as evidence of the lessons learned. In this regard, examples of similar works from different learners could be collected into the e-portfolio repository for comparison and evaluation.

The Design Aspect of E-Portfolios

The advent of Web technology has brought about the currency of e-portfolio, which can not only be considered as an effective way to assess student learning, but also as a vehicle for knowledge development and for career building (Napper & Barrett, 2004). The key behind the e-portfolio movement lies in the empowerment of the learner to take charge of his or her own learning (Ramsdon, 2003; Barrows, 1988). Specifically, the e-portfolio scheme of learning shifts the locus of control from what we faculty teach to what students learn (Acosta & Liu, 2006); namely:

- *Enable students to determine what they need to learn through questioning and goal setting*

It is believed that students should work to identify their knowledge and skill deficits, and to develop strategies in the form of personal learning goals for meeting those deficits. The emphasis is to foster a sense of students' ownership in the learning process. In particular, e-portfolios emphasize analysis and reflection, and the development process, but not merely the product of learning. This process perspective not only raises the cognitive bar, but also shifts the locus of control from not so much what the instructor is doing, to what the student is doing to meet learning objectives. Moreover, the student can reflect on his or her learning and can demonstrate learning to persons outside of the immediate learning environment with the production of relevant electronic artifacts. For example, interested employers could review a student's resume, group project contributions, and other items of interest the student wants to make accessible. Likewise, if teachers, through the e-portfolio support environment, can guide the students in identifying what they already know and what they need to learn, then knowledge gaps and mistakes can be viewed in a positive way such as another opportunity to learn. And students can assume more responsibility in addressing their own learning needs during any instructional episode

- *Enable students to manage their own learning activities*

It is believed that students must be enabled to develop their learning plans, which should describe priorities, instructional tactics, resources, deadlines, roles in collaborative learning situations, and proposed learning outcomes, including presentation and dissemination of new knowledge and skills, if applicable. Traditionally, these instructional events are arranged by teachers to be obeyed by students, in order to accomplish a specified set of pre-determined objectives. Yet, it is not advantageous for students to learn to be self-directed. To manage their own learning activities, students must be guided and supported by the teacher, through the e-portfolio environment, slowly taking on more and more responsibility of their own learning. For example, collaborative learning, inside and outside of the academy, is another feature of the new portfolio model, which should document such efforts as peer-to-peer projects promoting teamwork and communication skills, student-mentor projects (say, internships in the industry) giving students the opportunity to experience the world of work for better understanding of their future profession and workplace culture, student service-learning projects offering students first-hand understanding of societal issues and problems. Whichever type of projects the student is involved, he or she should maintain housekeeping of his or her e-portfolio and allow peers, mentors, and the community to give input, while the instructor at school provides the opportunity for the interactions, and assesses the intended learning outcomes.

The Curriculum Aspect of E-Portfolios

It is anticipated that the e-portfolio, as a tool to transform teaching and learning, should become a catalyst for curriculum change and a new model of assessment, which should connect the educational mission and objectives with the needs of society. It should also bring students closer to their future profession, and carry learning into students' future careers and possibly into their lifelong devotions. Thereby, the e-portfolio review process should serve as the feedback mechanism to update the academy on the skills required by students as they enter society. Put it simply, if students are immersed in projects that extend into the dynamic workplace and community (rather than the limitations of the campus) then they must demonstrate not only applicability of knowledge, but also flexibility and adaptability. The pedagogical challenge then is to set up connections between academic objectives and societal needs that will update the curriculum by incorporating current global perspectives. It is also expected that faculty members will then be in discussions with interested parties in the community to determine student outcomes. Therefore, the assessment of a course, program of study, and the related discipline will be somehow corroborated with persons outside of the academy. In this regard, the deliberation of an e-portfolio scheme of student learning, including its elements of flexibility should always be an important area of concerns.

CASE EXPERIENCE

Many of today's users demand a personalized learning experience that extends beyond traditional boundaries to include social networks of peers, evaluators and even external experts. To meet this challenge, the idea of e-portfolios is being adopted at a growing number of universities worldwide to help users analyze patterns in their learning based on intended learning outcomes and performance criteria (Lorenzo & Ittelson, 2005). The Department of Computer and Information Science (DCIS), as a constituent unit of education under the Faculty of Science and Technology at the University of Macau, is installed to offer degree programs in both the undergraduate and graduate levels in Software Engineering. The department has a current population of about 180 undergraduates and 50 graduate students mostly part-time. It has to coordinate per academic year, the enactment of about 20 graduate and 40 undergraduate courses. To help manage course delivery, the university provides course management systems, such as WebCT (since 1998) and MOODLE (since 2008) to teaching staff for their course enactment. Currently, the means of education delivery in our department has largely been didactic; yet, we are quite willing to combine the best of our old values of good teaching through the instructivist approach with the modern-day constructivist way of thinking such as problem-based learning (PBL) (Amador, Miles, & Peters, 2006). We are also interested in the continuing efforts to extend our curriculum and instructional practice over the Internet, blending some continually renewed electronic (mostly Web-based) course support, with our conventional face-to-face interaction between teaching staff and our students. The use of e-portfolios in our DCIS department has not been institutionalized yet. Still, bottom-up e-portfolio efforts from individual academic staff have been encouraged so long as the educational potential for enhancing student learning could be realized in a positive direction. It is believed that the development of e-portfolios could render a program assessment process where teachers and faculty can examine and improve classes and programs based on student achievement of intended learning objectives and standards.

The PSU Model Adapted

Following a model similar to the Pennsylvania State University's e-portfolio system (http://portfolio.psu.edu), we believe that over the course of a student's college years, the e-portfolio should play a variety of roles. Firstly, it should reinforce the process of student learning by embracing a user-centric approach, and by prompting students to take more responsibility for their own learning. Secondly, it should integrate seamlessly with any Learning Management Systems (LMS) in use, such as our MOODLE environment (http://ummoodle.umac.mo). Thirdly, it should enable students to receive feedback and assessment from peers and others, by showcasing student achievements to multiple audiences. It should also provide a portable demonstration of users' acquisition of knowledge and skills, and place personal learning in a social networking context. Collectively, e-portfolios should enable students to enhance their learning by giving them a better understanding of their skills, as well as where and how they need to improve in order to meet their academic and career goals (Lorenzo & Ittelson, 2005). Besides, e-portfolios should preferably pair social networking and informal learning with traditional classroom education, thus accelerating and expanding student learning. It is believed that harnessing social learning enables institutions to be more responsive and learner-centered across the learning landscape. Students can be linked to an active network of their peers and mentors enabling learning beyond the boundaries of the classroom. More relevantly, the ability to publish in a variety of media within the e-portfolios should give students ultimate control over their learning journey. Thereby, the use of e-portfolios can truly embrace the idea of a personalized learning environment. Consequently, e-portfolios can be utilized by students, faculty and staff, and by the administration of an institution (Lorenzo & Ittelson, 2005; Kahn, 2001) for such functions as: plan educational programs; document knowledge, skills, abilities and learning; track development; define, develop and embark on a career path; evaluate a course, program or institution; and monitor and evaluate personal performance.

