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Wikifolios and Participatory Assessment for Engagement, Understanding, and Achievement in Online Courses

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This paper presents new insights from ongoing design-based research of graduate-level online courses in a school of education. This research has been refining the use of widely available wikis and online assessment tools to deliver broad learning outcomes. The research started with a general goal that reflects current situative theories of instruction and assessment, and resulted in five general design principles and course features used to enact those principles. Reflecting the first two principles, each student articulates the relative relevance of chapter concepts for a personally meaningful problem context and then engages threaded discussions within and across networking groups via comments placed directly on wikifolios. Reflecting the third principle, wikifolios and comments are not directly graded; rather, they are evaluated using student reflections placed directly in their wikifolio. Reflecting the fourth and fifth principles, conceptual understanding and aggregated achievement are discreetly assessed with timed exams using conventional items. Examples and learning outcomes from two recent courses are presented.

Keywords: situativity, wikis, assessment, e-learning, accountability, participation.

The wiki, invented in 1995, was named after the Hawaiian word for "quick" to highlight its simplicity. Since then, wikis have transformed the way we catalog, construct, share, and refine information. Some expected that these uncomplicated tools would revolutionize education (Duffy & Bruns, 2006). Arguably, the educational potential of wikis has been ob-

scured and overshadowed by debates over the accuracy of collaborative encyclopedias and whether students should be allowed to reference or even access them (e.g., Crovitz & Smoot, 2009).

This paper describes a particular use of wikis that is perhaps best understood as a simpler and more informal alternative to e-portfolios. These *wikifolios* were introduced in online courses in a graduate school of education taught by the first author. They were introduced mid-semester when an existing e-portfolio system in one course management system proved too unwieldy for the instructor's goal of efficiently fostering disciplinary interaction among the students and instructor. This paper describes wikifolios and related course features that were created as an alternative and then refined across subsequent classes, and presents examples and evidence of learning outcomes from two of those classes.

The refinement of wikifolios occurred alongside a broader program of research exploring newer situative and sociocultural approaches to instruction, assessment, and accountability. This broader research program included design studies of educational video games (e.g., Hickey, Ingram-Gobel, & Jameson), secondary language arts curriculum (e.g., Hickey, McWilliams, & Honeyford, 2011), and inquiry-oriented multimedia programs in science (e.g., Taasoobshirazi et al., 2007; Hickey & Zuiker, 2012). All of these studies targeted a research question that is relevant to many educational innovators: How can we foster productive social engagement with disciplinary knowledge (e.g., Engle & Conant, 2002), while delivering individual understanding of targeted concepts *and* evidence of aggregated achievement on external measures? This study explored this research question in the context of fully online college courses.

This paper first reviews relevant prior research that inspired and guided this effort. This research suggested that educational (i.e. non-encyclopedic) wikis can (a) overcome some concerns with e-portfolios, (b) be readily refined and theorized using design-based research methods, and (c) accomplish some of the goals of newer participatory, connectivist, and situative approaches to learning and instruction. After summarizing the context in which the present research was conducted, the paper describes wikifolios and related features, describes more specific relevant research, and presents some initial evidence of effectiveness. In order to maximize usefulness for others and foster coherence, the features, research, and evidence are presented in the context of four general design principles that emerged across the broader program of research.

PRIOR RESEARCH

Non-Encyclopedic Uses of Wikis

Around the same time that Wikipedia began its rapid growth, Mark Guzdial and others involved with Georgia Tech's *CoWeb* began highlighting the many other ways that wikis could be used in schools (e.g., Guzdial, Rick, & Kehoe, 2001). These uses included distributing course information, collaboratively completing assignments, creating artifacts, and engaging in shared discussion and review. Guzdial et al. showed how the simplicity of wikis made it possible for any educator to create and customize such resources and made it simple for students to work with them. The establishment of the commercial hosting services *Wikispaces* and *PBwiki* (now *PBworks*) around 2005 led to a dramatic increase in K-12 wiki usage (Morgan & Smith, 2008), while the introduction of wikis in all of the major course management systems (i.e., *Moodle, Blackboard,* and *Sakai*) did the same for higher education. Continuing calls for *21st Century Skills* (Silva, 2008) and *New Media Literacies* (Jenkins, 2009) have also stimulated educational uses, along with widely-cited efforts such as the Flat Classroom Project.[1]

These developments raise obvious questions regarding the *actual* educational use of wikis and their impact on learners and learning. Reich, Murnane, and Willett (2012) analyzed a representative sample of all 180,000 education-related public wikis in PBworks as of 2008. They found that 40% of the wikis were used as trial sites or for resource sharing, while 34% were used for content delivery. Another 25% of the educational wikis were for student assignments and portfolios, but with little or no interaction or collaboration. They determined that just 1% of the wikis were actually used as "collaborative student presentations and workspaces." Forte and Bruckman (2009) pointed to similar wiki usage patterns in other settings, and suggested that this lack of collaboration was partly due to the persistent traditional focus in education on isolated individual knowledge and skills, as institutionalized by conventional assessment practices.

Wikis and Portfolio Assessment

Many of the non-encyclopedic uses of wikis in education are consistent with the goals of portfolio assessment. Assessment of student proficiency and accomplishment via portfolios of student-created artifacts has always been central to studio-related domains like the arts and architecture (Davis-Soylu, Peppler, & Hickey, 2011). With the assessment reforms initiated in the late 1980s, portfolio assessment became more popular in other domains. In K-12 contexts, and particularly in the US, this trend was reversed as test-based accountability began suppressing all manner of "alternative"

assessments in the late 1990s (Stecher, 2010). The situation is different in higher education, where portfolio assessment is becoming widespread via multi-media "e-portfolios." While some e-portfolio systems include wikis and wiki-like editing, most are comprehensive systems designed to allow any student to create and maintain a sophisticated online dossier of their efforts and accomplishments. Most e-portfolio platforms currently have or are introducing social networking functions as well (Kim, Ng, & Lim, 2010). For many institutions, e-portfolios entail a significant financial and logistical investment (Wilhelm et al., 2006).

One obvious concern with portfolio assessment is that the desire to create impressive presentations can hinder the reflection and collaboration that is the ostensible goal of "portfolio pedagogy" (Kimball, 2006). Careful analysis of conventional portfolio assessment practices revealed that the more salient summative functions of displaying completed artifacts and other evidence of accomplishment often undermines the more elusive formative functions (Delandshere & Arens, 2003). It seems that this is likely to be a greater concern with e-portfolios because they allow even more sophisticated artifacts and more widespread sharing of those artifacts. Furthermore e-portfolios heighten the persistent problem of plagiarism, in that digital artifacts are so easily located, modified, and presented as one's own creations (Pittam, et al., 2009). As will be illustrated here, another potential problem with e-portfolio systems is that their designs inevitably reflect particular assumptions about learning and accountability. Given that these assumptions might not be consistent with individual programs or educators, systemic introduction of e-portfolio systems are likely to encounter significant challenges. Because the wikifolios and related features presented in this paper are quite flexible and can all be implemented with free or inexpensive tools on the open web, they may offer a more affordable and pragmatic alternative.

Design-Based Research and Educational Wikis

Design-based research methods (e.g., Kali, Linn, & Roseman, 2008) highlight another potential advantage of educational wikis. In recent years, many have come to appreciate the ways that design-based educational research methods lead to useful "local" theories (Cobb, et al., 2003) in the context of efforts to reform practice. Arguably, the flexibility and simplicity of wikis facilitate easy refinement of instructional features to support such research. Put differently, by making it easy to refine instructional features, wikis make it easier to refine specific principles behind those features. The research presented here drew inspiration from Forte and Bruckman's (2006) design studies of freshman essay writing in Georgia Tech's CoWeb. Their studies refined specific principles and wiki features for fostering dimensions

of "authentic" writing derived from the broader research literature. Rather than building sophisticated software tools, Forte and Bruckman iteratively refined simple wiki tools practices to support these dimensions, while refining specific principles to help others use those tools. In doing so they also began crafting more general principles for technology-supported writing instruction.