E-Portfolio Designed as a Tool for Assessment

In fact, different portfolios (Stefani, Mason, & Pegler, 2007) have been used by students at traditional universities and colleges where face-to-face teaching is the dominant mode of educational delivery. For example, course portfolios are those assembled by students for individual courses. They document and reflect upon the ways in which the student has met the outcomes for that particular course. Instructor's endorsement is often required to authenticate the course portfolios. Program portfolios are developed by students to document the work they have completed, the skills they have learned, and the outcomes they have met in an academic department or program. The mentor or appraiser could add comments. It could be a requirement for graduation. Students might use a selection from their program portfolio to show to prospective employers. Whatever the primary focus of engagement with students, the use of e-portfolios inevitably adds a strong online element to the activities of teaching and learning. Institutions need to provide electronic support and services; teachers need access and skills to integrate the e-portfolio application into their overall course design, and students need a wide range of electronic abilities in order to develop their e-portfolios. The underlying pedagogy for e-portfolio use is considered the most significant link with online learning support. Our experience has indicated that constructivism (Vat, 2006, 2004; Bangert, 2004) does seem to be the approach worthy of repeated experimentation. The aim of constructivist principles as applied to student learning is to engender independent, self-reliant learners who have the confidence and skill to use a range of strategies to construct their own knowl-

edge (Eklund et al, 2003; Slavin, 1994). Where students are required to develop and maintain their e-portfolios, they are expected to reflect on their learning, consider how to give evidence of their learning and then develop a plan of what they would like to learn. In other words, an e-portfolio implementation of constructivism usually implies a considerable level of learner autonomy and initiative, of learner responsibility for their learning and of opportunities to refine their learning based on feedback from the teacher and their peers. More importantly, the use of e-portfolios can be the basis for several student-centered initiatives (Batson, 2005), including: creating a system to track student work over time, in a single course, with students and faculty reflecting on it; having a more fully informed and constantly updated view of student progress in a program, which is very helpful in formative assessment; aggregating other students' work in a particular course to see how the students as a whole are progressing toward learning goals; and assessing other courses in similar ways that are all part of one major and thus assessing the entire program of study.

E-Portfolio Positioned as a Tool for Learning

The ease with which the digital form can be adapted, linked and transported is essential to the emergent means of enhancing the use of e-portfolios. One example is an electronic showcase to present student work to prospective employers, or to obtain a place on a post-graduate course. It is a showcase of the student's versatility and an indicator of his or her potential. Besides providing a means of presenting evidence of learning and achievement, the e-portfolio must serve as a reflective document spanning the student's intellectual development and helping learners to become critical thinkers. This idea is often linked to the use of a portfolio as a personal development plan (PDP) (Lorenzo & Ittelson, 2005). As a specific tool of learning, it is not difficult to perceive the development of the e-portfolio over time as an important aspect of learning. The emphasis is on the development process and what this offers the student, rather than merely on a polished end product, no matter how versatile it is. In this light, we identify with DiBiase et al. (2002) concerning the development of a portfolio from simple collection of materials, through selection, reflection and projection to final presentation. These stages could be briefly summarized as follows: a) Collection of materials requires the students, with support from teachers, to save learning artifacts such as assignments, project reports, and presentations that represent achievements, and successes in their day-to-day study; b) Selection of materials requires students to review and evaluate potential portfolio materials to identify those that demonstrate the development of particular skills or achievement of specific standards; c) *Reflection of work done*, requires students to evaluate or assess their own learning through reflective commentary. Students reflect on their own growth and development over time, recognizing achievement of goals and standards, identifying gaps in development or understanding and acknowledging skills requiring further work; d) *Projection of work to accomplish*, requires students, with the teachers' assistance, to compare current achievements or outcomes to standards or performance indicators. They then set learning goals or develop action plans for the future. This stage should link portfolio development and personal development planning (PDP) to support lifelong learning; and e) Presentation of achievements, invites students to share their portfolios with teachers and peers, with an attempt to promote collaborative learning, to foster self and peer evaluation and to further encourage commitment to PDP and lifelong learning.

E-Portfolio Implementation with Learning Management Systems

Over the years of our trials and errors with different e-portfolio toolsets, we have accrued some

experiences on how to assemble and reconfigure some e-portfolio systems to enhance student learning. These experiences come from mainly three sources of interest: a) the desire2learn.com, an e-portfolio software developer; b) the Sakai project, an open source collaborative learning environment (CLE) community; and c) some free Internet tools to create online portfolios for work or school.

The Desire2Learn.com

The Desire2Learn e-Portfolio (http://www.desire2learn.com/eportfolio) allows users to map their learning journey throughout their lifetime. The e-Portfolio enables users to control what they get out of their learning experience: their goals, their outcomes, and their choice of information recipients. It is a rich and engaging user-centered environment readily accessible both for those familiar with Web 2.0 applications, and for novices. Students choose what to put in their portfolios such as achievements from previous courses, photos and videos from their extracurricular work. The e-Portfolio can be loaded with different formats of information: files, multimedia, personal reflections, presentations, and websites. Users can also decide which specific e-Portfolio elements they publish, and to whom. Using Desire2Learn's assessment engine, any e-Portfolio item can be commented on or evaluated using a rubric that can be created at and shared with any level of the institution. Whether users are presenting materials for assignments, working on group projects, or creating resumes, they could navigate their learning journey with their personalized e-Portfolios. Work becomes thereby organized, searchable, reusable, transportable, and subsequently, more usable and valuable. With Desire2Learn's built-in tools to manage competencies and learning outcomes, assessments by peers and instructors can be made on any e-Portfolio items, from individual documents and files to learning journals, or presentations, enabling users to have a full view of their entire learning path.

Information within the Desire2Learn e-Portfolio can be structured and made consistent across a course, program or organization. Forms and rubrics created by instructors can be shared across the entire organizational structure—providing users with a familiar and consistent environment as they traverse from course to course. For example, a user can fill out a work history form to provide data to the institution. This data can be aggregated to determine the extent of the correlation between the users' grade performance and their real-world experience. Institutions gain knowledge through data on the users' progress toward learning outcomes and the degree of shared learning and collaboration. Instructors can aggregate individual efforts at the course, departmental, and institutional level. Robust reporting allows useful longitudinal and temporal analysis. Equipped with such insight, organizations can shape the learning experience and improve learning outcomes for all users. As users chart their paths, an institution then gains valuable insight into their learning journeys. Organizations could thus create a customarily branded and optimized learning environment with student e-Portfolios as an extension of their campus.