As elaborated below, the present research focused on refining the text of the wikifolio *assignments;* not a single line of code or any other changes to the course management system or the wiki technology were involved. Some revisions were literally made while students were working on the assignment, in response to the instructor's examination and discussion of the first posts. Perhaps most importantly, neither the instructor nor the students needed to learn to navigate any new interface or other technology tools in order to implement any of the refinements. This made it possible to focus more time and attention on refining the specific principles and the accompanying general principles that are presented in this paper.

Participatory Culture and Sociocultural Theories of Learning

Additional inspiration for the refinements carried out in this research came from ethnographic accounts of "hanging out, messing around, and geeking out" in friendship-driven and interest-driven digital social networks (Ito, et al., 2009). The tremendous levels of free-choice engagement and distributed learning in these networks exemplify what media scholar Henry Jenkins (2009) characterized as a *participatory culture*. These communities feature low barriers to creative expression and personal engagement, strong support for creating and sharing, informal mentorship, and strong social connections. The design and refinement of the assignments and wikifolio structure aimed to foster a participatory culture around mastering the abstract concepts and discrete skills outlined in challenging graduate-level textbooks; the unique approach to grading wikifolios that emerged in these studies was intended to "protect" this participatory culture around the wikifolios, while also accomplishing some of the accountability that is expected in most formal course contexts.

The broader trend toward more participatory views of learning is captured in an approach that has been deemed *connectivism* (Siemens, 2005). This net-centric view of education emphasizes diversity of opinions, connections across networks (and networks of networks), the value of learning over knowledge, and the value of current knowledge. Brown and Adler (2008) point out that connectivism is consistent with contemporary situative theories of learning that focus on the social and technological contexts of learning. As articulated by Greeno et al. (1998), situative theories of learning treat *engaged participation* as learning in and of itself, rather than as a

social means towards an individual goal. As elaborated in Hickey (2003), situative theories diverge from ostensibly similar social constructivist approaches (e.g., Dede, 2006) by focusing primarily on learning in terms of social and technological *practices* rather than individual change. Contrary to some characterizations (e.g., Anderson, Reder & Simon, 1996), situative theories do not ignore or deny individual learning. Rather, they treat the various forms of behavior or cognition that lead to individual knowledge as special cases of socially situated activity.

The wikifolio framework presented here draws directly on situative theories of assessment that emerged in prior design studies. As summarized in Hickey & Anderson (2007), situative theories offer a coherent way to address the tensions between individual and social learning and between competing approaches to individual learning. This offers a promising way of meeting demands for individual accountability via conventional tests, while still supporting constructivist (Duffy & Jonnasen 1991) and constructionist (Kafai & Resnick, 1996) practices within a participatory/connectivist approach.

RESEARCH CONTEXT & METHODS

This research was initiated when the first author set out to create online versions of existing face-to-face graduate-level education courses. These courses are called *Assessment in Schools* and *Learning & Cognition in Education.* While the wikifolios were first developed in the Assessment course, they were more fully refined and studied in the Learning and Cognition Course. All of the online work was carried out in the *OnCourse* system developed using the open-source *Sakai* course management system.

As introduced above, design-based research (DBR) methods iteratively refine general and specific design principles while refining instructional features in specific contexts. This means that DBR is neither "basic" research testing fundamental theories (as in much modern cognitive psychology research) nor "applied" research testing the relevance of those theories to practice (as in much modern educational psychology research). While more basic theories of learning play a role in DBR, they are reframed as "meta-principles" that are used to derive more general design principles. These general principles are then used to derive specific principles and features in particular instructional contexts (Kali, Linn, & Roseman, 2008).

Attempting to translate face-to-face courses to online courses provided an opportunity to build on the meta-principles and general principles derived from newer situative theories of formative and summative assessment (Gee, 2003; Greeno & Gresalfi, 2008; Hickey & Anderson, 2007). One of the meta-principles is the situative assumption that abstract concepts draw

most (or even all) of their meaning from their contexts of use (Greeno et al., 1998). This suggests a general design principle that instruction should begin with relatively concrete and personally meaningful contexts. Because both of the courses concerned education and included many teachers, the obvious contexts were more specific instructional domains and particular instructional goals within those contexts

The search for instructional features to enact this core principle was directly informed by Engle & Conant's (2002) efforts to foster *productive disciplinary engagement.* Engagement that is *disciplinary* maintains a focus on the topics of the course without devolving into ostensibly related topics (i.e., discussing teaching practices in general without any consideration of course specifics). Engle and Conant argued that disciplinary engagement is *productive* when it makes intellectual progress, builds new understanding, raises questions, challenges assumptions, and brings in external resources. One of their principles for fostering such engagement is that course content should be *problematized:*

> Previously accepted facts can be treated as examinable claims, common explanatory accounts as needing evidence, and standard procedures as needing explanation for their functionality. Thus *problems do not need to be open from the perspective of experts in a discipline, but rather from the perspective of students interpreting them, using available knowledge and resources.* (Engle & Conant, 2002, p. 404, emphasis added)

Most of the refinements in the present research can be understood as a persistent search for techniques to "open up" the disciplinary knowledge represented by a comprehensive textbook in a way that could foster shared engagement that was indeed both disciplinary and productive. As will be discussed next, the content of both courses was problematized by having students consider the relative relevance of the "big ideas" of each chapter in a personally meaningful context. Because of this, the ability to problematize course content is a prerequisite for others who wish to directly adapt this framework for their own course; as described in the conclusion, doing so has proven surprisingly easy in a number of school contexts.

Initial Implementation in *Assessment in Schools*

The first effort to enact this core design principle took place in the Assessment in Schools course when taught for the first time by the first author. Nearly all of the 40 students were practicing teachers pursuing a graduate degree, and many were taking two courses per semester. Because the students were so busy and on two different campuses, the course was designed around weekly online assignments that were supplemented by monthly face-to-face meetings at a centrally-located facility.

The primary content of the assessment course was (a) key assessment principles of reliability, validity, and bias, (b) general guidelines for creating classroom assessments, and (c) specific guidelines for common assessment item formats. This content was problematized by first having each student define a lesson that was typical of their teaching and that would lend itself to a variety assessment formats. Students were then led to articulate which aspects of the three principles or which of the assessment guidelines was most relevant to that lesson. The assumption was that any engagement in such consideration was likely to be disciplinary; the obvious challenge was finding ways to foster productive online engagement in discussions about this topic. Given the growing evidence that the student interaction in many online courses is actually quite routine and unproductive (e.g., Dennen & Wieland, 2007), this was a central challenge in this work.

E-portfolios

The online aspects of the assessment course were initially implemented within an e-portfolio system that had been created within the OnCourse course management system. Initially, the OnCourse e-portfolios seemed like a promising context for the online assignments because they lent themselves to student-generated artifacts and interactions among students and the instructor around those artifacts. Most importantly, within the context and duration of the course, these artifacts and interactions could be both *public* and *persistent.* As Sarmiento and Stahl (2008) point out, artifacts and interactions that are both public and persistent offer unique possibilities for disciplinary engagement. In particular, public and persistent artifacts seem less likely to be treated as "assignments" whereby students submit something to an instructor in exchange for a grade or points.