In addition, the Desire2Learn e-Portfolio stores all the artifacts created by a user. Users group artifacts together into collections that can be managed manually or dynamically populated with items such as videos, presentations, pictures or documents that share tags or keywords. Compiling collections and sharing them with learning networks is simplified so that users could focus on learning and not on the software. Reflections throughout the learning process allow students to internalize and synthesize learning beyond the outcomes of traditional memorization. Users are allowed to choose which reflections are to be shared and commented upon. This personalization of the lifelong learning process is at the heart of Desire2Learn e-Portfolio. Besides, users control their presentations: how they look, who sees them, and what level of permission each reviewer

has. A range of professional and appealing presentation templates allows users to add flair and individuality while meeting presentation needs. The organization can incorporate their branding while still allowing the user to personalize the look and feel of the presentation. Both evaluators and peers can comment on presentations and even individual items can be assessed.

Moreover, the Desire2Learn e-Portfolio delivers useful assessment capabilities through integration with Desire2Learn's Competencies and Learning Outcome tools. These key features allow for feedback and assessment at a granular level which can be applied to individual artifacts, collections, reflections, or entire presentations. Evaluators can review all comments and assessments made by peers, gaining a more complete picture into the learning process to make a more authentic assessment. Furthermore, e-Portfolio reporting capabilities are built with the user and the institution in mind. As a user, we can view logs of anyone who accessed our e-Portfolios and any changes made to e-Portfolio items. For the institution, a wealth of rich information from the e-Portfolio is available in the data warehouse and reporting tools. Organizations have access to the very detailed information of competency achievements (when they were completed, where, and how they were assessed). Institutions can also gain access to rubrics assessments and frequencies, information from forms such as artifact templates and data can be further aggregated and analyzed.

The Sakai CLE Project

The Sakai portfolio (http://www.rsmart.com/portfolios) comprises a suite of web-based tools that allow users to store, to organize and to present digital artifacts representing evidence of their teaching, learning or institutional achievement. Sakai's suite of portfolio tools is designed to facilitate the creation of portfolios for self-presentation, reflection, teaching and learning as well as course, program and institutional assessment. By collecting, selecting and presenting subsets of their work, students can create portfolios that showcase coursework, professional experience, academic competency or simply self-expression. Instructors can guide students in their creation of portfolios by designing educational scaffolds that engage them in reflection upon learning in relation to a set of educational outcomes or professional standards. Administrators can use the system as a decision-making and reporting tool. Configured and customized to align with institutional goals and objectives, portfolio sites collect real evidence of teaching and learning that can be correlated with and assessed against course, program, departmental, and institutional objectives.

To create and work with a portfolio in Sakai, we use both the Resources tool and the Portfolios tool in the Sakai CLE environment. First, we collect the materials we want to present in Resources. Then we use the Portfolios tool to present the information. Namely, the process of creating a portfolio involves selecting items from Resources, giving the portfolio a name and an optional expiration date, deciding whether or not to allow comments, determining which site participants or users outside the site will have access to the portfolio, deciding whether or not to make the portfolio public, and optionally notifying others that a portfolio has been shared with them.

One of the most archetypal uses for portfolios suggested in Sakai is the personal representational portfolio, namely, our student portfolio. Personal representation portfolios have a long history of use in disciplines such as art, music, writing and photography, where a culture of presenting samples of one's work has long been the norm. These types of portfolios are generally created to showcase a selection of one's work in a given area, in order to demonstrate talent, experience, skill or development. Personal representation portfolios may also be created to provide evidence of one's development over time across different areas. An example of this use case might be a resume or curriculum vitae, assembled using artifacts from

one's online learning environment and shared with potential employers, educational institutions, mentors, peers or other interested parties. Portfolios created for personal representation tend to have both a developmental and a creative focus. They are most effective when they guide users in collecting information about themselves, assist users in developing their virtual identities and facilitate users' presentation of themselves to designated audiences. Some common examples of personal representation portfolios include: digital resumes, professional portfolios, and personal narrative portfolios.

Another example of the Sakai portfolios in use is the teaching and learning portfolios. Teaching and learning portfolios have an educational focus and are generally used to gain insight into a teaching and learning process. They are multi-faceted, guiding students in collecting learning artifacts, reflecting upon these in relation to a linked set of learning standards, objectives or criteria and presenting their work for feedback and evaluation. Teaching and learning portfolios require advanced planning on the part of educational practitioners in identifying learning outcomes, objectives, or criteria used to represent the goals of the teaching and learning process. Many practitioners find that the process of creating a teaching and learning portfolio is as valuable as the actual product for their students. Asking students to reflect upon their learning and present their work in a way that best speaks to their mastery of a subject, issue or experience is a fundamental experiment in meta-cognition that goes beyond what the average student is traditionally asked to do in a classroom. By giving students the opportunity to reflect upon their learning and share their learning artifacts with external audiences, these portfolios seek to make the processes of teaching and learning more transparent as well as accessible. Some examples of teaching and learning portfolios include: general education portfolios, disciplinary portfolios, and extracurricular transcript portfolios.

The third type of Sakai portfolio most commonly created is the assessment and accreditation portfolio. Assessment and accreditation portfolios are generally derived from teaching and learning portfolios and are used to assess the efficacy of a given instructional program or objective. In an age of accountability measures applied to education, this type of portfolio is steadily growing in use. Assessment and accreditation portfolios tend to include quantitative measures of student performance gauged against a set of learning outcomes that have been identified by an instructor, program, department or institution. By using reports that aggregate and analyze data surrounding student learning in relation to a predefined set of educational outcomes, these types of portfolios provide a rich source of information about the actual results of the teaching and learning process and can therefore help institutions align their institutional practice with their stated institutional mission or goals. Institutions may present this data along with representative artifacts to demonstrate their progress in fostering learning in accordance with their goals. The results of assessment portfolios are thus a valuable resource for the accreditation process. In support of accreditation or program assessment, they are usually combined with portfolios for teaching and learning to aggregate and analyze assessment data and identify representative artifacts of learning. Some examples of assessment and accreditation portfolios include: institutional outcomes assessment portfolios, departmental outcomes assessment portfolios, and institutional accreditation portfolios.

The Free Internet Tools

Oftentimes, within the course delivery constraint of a semester, it is found that the use of free Internet tools to introduce to students the educational potential of portfolios in their learning and subsequent professional development planning, has been well received. It is also experienced that Michele Martin's free guides from

Google.com (http://www.google.com/notebook/user/17615569108845553326) have been very helpful in showing our students how to create their personal portfolios over the Web. It is our students' feedback that following Martin's six steps to creating their online portfolios has been very intuitive and instrumental to their reflective growth: 1) identify the purpose of our portfolio; 2) identify, create, organize our artifacts; 3) identify the technology tools we will use; 4) set up a portfolio structure and table-of-contents; 5) create the portfolio; and 6) market or share our portfolios.

Identifying the purpose of the portfolio should help our students determine the structure and format for their portfolios, the artifacts to select, and the tools for creating the portfolios. Most importantly, students should identify the audience for their portfolios, including such issues as: What is their level of comfort with technology? What are they expecting to see or find in their portfolios? What kind of story do they want the student to tell about him or herself? What does the student want to highlight for this audience?

Selecting the artifacts to be included in the student portfolios must be a thoughtful process since there are typically numerous artifacts for telling different stories of student learning. Examples of artifacts include: resume or record of work samples which could include documents, presentations, reports, online materials; copies of credentials such as degrees, certificates, licenses; other records of achievements, such as newspaper stories of work accomplished; recommendations and commendations from schools; transcripts of academic records; and project records. Whichever artifacts selected, depends on the purpose of the portfolio.

There are a variety of tools students can use to create their online portfolios. Helen Barrett provides a great list at (http://electronicportfolios.org/categories.html). Yet, in selecting what free tools to use to create the portfolios, students are often reminded of the following:

- Do you already have an online presence, such as a blog? If so, how do you want to connect your blog and your portfolio?
- Do you want people to be able to interact with your portfolio through feedback comments?
- Do you want your portfolio to be public or private?
- Do you want to use your own name as your URL for your portfolio?
- Is your portfolio primarily for employment or is it for documenting your own learning?
- What kinds of artifacts do you want to include? Which tool presents artifacts in the best way possible?

Tellingly, students also need help in identifying the structure of their portfolios. It is convinced that every portfolio should have: a) a welcome page explaining the purpose of the portfolio, and any other information the audience may need to know upfront; b) tips on navigating through the portfolio, like a video introduction to the portfolio; c) contact information, including an e-mail address at a minimum, and the various places one can be found online, such as LinkedIn, Facebook, and Twitter. Additional sections, depending on the purpose of the portfolio, could include the following: a biography, work history (for work portfolio), educational credentials and background, competencies, personal beliefs statements, personal strengths, achievements, volunteer work, conference presentations, project works, and class assignments from schools.

The exact details to create online portfolios depend on which free tool to use. For example, if we would like to use WikiSpace.com, then the following source from Michele Martin is an excellent guide (http://www.scribd.com/doc/2238100/Using-WikiSpaces-for-Your-Eportfolio). If the use of Google Sites is preferred, then the following How-to-guide developed by Helen Barrett is also found to be another favorite site among students (http://sites.helenbarrett.net/portfolio/

how-to). Once the portfolios have been created, it is time to begin marketing them, especially if students are using them to sell their professional skills or search for a job. Some typical tips used by students include:

- Buy our name as a domain (e.g., www.marysmith.com) and map our portfolio to our name. This service is available from WikiSpaces.com and Wordpress.com. That way, we will have an easy to remember URL to post on our resume.
- Put links to our portfolios on our blogs and social networking profiles (LinkedIn, Facebook).
- Put the link in our e-mail signatures.
- Include the link on our resumes.
- Include a link with online applications if the applications allow for such inclusion.

A Course Enactment Example

To put our discussion into perspective, the following course example serves to illustrate an outcomes-based design of a sophomore-level major course in our undergraduate *Computer and Information Science* program. In this course, one meaningful exercise for all the participating students is to incrementally construct in a course of one semester their individual e-portfolios using the free Internet tool provided by Google Sites (http://sites.google.com) as a summary of their learning experiences. The specifics of our course learning are hereby presented below in the context of ***SFTW 241 Programming Languages Architecture (I)***, offered in the spring semester of every school year.

Course Description

This is the first of a 2-course sequence (SFTW241 compulsory + SFTW342 optional) introducing the concepts, techniques, and models of computer programming. The concepts are organized in terms of computation models introducing different techniques for programming and reasoning about programs. Example computation models covered in this course include the imperative and object-oriented programming and reasoning techniques. Each computation model is based on a core language introduced in a progressive way, by adding concepts one after the other. Languages of interest include both software and hardware description languages, such as C versus Verilog, C++ versus Java, Ada versus VHDL. Other contemporary languages considered of interest in inquiry-based learning could include: JavaScript versus Ajax, Ruby on Rails versus Groovy on Grails.

Course Syllabus

There are a number of conceptual items selected to be dealt with in SFTW241. They are listed below alongside a brief description of the topics involved in student learning.

SFTW 241 - Intended Learning Outcomes (ILOs)

It is expected that at the end of their study of SFTW241, students will be able to perform the following based on the items of interest identified:

Item 01: *Overview of Programming Languages*

1. Summarize the evolution of programming languages illustrating how this history has led to the paradigms available today.
2. Identify at least one distinguishing characteristic for each of the programming paradigms covered in the course.
3. Evaluate the tradeoffs between the different paradigms, such as structured programming and object-oriented programming, considering such issues as space efficiency, time efficiency, safety and power of expression.

Table 1.

Concept	*Topics Identified*
Overview of Programming Languages	History of programming languages; brief survey of programming paradigms (procedural, object-oriented, and concurrent languages); the effects of scale on programming methodology
Virtual Machines	The concept of a virtual machine; hierarchy of virtual machines; intermediate languages
Introduction to Language Translation	Comparison of interpreters and compilers; language translation phases (lexical analysis, parsing, code generation, optimization)
Declarations and Types	The conception of types as a set of values together with a set of operations; declaration models (binding, visibility, scope and lifetime); type-checking overview; garbage collection;
Abstraction Mechanisms	Procedures, functions, and iterators as abstraction mechanisms; parameterization mechanisms (reference versus value); activation records and storage management; type parameters and parameterized types; modules in programming languages
Object-Oriented Programming	Object-oriented design; encapsulation and information-hiding; separation of behavior and implementation; classes and subclasses; inheritance (overriding, dynamic dispatch); polymorphism (subtype polymorphism versus inheritance); class hierarchies; collection classes and iteration protocols; internal representations of objects and method tables
Type Systems	Data types as set of values with set of operations; data types including elementary types, product and co-product types, algebraic types, recursive types, arrow (function) types, and parameterized types; type-checking models; semantic models of user-defined types, including type abbreviations, abstract data types, and type equality
Programming Languages Design	General principles of language design; design goals; typing regimes; data structure models; control structure models; abstraction mechanisms

4. Distinguish between programming-in-the-small and programming-in-the-large.

Item 02: *Virtual Machines*

1. Describe the importance and power of abstraction in the context of virtual machines.
2. Explain the benefits of intermediate languages in the compilation process.