The OnCourse e-portfolio system had been designed around a "matrix thinking" approach to assessment that emphasized critical self-reflection. Customizable matrices allowed students to reflect on how specific aspects of their course projects demonstrated competencies at the intersections of two sets of goals. The first goals were general educational learning goals that were defined at an institutional level (i.e., the *Principles of Undergraduate Learning* in Kahn & Hamilton, 2008); the second were students' self-defined professional goals. The assignments designed for the new Assessment in Schools course appropriated this matrix structure. They did so by asking students to consider how aspects of their instructional goals were most relevant to aspects of the assessment principles or the various assessment development guidelines. After defining their instructional goal the first week, students were to post such a matrix each subsequent week and discuss them in the OnCourse discussion forum.

After weeks of refinement, the e-portfolio assignments still seemed rather complicated. While pilot testing with doctoral students generated useful refinements, concerns remained that the matrix structure was difficult to explain and might not lend itself to easy conversation. The first several weeks of class confirmed these concerns. Students reported spending most of their time just figuring out how to complete the assignment. While there were certainly examples of disciplinary engagement, many of the posted claims of relevance were brief and unconvincing. Most of the students commented on the discussion forums as the assignment required. While some of the posts involved disciplinary topics, very few exchanges could have been characterized as "productive" according to the criteria above.

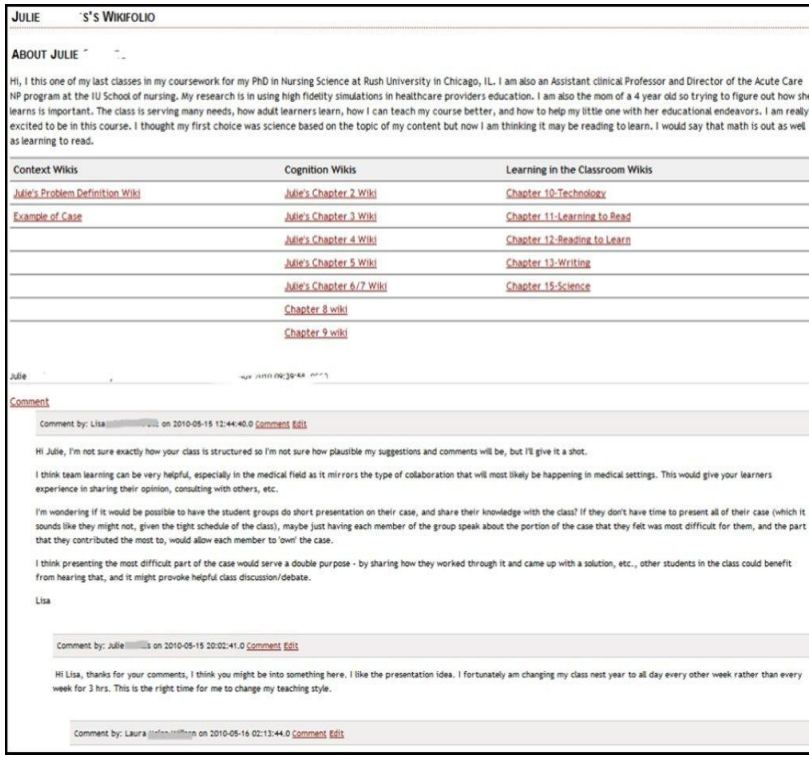
"Emergency" wikifolios

By the third week of the course, it was clear that the e-portfolio system was utterly unworkable for enacting the core design principle. A quick review of the research literature summarized above pointed to the OnCourse wiki tool as a promising alternative. The instructor did not consider it at first because some faculty colleagues characterized the OnCourse wiki as "limited" and even "crude." It lacked many of the features of *Wikispaces* and other popular wiki platforms. In particular, it lacked the ability to easily store and display images and other features needed to make professional-looking pages.

However, the OnCourse wikis turned out to be ideal for enacting the core design principle for several reasons. First, as a wiki, it was simple to show students how to post and share their ideas with their classmates. Second, because it was a relatively unsophisticated system, student would focus their attention on the disciplinary topics of the course and would be unlikely to worry about making artifacts that were physically attractive beyond basic text formatting. Finally, the OnCourse wikis feature a simple commenting system whereby students and instructors could easily comment directly on each other's wikis. As elaborated below, it was possible to comment directly on the wiki and post a comment to a comment, allowing an unlimited number of threaded discussions at the bottom of each wiki.

Echoing the experience of Forte and Bruckman (2006), it was quite simple to create a wiki page with a link to each student's wikifolio homepage (shown in Figure 1 below). An instructor wikifolio was posted each week and students were encouraged to examine both the wiki and the edit window for clues for creating their own. By the second wikifolio assignment, all of the students succeeded in posting wikifolios and most of the students were engaging in disciplinary commenting. While many refinements were still needed, the class quickly found a nice rhythm. The posts got longer and longer, and multiple threaded discussions emerged on most posts. Near the

end of the course, the reflections described below were introduced. Given the disruptions, overall performance on a timed final examination featuring multiple choice and short answer items from the text-book item bank was quite satisfactory (with an average score of 86%). Anonymous course evaluations showed that while many students did not like the mid-course change, many of them reported liking the wikifolios.



JULIE 'S'S WIKIFOLIO

ABOUT JULIE

Hi, I this one of my last classes in my coursework for my PhD in Nursing Science at Rush University in Chicago, IL. I am also an Assistant clinical Professor and Director of the Acute Care NP program at the IU School of nursing. My research is in using high fidelity simulations in healthcare providers education. I am also the mom of a 4 year old so trying to figure out how she learns is important. The class is serving many needs, how adult learners learn, how I can teach my course better, and how to help my little one with her educational endeavors. I am really excited to be in this course. I thought my first choice was science based on the topic of my content but now I am thinking it may be reading to learn. I would say that math is out as well as learning to read.

Context Wikis	Cognition Wikis	Learning in the Classroom Wikis
Julie's Problem Definition Wiki	Julie's Chapter 2 Wiki	Chapter 10-Technology
Example of Case	Julie's Chapter 3 Wiki	Chapter 11-Learning to Read
	Julie's Chapter 4 Wiki	Chapter 12-Reading to Learn
	Julie's Chapter 5 Wiki	Chapter 13-Writing
	Julie's Chapter 6/7 Wiki	Chapter 15-Science
	Chapter 8 wiki	
	Chapter 9 wiki	

Julie

Comment

Comment by: Lisa on 2010-05-15 12:44:40.0 Comment Edit

Hi Julie, I'm not sure exactly how your class is structured so I'm not sure how plausible my suggestions and comments will be, but I'll give it a shot.

I think team learning can be very helpful, especially in the medical field as it mirrors the type of collaboration that will most likely be happening in medical settings. This would give your learners experience in sharing their opinion, consulting with others, etc.

I'm wondering if it would be possible to have the student groups do short presentation on their case, and share their knowledge with the class? If they don't have time to present all of their case (which it sounds like they might not, given the tight schedule of the class), maybe just having each member of the group speak about the portion of the case that they felt was most difficult for them, and the part that they contributed the most to, would allow each member to 'own' the case.

I think presenting the most difficult part of the case would serve a double purpose - by sharing how they worked through it and came up with a solution, etc., other students in the class could benefit from hearing that, and it might provoke helpful class discussion/debate.

Lisa

Comment by: Julie on 2010-05-15 20:02:41.0 Comment Edit

Hi Lisa, thanks for your comments, I think you might be into something here. I like the presentation idea. I fortunately am changing my class nest year to all day every other week rather than every week for 3 hrs. This is the right time for me to change my teaching style.

Comment by: Laura on 2010-05-16 02:13:44.0 Comment Edit

Figure 1. Example of a student-created wikifolio homepage providing background information.

Planned Implementation in Learning & Cognition

In the subsequent semester, the wikifolio strategy that emerged in the Assessment in Schools class was more systematically implemented in an online version of the Learning & Cognition course taught by the first author. This instructor had been teaching face-to-face versions of this course for many years. At this particular university, the course is required for many graduate degrees in the college of education. The course is taught by multiple instructors, and there is a broader expectation of accountability for the

course. Students who complete the course were expected to understand the differences between the three "grand theories" of learning and cognition (i.e., behavioral, cognitive and situative/sociocultural) and the primary processes in the dominant cognitive model (e.g., encoding, retrieval, metacognition, motivation, etc.) as they relate to education.

This instructors' section of this course was organized around the fifteen chapters of a relatively advanced text (Brunning, Schraw, & Norby, 2010). Two chapters cover behavioral and sociocultural theories of learning, and eight chapters cover major aspects of cognition (e.g., long-term memory, encoding, problem solving, etc.). The last five chapters cover learning in each of the five primary content domains in education (literacy, comprehension, writing, mathematics, and science). All of the activities were asynchronous, meaning that students were never required to log in at a particular time. There were, however, strictly enforced weekly deadlines for each wikifolio posting in order to foster "critical mass" of shared engagement.[2] At this university, Learning & Cognition was taken by a challenging mix of educators, designers, trainers, and researchers. Students enrolling in the online sections ranged from timid residential students taking their first online course to tech-savvy students in online programs in Learning Sciences and Instructional Systems Technology. In the two semesters that are the focus of this paper, the course had seventeen and nineteen students enrolled.

Research Method

Redesigning Learning & Cognition as a fully online course presented the opportunity to build on the lessons from the Assessment in Schools course. This redesign occurred alongside other efforts to enact the core design principle in two other educational settings (new media for secondary language arts and educational video games for elementary science). Each context and setting presented similar goals of fostering productive disciplinary engagement that would also leave individual students with a robust understanding of targeted concepts and deliver evidence of the overall impact on externally-developed achievement measures.

Consistent with design-based research methods and the goal of coherence across research settings, significant effort was invested in defining a set of general design principles that were the same across all of three settings; it would then be possible to show how the general principle was transformed into a more specific principle while creating features in each context to enact that principle. Design-based researchers assume that such a paring of general and specific principles that can then be illustrated with specific features provides useful guidance for other innovators who are working in similar settings towards similar goals. For the reasons elaborated below, all of the principles are framed as aspects of educational assessment; because the

refinement of these principles was framed by the participatory theories of learning summarized above, the method defined by the five general design principles that emerged was called *Participatory Assessment.*

After the first Learning & Cognition course, the instructor then implemented the new framework in a fully online version of Assessment in Schools, and then again in Learning & Cognition the following semester. Numerous refinements were made in each course. Insights from the online courses were tried out in the two other settings, and insights from the other settings were tried out in the online course. Because numerous features (including assessments) were modified repeatedly, it is impossible to make direct comparisons from one version to the next, or to tie any particular refinement to any particular improvement in learning outcomes. Rather, this paper will now shift gears. The next sections will introduce each of the five general design principles that currently define Participatory Assessment. For each principle, the course features used to enact it are presented, along with initial evidence of the engagement those features supported. This is followed by a more comprehensive consideration of student engagement, along with initial evidence of the understanding and achievement that resulted.

Participatory Assessment Design Principles

Drawing on situative theories of learning and assessment (particularly Greeno et al., 1998, and Greeno & Gresalfi, 2008) the five design principles of Participatory Assessment assume a much broader view of learning than the design principles that follow from more well-known behavioral or cognitive theories of learning. Because situative theories focus primarily on interactions with social and technological resources, social and technological interactions (which are treated as instructional practices in prior theories) are themselves viewed as learning in these newer theories. In assuming this broader view of learning, the widely-embraced distinction between "assessment" and "instruction" is obscured. This and other relevant assumptions are elaborated below.

1. Let Contexts Give Meaning to Concepts and Skills.

Drawing from situative theories of knowing and learning (Greeno et al., 1998), this design principle suggests fostering increasingly sophisticated, communal discourse around valued concepts and skills by discussing how that knowledge gains meaning from the contexts in which it is or might be used. This is the primary design principle, in that the other principles aim to "protect" the activity that follows from this principle. As introduced above, this principle was enacted by asking students to (a) define their own unique domain-specific learning goal, (b) take on the identity of an educator in a specific teaching domain, and (c) compose weekly wikifolios identifying

the chapter concepts that are most relevant and least relevant to their learning goal. These features are elaborated as follows.

Domain-specific learning goal. In the first week, online videos, course-specific FAQs, a program-specific help page, and the instructor's sample allowed every student to quickly post a homepage and personal introduction (Figure 1). Reflecting the crucial role of "lurking" in participatory cultures (Dena, 2006), students are encouraged to first look at the samples or their classmates' examples before starting their own post. In this first post, each student is asked to define a domain-specific learning goal that best illustrates what they do or hope to do with their own students (Figure 2). To begin learning the nuanced distinction between the *processes* of learning and the *practices* of teaching, the first assignment asks students to define their learning goals in a manner that is relatively free of specific assumptions about knowing and learning (i.e., "learning linear functions" rather than "using problem-based learning to teach linear functions"). The goals need to be framed at an appropriate grain size; students in unique disciplines (e.g., music, vocations, etc.) needed to adapt their goals to work with one of the five domain groups. While this enables students to use their goals to engage with the big ideas in each chapter, it also requires a good deal of individualized and contextualized feedback. As described below, this feedback is provided publically and persistently via the wiki commenting feature.

Professional groups. Reflecting the general goals of situative, connectivist, and participatory perspectives, students in these particular sections of the course were also expected to develop professional social networking skills and to begin developing and projecting a professional identity around a particular instructional domain. Put differently, the goal was for students to build their understanding of learning and cognition in a way that would prepare them to discuss this knowledge with other educators, and particularly with other educators in particular academic domains. In their introductory post, students are asked to describe and discuss what they teach or study or would like to teach or study in the future, and what role they play or might play in the educational establishment. The introductions and problem statements are used by the instructor to organize the students into five networking groups according to the five primary academic domains in the text (literacy, comprehension, writing, math, or science). This was inspired in part by Gee's (2004) notion of *affinity spaces* and is elaborated in Bishop & Hickey (2012). The expectation is that students will collaborate more intensively within their primary groups, while looser groups are expected to emerge in discourse across those groups that reflect different aspirational roles in the educational system (i.e., instructional leaders, administrators, or researchers). As detailed below, each of the five groups also compose groupwikis in the last five weeks of the course, and commented more deliberately on their classmates' wikifolios.

JULIE'S PROBLEM DEFINITION

Problem: I am currently using medical case studies that the students (adult learners) complete independently the students learn a lot but I am doubling my class size this fall so grading 20- 20 page case studies is a nightmare and students do not have an opportunity to learn off each other. We also have not had a lot of time in class to discuss the process they have gone through finding the differential diagnosis etc. So I wanted to transform these cases into team based learning activities and bring some discussion of the cases into the classroom or even create simulations out of the cases. Questions: 1) How do I create a case study team based learning assignment that still creates Individual Accountability in a Cooperative Learning Setting? 2) How do I support the case study learning in class? 3) How can I have the cases drive the learning and use class time only to fill in the gaps rather than "death by powerpoint"? 4) Theoretically adult learners should be allowed to be self directed learners but how do I confirm accountability in a high stakes outcome?

Case Study Structure (in progress)

Groups of 3-4 students will each work on the same case study Peer-Questions Group submission Individual journal (ind. accountability) Random person from group will present findings (ind. accountability)

Reflection 2-5

Consequential reflection (1 point). What were the consequences of choosing this particular problem for learning about memory and cognition? How did landing in one group vs. another group change the way you are learning about memory and cognition? Hint: what are the implications of choosing an early literacy problem vs. a comprehension problem for learning about automaticity?