Item 03: *Introduction to Language Translation*

1. Compare and contrast compiled and interpreted execution models, outlining the relative merits of each.
2. Describe the phases of program translation from source code to executable code and the files produced by these phases.

Item 04: *Declarations and Types*

1. Explain the value of declaration models, especially with respect to programming-in-the-large.
2. Identify and describe the properties of a variable such as its associated address, value, scope, persistence, and size.
3. Demonstrate different forms of binding, visibility, scoping, and lifetime management.
4. Defend the importance of types and type-checking in providing abstraction and safety.
5. Evaluate tradeoffs in lifetime management, such as reference counting versus garbage collection.

Item 05: *Abstraction Mechanisms*

1. Explain how abstraction mechanisms support the creation of reusable software components.
2. Demonstrate the difference between call-by-value and call-by-reference parameter passing.
3. Defend the importance of abstractions, especially with respect to programming-in-the-large.
4. Describe how the computer system uses activation records to manage program modules and their data.

Item 06: *Object-Oriented Programming*

1. Justify the philosophy of object-oriented design and the concepts of encapsulation, abstraction, inheritance, and polymorphism.
2. Design, implement, test, and debug simple programs in an object-oriented programming language.
3. Describe how the class mechanism supports encapsulation and information hiding.
4. Design, implement, and test the implementation of "is-a" relationships among objects using a class hierarchy and inheritance.
5. Compare and contrast the notions of overloading and overriding methods in an object-oriented language.
6. Explain the relationship between the static structure of the class and the dynamic structure of the instances of the class.

Item 07: *Type Systems*

1. Formalize the notion of typing.
2. Describe each of the elementary data types.
3. Explain the concept of an abstract data type.
4. Recognize the importance of typing for abstraction and safety.
5. Differentiate between static and dynamic typing
6. Differentiate between type declarations and type inference.
7. Evaluate languages with regard to typing.

Item 08:*Programming Languages Design*

1. Evaluate the impact of different typing regimes on language design, language usage, and the translation process.
2. Explain the role of different abstraction mechanisms in the creation of user-defined facilities.

SFTW 241: Learning Opportunities Leading to ILOs

Besides our regular lectures with slide presentations, there are various learning activities designed into student course work throughout the semester, including: readings, individual (plus optional) assignments, pair assignments, and project assignment. With the help of our UMMOODLE environment, we also managed to induce online discussion (mostly asynchronous) to help students achieve our ILOs. It should be noted that in order to provide personalized feedback to our student work, almost all the student assignments are given an assignment Wiki inside our UMMOODLE to stimulate student reflection and collaboration to accomplish their coursework. The following is an excerpt from our Spring-2009 SFTW241 coursework to illustrate our discussion. For details, please refer to the student e-portfolios URLs listed at the end of this section:

There is one project in the Spring-2009 semester of SFTW241, in which students are to form into group-based learning units to stimulate one another in their project work (programming in C++, Java, and Ada), which is designed to occupy one and half month in the semester, spanning mainly throughout the month of May. The portion of project work is designed to take care of the ILOs from ***Item 06 (1, 2, 3, 4, 5, 6)***.

Besides, to prepare students to perform their project work, in the month of April, students are to work in pair with their chosen pair partner, to complete two pair assignments (programming in Java and C++), to get them warmed up for the project assignment, because each project team is to be formed by two pairs of students. This portion of the pair assignment takes care of the following ILOs: first assignment supporting ***Item 03 (1,2), Item 04 (1, 2, 3, 4, 5)***; and second assignment supporting ***Item 05 (1, 2, 3, 4), Item 06 (1, 2, 3, 4),*** and ***Item 07 (1, 2, 3, 4, 5)***.

Moreover, to get students prepared for their pair assignments, each student is given an individual

Table 2.

Items of Evaluation	*Semester Scores Allocation*
Individual Assignment	5
Pair Assignments	5
Team Assignment (Wiki Housekeeping)	5
Project Assignment	35
Final Examination	40
Student e-Portfolio	10
Bonus <Optional Exercises>	5
Bonus <Semester Interview>	5
Total Accrued	100 with 10 points bonus

assignment (programming in C and C++) in the month of March to get familiar with the basic rubric of evaluation, in a chosen topic related to the context of SFTW241. A similar rubric is used to evaluate student's course work throughout the semester, including the pair and project assignments. This individual assignment supports the ILOs from ***Item 02 (1, 2), Item 04 (1, 2, 3, 4, 5),*** and ***Item 05 (1, 2, 3, 4).***

The coursework of SFTW241-2009 also provides 3 optional exercises in ANSI C to get students up to speed in their programming exercise starting from the Individual Assignment. Students are not obliged to complete these exercises, but those who completed them shall have bonus score allocated towards the end of the semester. These optional exercises are meant to review algorithms as models of computational processes.

For the sake of completeness, reading assignments have also been given to students throughout the semester, to stimulate their online discussion. Such readings largely support the ILOs from ***Item 01 (1, 2, 3, 4), Item 03 (1, 2),*** and ***Item 08 (1, 2)***.

SFTW 241 – Assessment Measures Devised

In particular, the assessment scheme we used in the Spring-2009 semester of SFTW241 is as follows:

Table 3.

Total Semester Points	*Semester Grade Awarded*
93 - 100	A
88 - 92	A-
83 - 87	B+
78 - 82	B
73 - 77	B-
68 - 72	C+
63 - 67	C
58 - 62	C-
53 - 57	D+
50 - 52	D (Pass)
Below 50	F (Fail)

And semester grades are awarded according to the following system of score accounting:

The specific rubric conceived to evaluate each of the Optional Exercises, Individual Assignment, Pair Assignments, and Project Assignment, is composed of the following items of interest:

1. Assignment statement of purpose
2. System description
3. System analysis
4. System design
5. Data structures and algorithms used
6. Program design including structure chart and architectural components
7. Concept of operation
8. ANSI C/C++, Java or Ada coding
9. Test-run under Windows XP Eclipse CDT/ JDT/GNATBench (Ada)
10. Program source documentation and user guide

This rubric is designed based on the pre-requisite requirements of SFTW241, namely, students are expected to have proficiency in at least the ANSI C programming language, and two semester's learning in data structures and algorithms with ANSI C.

SFTW 241: Sample Course Alignment Grid

The course alignment grid serves to check the course alignment between the teaching and learning activities of SFTW241 and the student learning outcomes. The grid produced here is not the exact grid we used in the Spring-2009 semester of SFTW241, for it is meant to convey the importance of course alignment. Typically, we used an Excel spreadsheet and filled in the course outcomes on the vertical axis. On the horizontal axis, we listed the class sessions, readings plus other resources, assignments, and assessments. Oftentimes, we also include labs, guest speakers, and other distinctive teaching and learning activities that we planned for our classes. Once both axes were complete, we could plot the outcomes for each of the items in the horizontal axis. The grid serves as a matrix, allowing faculty to chart the relationship between our course activities and course learning outcomes. Such a grid makes this relationship visible and easy to analyze and understand.

SFTW 241: Student e-Portfolios on Google Sites

Listed below are some students' e-portfolios completed after their taking SFTW241 in the spring semesters of both 2008 and 2009. I would like to express my appreciations to these students for allowing their e-portfolios URLs to be shown here for readers' convenience.

FUTURE TREND FOR E-PORTFOLIOS

The essence of e-portfolio lies in its support of deep learning (Barrett, 2004; Weigel, 2002; Salomon & Perkins, 1989) by facilitating the connections among different learning experiences, which occur in various contexts and environments (Tosh, Werdmuller, Chen, Light & Haywood, 2006). In fact, the idea of a portfolio has long been used to demonstrate progress over time, to represent samples of best work, and to prepare for job or career searches. Yet, advances in Web technologies as well as the availability of higher capacity memory storage at lower cost, have increased the opportunity and potential of electronic portfolios to support student learning in a variety of courses, environments, and experiences, both inside and outside the classroom. Through e-portfolios, we are witnessing the emergence of intentional learners who are able to adapt to new environments and situations, synthesize knowledge and experiences from a variety of sources, and seek out opportunities for continued learning throughout their lives (Huber & Hutchings, 2004). Research on student

Table 4.

Activity	*Outcome 1*	*Outcome 2*	*Outcome 3*	*Outcome 4*	*Outcome 5*
Class 1	X				
Class 2	X				
Class 3	X	X			
Class 4		X	X		
Class 5		X	X		
Class 6		X	X		
Class 7			X		
Class 8				X	
Class 9				X	
Class 10			X		X
Class 11			X		X
Class 12		X		X	X
Reading A	X	X			
Reading B		X	X		
Reading C			X	X	
Reading D				X	X
Assignment 1	X	X			
Assignment 2		X	X		
Assignment 3		X	X	X	
Assignment 4			X	X	X
Assessment 1	X	X			
Assessment 2		X	X		
Assessment 3		X	X	X	
Assessment 4			X	X	X

engagement with learning (Ramsdon, 2003; La-Sere Erickson & Weltner-Strommer, 1991) suggests that when students perceive that they have choices in how to learn subject matter, they are more motivated to move beyond just information acquisition to gaining a deeper understanding of the subject (Entwistle, 1998; Marshall, 1996; Marton & Saljo, 1984). E-portfolio tools could be characterized by a focus on learner control, a customized learning environment, and the ability to digitally represent and share formal and informal learning experiences with others. Such features can be used to enhance both social and intellectual interactions in various learning contexts, including academic, workplace, and community. Likewise, at the core of the emerging landscape of e-portfolio

Table 5.

SFTW241 - 2009	SFTW241 - 2008
http://sites.google.com/site/fstda727244/Home	http://sites.google.com/site/fstda627169/Home
http://sites.google.com/site/fstda727263/Home	http://sites.google.com/site/fstda627212/Home
http://sites.google.com/site/fstda727279/Home	http://sites.google.com/site/fstda627398/Home
http://sites.google.com/site/fstda727303/Home	http://sites.google.com/site/fstda627463/Home
http://sites.google.com/site/fstda727573/Home	http://sites.google.com/site/fstda627600/Home
http://sites.google.com/site/fstda728127/Home	http://sites.google.com/site/fstda628120/Home
http://sites.google.com/site/fstda728146/Home	http://sites.google.com/site/fstda628591/Home
http://sites.google.com/site/fstda728152/Home	http://sites.google.com/site/fstda628706/Home
http://sites.google.com/site/fstda728259/Home	http://sites.google.com/site/fstda628572/Home
http://sites.google.com/site/fstda728860/Home	http://sites.google.com/site/fstda627861/Home

is an emphasis on integration and synthesis of learning, irrespective of where that learning occurs. According to Tosh et al. (2006), the learning model of e-portfolio can be characterized by three working elements: reflection, meaning the learner maps out his or her thoughts on a course, a piece of work, or more general experiences; communication, meaning the learner communicates his or her reflections to others (students, staff, tutors, and instructors); and sharing, meaning the learner gives selected others (typically knowledge users) access to his or her material including reflections, artifacts, and other tangible and intangible resources. The mutual interactions among these elements exercised in the overlapping domains of academic, workplace and community, become the dynamic forces to transform students into active participants in their learning rather than the passive recipients of information (Batson, 2002). Yancey (2001, p.83) reiterates that "the engaged learner, one who records and interprets and evaluates his or her own learning, is the best learner." It is expected that tools and practices that comprise the emerging landscape of e-portfolios should support such activities not only on a personal level but also on a social level. The result is naturally a heightened intentionality to learn through an enhanced self-awareness acquired through reflection, communication and sharing in the learner's domains of concerns.

CONCLUSION

The premise in our analysis in this chapter lies in the assumptions of the meaning of collaboration in higher education. We believe in the following: If schools are to improve, staff must develop the capacity to function as professional learning communities (PLC's). If schools are to function as PLC's, they must develop a collaborative culture. If schools are to develop a collaborative culture, they must overcome a tradition of teacher isolation. If schools are to overcome their tradition of teacher isolation, teachers must learn to work in effective, high-performing teams. If schools are to support effective teamwork to enhance student learning, there must be some technology-enhanced environment to enable learning among teachers and students. And the concept of e-portfolio system fits right in to provide the mechanism of a learner-centered collaborative knowledge environment to stimulate and facilitate a learning-centered knowledge sharing culture to enhance student achievement. The impact of an e-portfolio for students' housekeeping of their own learning histories, aided by an insightful institutional push, should serve as a transformative path to enable students to tap into (or rediscover) their own sense of wonder and excitement about their present life and future possibilities. Of critical concern here is the rationale for developing electronic

portfolios to support knowledge and learning activities referring mainly to the decisions that define expectations, enable empowerment, or verify performance of the people or units involved. Nonetheless, infusing reflective practice and designing fundamentally different ways to evaluate student work requires changes in practice. Under the peculiar umbrella of positive change, we must be open to the transformative impact of such an e-portfolio organizational effort on the intellectual and social capital of the school itself. Our discussion in this chapter has hereby been situated around story-telling the issues underlying the design of a collaborative e-portfolio culture and system for the learning enterprise. Hopefully, it has provided a sense-making perspective on the challenge of outcomes-based assessment in personalized instruction to overcome barriers to knowledge construction and sharing through the e-portfolio movement.