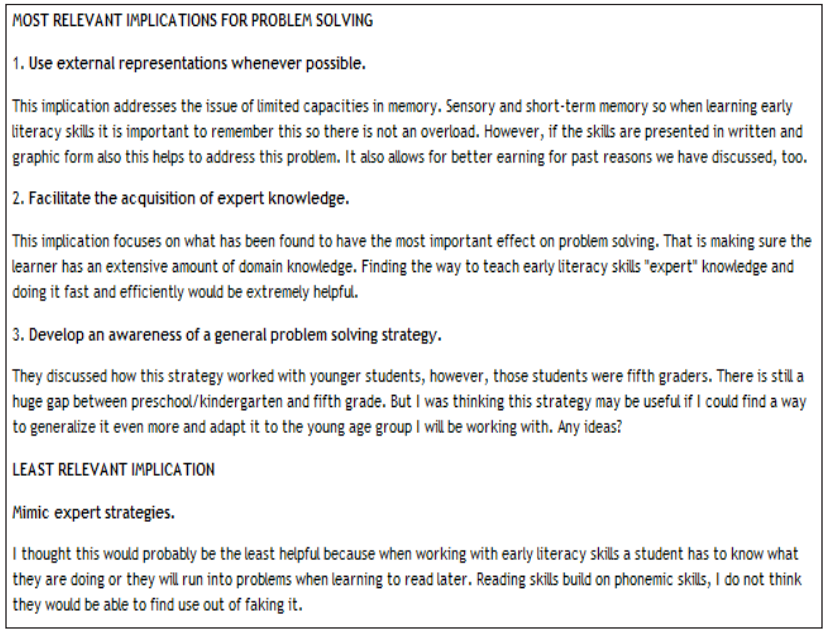
I believe this was the best choice I could have made out of the teaching modalities I currently use. Why the best, because if I am able to enrich a very flat case study into a lesson that creates strong encoding and ability to recall when needed then my other teaching using simulations, role playing etc will seem easy. I also know that the students were already getting something out of cases but hated doing them so I definitely wanted to keep them in the program but I also knew that they could be delivered in a significantly better way. I believe at the end of this course I will not only be able to deliver the case studies better but also enrich my other lessons.

Figure 2. Example of a domain-specific learning goal for contextualizing discussion and course content.

Weekly wikifolios. To ensure that students learn knowledge they can use in other contexts, the process of drafting and discussing the wikifolios focuses on the way the core course content intersects with each student's specific learning goal. At the outset, students are pushed to articulate and discuss the implications (i.e., the consequences) of different theories of learning and specific processes in cognition for *their* learning goals. This is labeled *consequential engagement* (after Gresalfi, Barab, Siyahhan, & Christensen, 2009, and elaborated below). Further consideration of these "context-concept relationships" takes place as students reflect critically on

their instructional problems for appreciating the focal course knowledge. For example, debating whether or not *self-efficacy* has more consequences for learning mathematics than language arts is a useful embodied context for discussing otherwise abstract nuances of self-efficacy.[3] This is labeled *critical engagement.*

Identifying the "most relevant" and "least relevant" concepts. The assignment for the weekly wikifolios asks each student to rank in order the three or more "most relevant" and articulate the one "least relevant" of the *implications for education* presented in each chapter summary (Figure 3). Parsing the relative relevance of the implications across each context is intended to cause students to consider the nuances of the implications. For example, doing so leads students to recognize that some of the implications were more general, while others were more specific and could be subsumed under the more general implications.



MOST RELEVANT IMPLICATIONS FOR PROBLEM SOLVING

1. Use external representations whenever possible.

This implication addresses the issue of limited capacities in memory. Sensory and short-term memory so when learning early literacy skills it is important to remember this so there is not an overload. However, if the skills are presented in written and graphic form also this helps to address this problem. It also allows for better earning for past reasons we have discussed, too.

2. Facilitate the acquisition of expert knowledge.

This implication focuses on what has been found to have the most important effect on problem solving. That is making sure the learner has an extensive amount of domain knowledge. Finding the way to teach early literacy skills "expert" knowledge and doing it fast and efficiently would be extremely helpful.

3. Develop an awareness of a general problem solving strategy.

They discussed how this strategy worked with younger students, however, those students were fifth graders. There is still a huge gap between preschool/kindergarten and fifth grade. But I was thinking this strategy may be useful if I could find a way to generalize it even more and adapt it to the young age group I will be working with. Any ideas?

LEAST RELEVANT IMPLICATION

Mimic expert strategies.

I thought this would probably be the least helpful because when working with early literacy skills a student has to know what they are doing or they will run into problems when learning to read later. Reading skills build on phonemic skills, I do not think they would be able to find use out of faking it.

Figure 3. Example of students parsing out material from the text relevant to their learning goal.

Having students articulate the "least relevant" implication is intended to foster content coverage and highly contextualized discourse about course concepts. Of course, all of the implications are relevant in some way to every goal. However, searching for the implication that is least relevant pro-

vides a functional context for making sense of each of the implications. As illustrated below, the "least relevant" posts repeatedly prompted some of the most productive discourse within the threaded wiki comments.

Identifying the "most relevant specifics." Another feature used to enact the first principle was intended to provide a context for reading the chapter and to support broader coverage. Each weekly assignment asked students to identify the five "most relevant specifics" (specific studies, theorists, terms, etc.) in light of their most relevant implications. The idea was that students might discuss the relative relevance of the specifics for their particular implications. So far, this has only happened in the groupwiki and then only sporadically. However, given the relatively modest goals of the course and the use of a relatively advanced text, it seems like the combination of relevant implications and relevant specifics and the desire to succeed on the exams was sufficient to motivate students to engage with the entire chapters and become familiar with a reasonable amount of the specific knowledge of each chapter.

2. Scaffold Productive Disciplinary Engagement

This second principle reflects the assumption that productive engagement is itself a learning goal and something that students need to be taught. This assumption diverges from the social-constructivist assumption that students' intrinsic motivation and natural curiosity will generate interactions that shape individual understanding. This principle was enacted via comments posted on the wikifolios, instructor examples and encouragement around the commenting practices, the aforementioned professional networking groups, and the groupwikis.

Wiki commenting for communal feedback and shared engagement. Most of the actual interaction in this course occurs via comments posted directly on the wikifolios (Figure 4). As with many wiki systems, the *Sakai/OnCourse* wiki commenting system allows for indented threads to emerge in the comments. The usefulness of this feature becomes apparent as soon as students put up their homepages and introductions. By providing carefully worded feedback in comments on the early posts, it is possible to give highly contextualized feedback. Because all of the students were engaged in a similar pursuit, that feedback is immediately and widely useful.