REFERENCES

Acosta, T., & Liu, Y. (2006). ePortfolios: Beyond assessment. In A. Jafari and C. Kaufman (Eds.), Handbook of research on ePortfolios (pp. 15-23). Hershey, PA: Idea Group Reference.

Amador, J. A., Miles, L., & Peters, C. B. (2006). *The practice of problem-based learning: A guide to implementing PBL in the college classroom*. Bolton, MA: Anker Publishing Company, Inc.

Angelo, T. A. (1999, May). Doing assessment as if learning matters most. *AAHE Bulletin,* 3-6.

Bangert, A. (2004). The seven principles of good practice: A framework for evaluating online teaching. *The Internet and Higher Education*, *7*(3), 217–232. doi:10.1016/j.iheduc.2004.06.003

Banta, T. W. (2003). *Portfolio assessment: Uses, cases, scoring, and impact*. San Francisco, CA: Jossey-Bass.

Barrett, H. (2004). *Electronic portfolio as digital stories of deep learning – emerging digital tools to support reflection in learner-centered portfolios*. Retrieved on June 30, 2009, from http://electronicportfolios.org/digistory/epstory.html

Barrows, H. S. (1988). *The tutorial process*. Springfield, IL: Southern Illinois University Press.

Batson, T. (2002). *Electronic portfolio boom: What's it all about?* Retrieved June 30, 2009, from http://www.campustechnology.com/Articles/2002/11/The-Electronic-Portfolio-Boom-Whats-it-All-About.aspx

Biggs, J. B. (1999). *Teaching for quality learning at university*. Buckingham, UK: Open University Press.

Bloom, B. S. (1976). *Human characteristics and school learning*. New York: McGraw-Hill.

Bransford, J. D., & Vye, N. J. (1989). A perspective on cognitive research and its implications for instruction. In L. B. Resnick & L. E. Klopfer [ASCD Yearbook] (Eds.), Towards the thinking curriculum: Current cognitive research. Alexandria, VA: Association for Supervision and Curriculum Development.

Brown, G., & Irby, B. J. (2000). *The career advancement portfolio* (2nd ed.). Thousand Oaks, CA: Corwin.

Cambridge, B. L. (2001). *Electronic portfolios: Emerging practices in student, faculty, and institutional learning*. Sterling, VA: Stylus.

Carroll, A. W. (1975). *Personalizing education in the classroom*. Denver: Love Publishing.

Case, R. (1992). On the need to assess authentically. *Holistic Education Review*, *5*(4), 14–23.

Darling-Hammond, L. (1996). The right to learn and the advancement of teaching: Research, policy and practice for democratic education. *Educational Researcher*, *25*(6), 5–17.

Darling-Hammond, L. (1997). *The right to learn: A blueprint for creating schools that work*. San Francisco, CA: Jossey-Bass.

DiBiase, D., Zembal-Saul, C., Sabre, J., Howard, D., Rademacher, H., Burlingame, P., et al. (2002). *Using e-Portfolio at Penn State to enhance student learning: Status, prospects and strategies*. E-education Institute, The Pennsylvania State University. Retrieved July 9, 2009, from https://www.e-education.psu.edu/files/e-port_report.pdf

Driscoll, A., & Wood, S. (2007). *Developing outcomes-based assessment for learner-centered education: A faculty introduction*. Sterling, VA: Stylus.

Eklund, J., Kay, M., & Lynch, H. (2003). E-learning: Emerging issues and key trends. *Australian Flexible Learning Framework*. Retrieved May 10, 2008, from http://www.flexiblelearning.net.au

Entwistle, N. (1998). Approaches to learning and forms of understanding. In B. Dart & Boulton-Lewis (Eds.), Teaching and learning in higher education. Melbourne: ACER.

Flanigan, E. J., & Amirian, S. (2006). ePortfolios: Pathway from classroom to career. In A. Jafari & C. Kaufman (Eds.), Handbook of research on ePortfolios (pp. 102-111). Hershey, PA: Idea Group Reference.

Georgiades, W. D., Keefe, J. W., Lowery, R. E., e al. (1979). *Take five: A methodology for the humane school.* Los Angeles, CA: Parker and Son.

Ghosh, R. A. (2006). *CODE: Collaborative ownership and the digital economy*. Boston: MIT Press.

Glasser, W. (1986). *Choice theory in the classroom*. New York: Harper Perennial.

Glasser, W. (1988). *The quality school*. New York: HarperCollins.

Goodlad, J. I. (1984). *A place called school*. New York: McGraw-Hill.

Henry, R. J. (2006). ePortfolio thinking: A provost perspective. In A. Jafari & C. Kaufman (Eds.), Handbook of research on ePortfolios (pp. 54-61). Hershey, PA: Idea Group Reference.

Herbert, E. (2001). *The power of portfolios*. San Francisco: Jossey-Bass.

Huba, M. E., & Freed, J. E. (2000). *Learner-centered assessment on college campuses: Shifting the focus from teaching to learning*. Boston: Allyn and Bacon.

Huber, M. T., & Hutchings, P. (2004). *Integrative learning: Mapping the terrain*. Washington, DC: Association of American Colleges and Universities.

Jafari, A., & Kaufman, C. (Eds.). (2006). *Handbook of research on ePortfolios*. Hershey, PA: Idea Group Reference.

Johnson, R. S., Mims-Cox, J. S., & Doyle-Nichols, A. (2006). *Developing portfolios in education: A guide to reflection, inquiry, and assessment*. Thousand Oaks, CA: SAGE Publications.

Kahn, S. (2001). Linking learning, improvement and accountability: An introduction to electronic institutional portfolios. In Cambridge, B. L. (Eds.), *Electronic portfolios: Emerging practices in student, faculty, and institutional Learning* (pp. 135–158). Washington, DC: AAHE.

Keefe, J. W. (1983). Advisement – A helping role. *The NASSP Practitioner*, *9*(4), 1–16.

Keefe, J. W. (1989). Personalized education. In Walberg, H. J., & Lane, J. J. (Eds.), *Organizing for learning: Toward the 21st century*. Reston, VA: National Association of Secondary School Principals.

Keefe, J. W., & Jenkins, J. M. (2008). *Personalized instruction: The key to student achievement* (2nd ed.). Lanham, MD: Rowman & Littlefield Education.

Larkin, J. (1998). *Workshop materials: CSUMB outcomes-based education*. Seaside, CA: CSUMB.

LaSere Erickson, B., & Weltner-Strommer, D. (1991). Knowing, understanding, and thinking: The goals of freshman instruction. In *Teaching college freshmen*. San Francisco: Jossey-Bass.

Lasley, T. J. II. (1998). Paradigm shifts in the classroom. *Phi Delta Kappan*, *80*(1), 84–86.

Lorenzo, G., & Ittelson, J. (2005, October). Demonstrating and assessing student learning with e-portfolios. *Educause Learning Initiative, 3*(19).

Maki, P. (2004). *Assessing for learning: Building a sustainable commitment across the institution*. Sterling, VA: Stylus.

Marshall, H. (1996). Recent and emerging theoretical frameworks for research on classroom learning: Contributions and limitations. *Educational Psychologist*, *31*(3/4), 147–244.

Marton, F., & Saljo, R. (1984). Approaches to learning. In Marton, F., Hounsell, D., & Entwistle, N. (Eds.), *The experience of learning. Edinburg: Scottish Academic Press*.

Napper, V. S., & Barrett, H. C. (2004). Information and technology: Assessment and ePortfolio. In *Proceedings of the Society for Information Technology & Teacher Education Conference* (pp. 39-40).

O'Brien, K. (2006). ePortfolios as learning construction zones: Provost's perspective. In A. Jafari & C. Kaufman (Eds.), Handbook of research on ePortfolios (pp. 74-82). Hershey, PA: Idea Group Reference.

O'Neil, J. (1992). Wanted: Deep understanding: Constructivism posits new conceptions of learning. *ASCD Update*, *34*(3), 1–8.

Palomba, C. A., & Banta, T. W. (1999). *Assessment essentials*. San Francisco, CA: Jossey-Bass.

Perkins, D. (1992). *Smart schools: Better thinking and learning for every child*. New York: Free Press.

Plater, W. M. (1998, November). So… Why aren't we taking learning seriously? *About Campus*, 9–14.

Plater, W. M. (2006). The promise of the student electronic portfolio: A provost's perspective. In Jafari, A., & Kaufman, C. (Eds.), *Handbook of research on ePortfolios* (pp. 62–73). Hershey, PA: Idea Group Reference.

Ramsdon, P. (2003). *Learning to teach in higher education* (2nd ed.). London: Routledge Falmer.

Rowntree, D. (1987). *Assessing students: How shall we know them?* (2nd ed.). London: Kogan Page.

Ryan, J. M., & Miyasaka, J. R. (1995). Current practice in testing and assessment: What is driving the changes? *NASSP Bulletin*, *79*(573), 1–10. doi:10.1177/019263659507957302

Salomon, G., & Perkins, D. N. (1989). Rocky roads to transfer: Rethinking mechanisms of a neglected phenomenon. *Educational Psychologist*, *24*(2), 112–132. doi:10.1207/s15326985ep2402_1

Senge, P. M. (1990). *The Fifth Discipline: The Art and Practice of the Learning Organization*. London, U.K.: Currency Doubleday.

Sherman, G. (2006). Instructional roles of electronic portfolios. In Jafari, A., & Kaufman, C. (Eds.), *Handbook of research on ePortfolio* (pp. 1–14). Hershey, PA: Idea Group Reference.

Slavin, R. E. (1991). Synthesis of research of cooperative learning. *Educational Leadership*, *48*(5), 71–82.

Slavin, R. E. (1994). Student teams and achievement divisions. In Sharon, S. (Ed.), *Handbook of cooperative learning methods* (pp. 3–19). Westport, CT: Greenwood Press.

Slavin, R. E. (1995). *Cooperative learning: Theory, research and practice* (2nd ed.). Needham Heights, MA: Allyn and Bacon.

Stefani, L., Mason, R., & Pegler, C. (2007). *The educational potential of e-portfolios: Supporting personal development and reflective learning*. New York: Routledge.

Suskie, L. (2009). *Assessing student learning: A common sense guide* (2nd ed.). San Francisco, CA: Jossey-Bass.

Tabaka, J. (2006). *Collaboration explained: Facilitation skills for software project leaders*. Boston: Addison Wesley.

Tapscott, D. (1997). *The digital economy: Promise and peril in the age of networked intelligence*. New York: McGraw Hill.

Tosh, D., Werdmuller, B., Chen, H. L., Light, T. P., & Haywood, J. (2006). The learning landscape: A conceptual framework for ePortfolios. In Jafari, A., & Kaufman, C. (Eds.), *Handbook of research on ePortfolio* (pp. 15–32). Hershey, PA: Idea Group Reference.

Vat, K. H. (2004). Toward a learning organization model for student empowerment: A teacher-designer's experience as a coach by the side. In *Proceedings of the 2004 IADIS International Conference on Cognition and Exploratory Learning in Digital Age* (pp. 131-140), Dec. 15-17, Lisbon, Portugal.

Vat, K. H. (2006). Developing a learning organization model for problem-based learning: The emergent lesson of education from the IT trenches. *Journal of Cases on Information Technology*, *8*(2), 82–109.

Vat, K. H. (2008). E-portfolio and pedagogical change for virtual universities. In Putnik, G. D., & Cunha, M. M. (Eds.), *Encyclopedia of network and virtual organizations* (pp. 508–515). Hershey, PA: Information Science Reference.

Vat, K. H. (2009). An e-portfolio scheme of flexible online learning. In P. Rogers, G. Berg, J. Boettcher, C. Howard, L. Justice, & K. Schenk (Eds.), Encyclopedia of distance learning (2nd Ed.) (pp. 941-949). Hershey, PA: Information Science Reference (IGI Global Inc.).

Weigel, V. B. (2002). *Deep learning for a digital age: Technology's untapped potential to enrich higher education*. San Francisco, CA: Jossey-Bass.

Wiggins, G. (1989, May). A true test: Toward more authentic and equitable assessment. *Phi Delta Kappan*, 703–713.

Wiggins, G., & McTighe, J. (2005). *Understanding by design* (2nd ed.). Alexandria, VA: Association for Supervision and Curriculum Development.

Wolk, S. (2007). Why go to school? *Phi Delta Kappan*, *88*(9), 648–658.

Yancey, K. B. (2001). General patterns and the future. In Cambridge, B. (Eds.), *Electronic portfolios: Emerging practices in student, faculty, and institutional learning* (pp. 83–87). Washington, DC: American Association of Higher Education.

Zubizarreta, J. (2009). *The learning portfolio: Reflective practice for improving student learning* (2nd ed.). San Francisco, CA: Jossey-Bass.