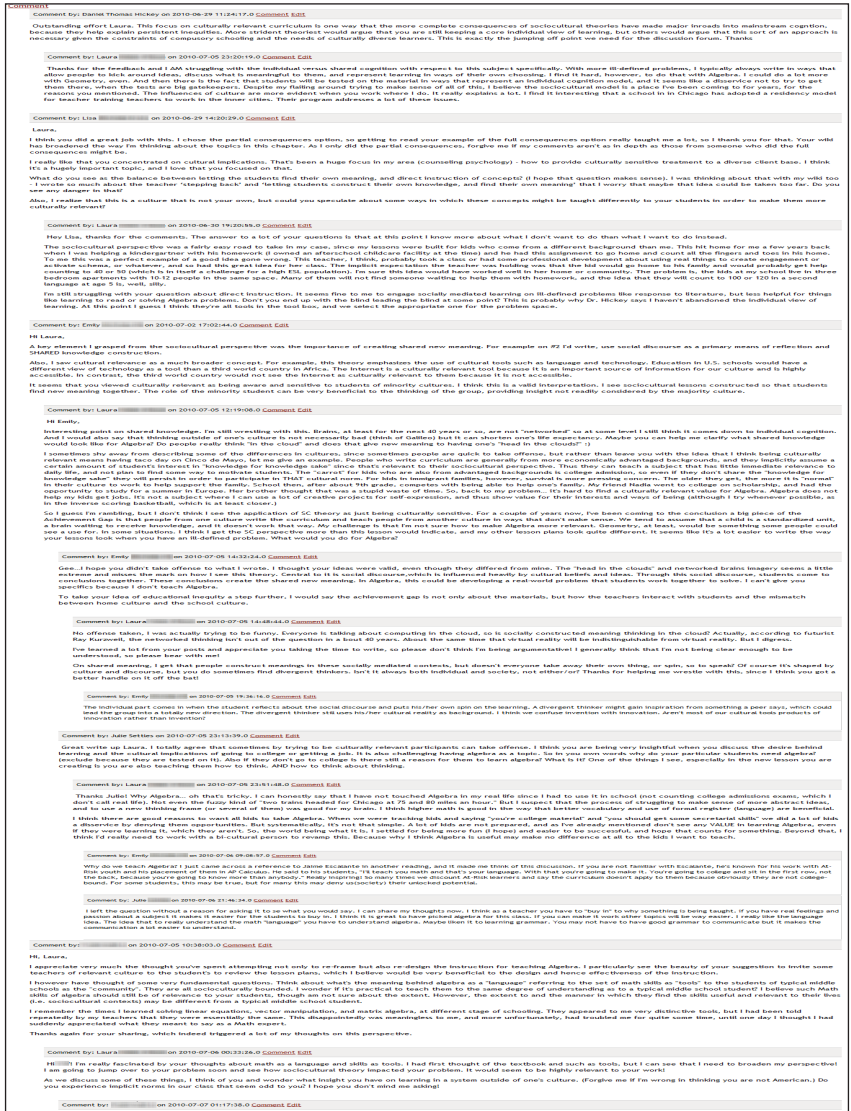


Figure 4. Sample of threaded student comments on a wikifolio artifact.

The usefulness of this anchored discourse becomes even more apparent in the initial problem definition assignment describe above. Many of these students (a) are used to developing actual lessons or modules, (b) conflate the learning process with teaching practices, (c) take modern cognitive learning theories for granted, (d) view behavioral theories as guidelines for mastery-oriented instruction and collaborative teaching, and (e) view situative theories as guidelines for collaborative learning. This makes the first assignment initially perplexing for many students. The contextualized feedback and threaded discussion on individual wikis across multiple examples helps students understand crucial aspects of the assignments that would be abstract and confusing if explained in the text of the actual assignment.

One of our observations in these classes is that that wiki commenting appears to be more productive discourse than the discussion forums that are typically used in online courses. This is presumably because the wiki discourse is physically and conceptually anchored to individually meaningful artifacts. To use the language of situativity theory (e.g., Barab et al., 2007), the wikifolios provide a concrete context and "embodied" experience in which to situate interactive consideration of the more abstract course concepts. While this assumption appears worthy of more systematic verification, the current focus has been on finding strategies for maximizing the anchored discourse that these features afford. One specific strategy that emerged is providing detailed feedback to two or three of the first posts (which are typically from the more experienced and more confident students). The instructor comments on those wikis and sends private messages thanking the authors for getting things started and asking them to comment on the comments. A message is sent to the class suggesting that everyone look at those posts (and possibly comment themselves) before starting their own wikifolio.

A sample exchange in comments. The initial inspiration for the "least relevant" assignment was a rather mundane concern for course coverage. It turned out that students would sometimes state that an implication was least relevant because they did not understand it well enough to connect it to their learning goal. This seemed to provide a safe and meaningful context for comments from classmates and the instructor that clarify misconceptions or point to under-representations of the implications. Consider for example the wikifolio for one student in the literacy group for Chapter Four, which covered encoding information to long term memory. She listed her least relevant implication as *Help students activate their current knowledge*, with the following justification:

> I think this is an important implication but I focused more on this in Chapter 2. Therefore, I am going to play devil's advocate with myself and explain some reasons why it could be

> less relevant than mentioned before. Finding a relationship between new and prior knowledge is beneficial in learning information. However, phonological awareness and early literacy skills are often very hard for students to link to prior knowledge when they do not have basic reading skills.

This is a good example of the sort of "context-concept" relationships that we hoped students would uncover. The wikifolio assertion prompted another member of the literacy group to comment:

> I think that activating prior knowledge will be important for you. You want students to be tapping into words they know that have salient features in common with new words ("let's think of words we know that have the bl- sound") and I think the strength of those connections is going to help make progress to automaticity. The book gave a relevant example on page 59 about how we process even words with missing features based on the strength of connections to known words.

This use of a specific example and a reference to an example in the textbook is a good example of what we mean by "productive" engagement. To that the first student responded:

> I think you are making a very good point and I will definitely consider this when addressing my instructional problem and lesson plan. However, it was especially hard with this chapter for me to find something that was least relevant because I felt all of the implications were relevant for my problem.

This final comment nicely illustrates Engle and Conant's (2002) assertion that problems that are "closed" to experts can be "opened up" for leaners. The entire exchange illustrates our assumption that meaningful engagement with the wikifolio assignment is bound to support at least some engagement that is disciplinary, and that meaningful discussion of those artifacts is likely to support at least some engagement that is productive. While this was certainly one of the more productive exchanges, we were pleased to see multiple examples like this by the second assignment; the instructor would regularly add comments commending the participants and encouraging the class to engage in such exchanges. This post and exchange also illustrate how searching for the most relevant and least relevant implications pushes students to uncover the meaning of all of the implications. We presume that this supports a general course goal of broad coverage while helping students learn to interact deeply and meaningfully with those same topics; additional features and data are needed to test this assumption more systematically.

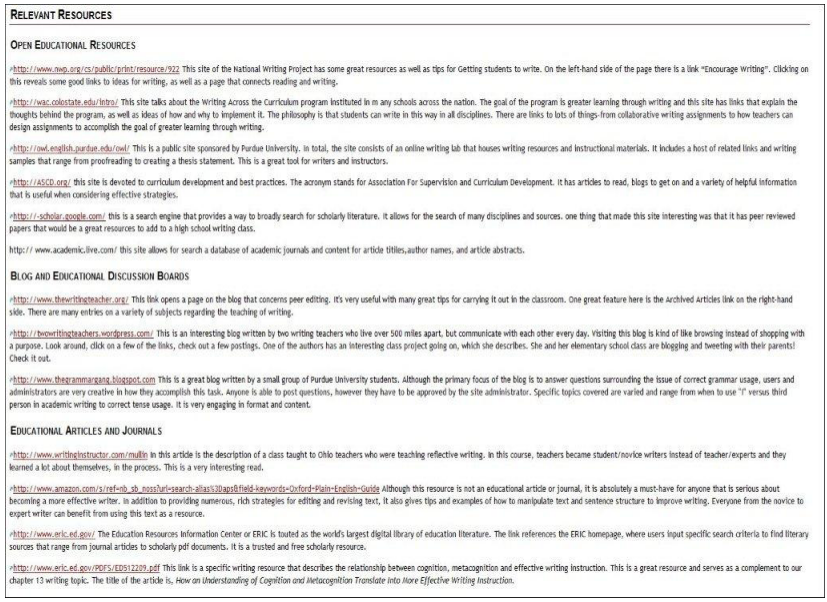
Professional networking strategies. As noted above, students' interests and learning goals were used to organize the class into five groups that corresponded with the five major educational domains. Just as in other social networks, a wide range of prior experience, ambition, and enthusiasm was expected and accommodated. Discussion leaders were encouraged to emerge within each group. Students were encouraged to speak for their group (by referencing their domain rather than their own instructional goal) when commenting on the wikis in other groups. Additionally, the instructor fostered discussion leaders via private messages that encouraged emerging leaders. By the last five weeks of class, one or two discussion leaders emerged in each group in both classes.

Deliberately fostering discussion leaders raises non-trivial issues of equitable treatment and common expectations. These concerns are attenuated by two sets of observations and assumptions. The first observation concerns the wide range of ambition among students in these classes. A significant proportion of them were full-time teachers attempting to complete their graduate degree in two years by taking two courses per semester. While some of these students became discussion leaders, full time students and working students taking a lighter load seemed much more likely to do so. The assumption here is that busier students gain as much from participating in a vigorously-led group than they would from groups where such students were required to take turns as discussion leaders. A further assumption is that allowing discussion leaders to emerge naturally may better prepare all participants to eventually become leaders in such discussions by providing plausible role models.

A second observation regarding discussion leaders follows from the role they play in fostering participatory cultures in other interest-driven social networks. As observed by Jenkins (2009) and Ito et al. (2009), the most active knowledge networks feature a handful of dedicated leaders, a small number of highly-active participants, and a much larger number of participants who follow along while making little or no active contribution. It is assumed that the level and authenticity of the discourse that is fostered by encouraging group leaders benefits all students, compared to more equitable strategies where leadership roles are assigned and rotated. This is clearly an issue worthy of further consideration and perhaps some experimental manipulation.

Groupwikis. During the last five weeks of the course, each group creates an expanded collaborative wikifolio called a *groupwiki* (Figure 5). Building directly on the now-familiar routines used in the individual wikifolios, the group members negotiate (a) an exemplary learning goal for the entire group, (b) the entire set of chapter implications ranked in order of relevance to that goal, (c) a lengthier set of specifics, (d) the debate or issue discussed

in the chapter that is most relevant to the exemplary goal, (e) annotated links to relevant web-based "open-education resources," and (f) descriptions of relevant external professional social networks based on each member's initial participation in that network.



RELEVANT RESOURCES

OPEN EDUCATIONAL RESOURCES

#http://www.nwp.org/cs/public/print/resource/922 This site of the National Writing Project has some great resources as well as tips for Getting students to write. On the left-hand side of the page there is a link "Encourage Writing". Clicking on this reveals some good links to ideas for writing, as well as a page that connects reading and writing.

#http://wac.colostate.edu/intro/ This site talks about the Writing Across the Curriculum program instituted in m any schools across the nation. The goal of the program is greater learning through writing and this site has links that explain the thoughts behind the program, as well as ideas of how and why to implement it. The philosophy is that students can write in this way in all disciplines. There are links to lots of things from collaborative writing assignments to how teachers can design assignments to accomplish the goal of greater learning through writing.

#http://owl.english.purdue.edu/owl/ This is a public site sponsored by Purdue University. In total, the site consists of an online writing lab that houses writing resources and instructional materials. It includes a host of related links and writing samples that range from proofreading to creating a thesis statement. This is a great tool for writers and instructors.

#http://ASCD.org/ this site is devoted to curriculum development and best practices. The acronym stands for Association For Supervision and Curriculum Development. It has articles to read, blogs to get on and a variety of helpful information that is useful when considering effective strategies.

#http://-scholar.google.com/ this is a search engine that provides a way to broadly search for scholarly literature. It allows for the search of many disciplines and sources. one thing that made this site interesting was that it has peer reviewed papers that would be a great resources to add to a high school writing class.

http:// www.academic.ilve.com/ this site allows for search a database of academic journals and content for article titles,author names, and article abstracts.

BLOG AND EDUCATIONAL DISCUSSION BOARDS

#http://www.thewritingteacher.org/ This link opens a page on the blog that concerns peer editing. It's very useful with many great tips for carrying it out in the classroom. One great feature here is the Archived Articles link on the right-hand side. There are many entries on a variety of subjects regarding the teaching of writing.

#http://twowritingteachers.wordpress.com/ This is an interesting blog written by two writing teachers who live over 500 miles apart, but communicate with each other every day. Visiting this blog is kind of like browsing instead of shopping with a purpose. Look around, click on a few of the links, check out a few postings. One of the authors has an interesting class project going on, which she describes. She and her elementary school class are blogging and tweeting with their parents! Check it out.

#http://www.thegrammargang.blogspot.com This is a great blog written by a small group of Purdue University students. Although the primary focus of the blog is to answer questions surrounding the issue of correct grammar usage, users and administrators are very creative in how they accomplish this task. Anyone is able to post questions, however they have to be approved by the site administrator. Specific topics covered are varied and range from when to use "I" versus third person in academic writing to correct tense usage. It is very engaging in format and content.

EDUCATIONAL ARTICLES AND JOURNALS

#http://www.writinginstructor.com/mullin In this article is the description of a class taught to Ohio teachers who were teaching reflective writing. In this course, teachers became student/novice writers instead of teacher/experts and they learned a lot about themselves, in the process. This is a very interesting read.

#http://www.amazon.com/s/ref=nb_sb_noss?url=search-alias%3Dapps&field-keywords=Oxford+Plain+English+Guide Although this resource is not an educational article or journal, it is absolutely a must-have for anyone that is serious about becoming a more effective writer. In addition to providing numerous, rich strategies for editing and revising text, it also gives tips and examples of how to manipulate text and sentence structure to improve writing. Everyone from the novice to expert writer can benefit from using this text as a resource.

#http://www.eric.ed.gov/ The Education Resources Information Center or ERIC is touted as the world's largest digital library of education literature. The link references the ERIC homepage, where users input specific search criteria to find literary sources that range from journal articles to scholarly pdf documents. It is a trusted and free scholarly resource.

#http://www.eric.ed.gov/PDFS/ED512209.pdf This link is a specific writing resource that describes the relationship between cognition, metacognition and effective writing instruction. This is a great resource and serves as a complement to our chapter 13 writing topic. The title of the article is, *How an Understanding of Cognition and Metacognition Translate into More Effective Writing Instruction.*

Figure 5. Example of group-sourced Internet resources most relevant to the exemplary learning goal.

This course feature highlights an important point regarding wikis versus discussion forums. Until this point in the course, the discussion forums were only used for answering questions; all of the substantive discourse was directed to the wiki commenting, where it could be contextualized around each student's wikifolio posts.[4] But the threaded topical discussions *were* useful (and actually more suitable) for the group discussions that were framed by the context of the group assignment *and* the members' prior shared experience with their wikifolios. One specific strategy that emerged here concerned the way that the instructor would intervene when productive debates concerning the groupwiki emerged on the discussion forums. The instructor would suggest that the group make that disagreement part of their groupwiki. The groups could post the differing opinions (usually different rankings of relevance) and then post a comment asking others to weigh in. This typically spawned a productive thread of discussion about the debate that included students from other groups.

Lead group commenting on other groups. Focusing different students on different domains raises the concern that students might disengage during the four weeks that focus on domains other than their own. In response, the wikifolio assignment for the four non-lead groups each week was further problematized by searching for relevance of the implications from the other domains for their own learning goal. Thus, for example, students focusing on writing had to search for relevant implications in the chapter on mathematics. The students in the lead group that week were then assigned to use their growing expertise to comment widely.

Examination of the wikifolios from the students in the non-lead groups suggests that this search for relevance provided students with a functional context for reading and discussing a potentially irrelevant chapter. For example, one of the implications in the chapter on mathematics pointed out that the teacher's own level of knowledge was particularly important in mathematics. This led many students in the other groups to speculate about the importance of teacher knowledge in their own domain. The wikifolio of a student in the writing group asserted "I feel the same way about English and writing teachers. If you are going to teach writing you must write yourself." The student went on to consider the nuanced differences in the roles of teacher expertise in teaching writing and teaching math, and then concluded "This is not to say that all teachers that do not have this grounding are poor teachers, or that people with brilliant math skills can teach." Then one of the students in the math group posted the following comment on the wikifolio from the mathematics chapter posted by the writing group member:

> I am so glad you made this point as I almost wrote something similar in my response to your question on our math groupwiki. Can you imagine if all we did was take courses in our subject area and not courses like this one where we get to explore how the brain actually works and its implication for teaching? We would have a lot of very competent people who could not get their ideas across to students. There seem to be a lot of people in power who have forgotten the point you made.

This comment illustrates how this feature fosters disciplinary discourse in which students practice projecting their developing professional identities. At the time of this course, the state government was attempting to reduce the proportion of "methods" courses and increase the number of disciplinary courses required for prospective secondary teachers. This comment also helps illustrate how the engagement fostered by the context-concept assignment appears inherently disciplinary and readily productive.

3. Assess Reflections Rather than Artifacts.

This third principle aims to protect student engagement around the wikifolios while also fostering an informal sense of individual accountability towards that engagement. This principle extends well-established concerns over excessively detailed rubrics (e.g., Popham, 1997) by drawing from situative considerations of portfolio assessment (i.e., Habib & Wittek, 2007). This principle argues that instructors should not directly evaluate the artifacts that students create or their interactions around those artifacts. Instead, instructors should assess students' reflections on those artifacts as evidence of their engagement in creating and discussing those artifacts.

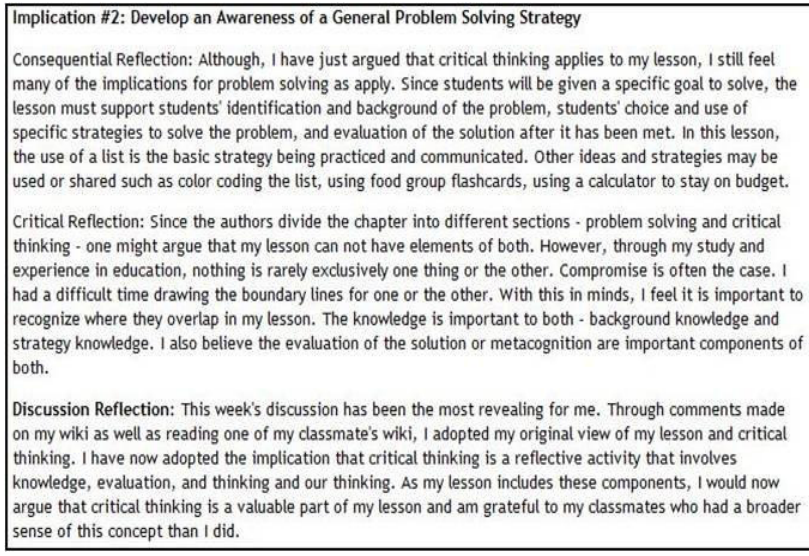
In this class, students were required to post their weekly wikifolios by a specific deadline and slightly penalized if they were late. However wikifolio content and comments were never directly graded. As summarized in the next section, the wikifolios generate extensive content and comments. While it was manageable for the instructor to participate in the discussions, formally evaluating them would have been a much larger commitment. More importantly, a participatory perspective argues that doing so undermines engaged participation. This is because summatively assessing the content of the artifacts leads learners to focus on what the instructor was "looking for" instead of making meaningful contributions to the emerging community of learners. Similarly, directly grading comments or requiring a certain number of comments presumably encourages students to post, even when they really do not have anything to say. This seems likely to result in dull exchanges that are not enlightening or even worth reading.

Despite these concerns about the consequences of grading, grades or points seem to be needed and/or expected in most formal educational settings. These seemingly incompatible goals provide the impetus for this third design principle. In order to balance expectations for accountability with the goal of fostering engaged participation, each wikifolio assignment asks students to include a brief reflection. Building on Greeno and Gresalfi (2008) and the notion of *consequential engagement* in Gresalfi, Barab, Siyahhan, & Christensen (2009), students are asked to articulate how their wikifolios demonstrate *consequential, critical,* and *collaborative* engagement. For example, the reflection guidelines for the chapter on problem solving and critical thinking were:

- **Consequential engagement.** What were the consequences of (a) your instructional problem and (b) your instructional domain for learning about (a) improving problem solving and (b) teaching critical thinking?
- **Critical engagement.** Can you think of (a) a better problem in your instructional domain or (b) a better instructional domain for considering (a) improving problem solving and (b) teaching critical thinking?

• **Collaborative engagement.** Review the comments from your classmates and reflect on any insights that emerged in the discussions, anything particularly useful or interesting. Single out the classmates that have been particularly helpful in your thinking, both in their comments and from reading their wikifolios.

Figure 6 shows a student reflection that was fairly representative of the reflections students posted in the second course. The consequential reflection confirms that the student did indeed consider the relative relevance of problem solving vs. critical thinking for her instructional goal; the critical reflection seems to confirm that the student did ponder the broader context-concept relationship. Notably, the discussion reflection does not actually point to any actual evidence of any collaboration. In and of itself, this reflection might be interpreted as an overstatement. But the reflection was validated by the several comment threads involving classmates and the author that started just below. While students knew that commenting was not technically required, they were told (in the syllabus and the assignment) that their overall success in the course (including on the exam) would be reflected in the number of times they were mentioned in their classmates' reflections on their collaborative engagement.



Implication #2: Develop an Awareness of a General Problem Solving Strategy

Consequential Reflection: Although, I have just argued that critical thinking applies to my lesson, I still feel many of the implications for problem solving as apply. Since students will be given a specific goal to solve, the lesson must support students' identification and background of the problem, students' choice and use of specific strategies to solve the problem, and evaluation of the solution after it has been met. In this lesson, the use of a list is the basic strategy being practiced and communicated. Other ideas and strategies may be used or shared such as color coding the list, using food group flashcards, using a calculator to stay on budget.

Critical Reflection: Since the authors divide the chapter into different sections - problem solving and critical thinking - one might argue that my lesson can not have elements of both. However, through my study and experience in education, nothing is rarely exclusively one thing or the other. Compromise is often the case. I had a difficult time drawing the boundary lines for one or the other. With this in minds, I feel it is important to recognize where they overlap in my lesson. The knowledge is important to both - background knowledge and strategy knowledge. I also believe the evaluation of the solution or metacognition are important components of both.

Discussion Reflection: This week's discussion has been the most revealing for me. Through comments made on my wiki as well as reading one of my classmate's wiki, I adopted my original view of my lesson and critical thinking. I have now adopted the implication that critical thinking is a reflective activity that involves knowledge, evaluation, and thinking and our thinking. As my lesson includes these components, I would now argue that critical thinking is a valuable part of my lesson and am grateful to my classmates who had a broader sense of this concept than I did.

Figure 6. Example of a typical student reflection.

One assumption behind this principle is that students must have or develop an enduring understanding of the relevant concepts in order to draft coherent reflections. This assumption was initially supported by an examination of the history files that revealed examples of students revising their

wikifolios while drafting their reflections. Of course, such brief reflections themselves cannot possibly provide formal evidence of enduring understanding of the many concepts in each chapter. Because the reflections were placed directly on the artifacts, and because the instructor had participated in prior discussions of those artifacts, it seemed appropriate to simply ensure that the artifacts were complete and that the reflections were coherent. As such, "grading" the weekly wikifolios turned out to be a relatively trivial task of verifying that the draft had been posted by the deadline, the wiki was complete, and the reflections made sense. During the first few weeks of both classes, a few students lost one or two points (out of 100) for being late or not finishing reflections; that nearly every student posted a draft by the deadline and completed their reflections suggests that a balance was reached between formative and summative assessment goals around creating and discussing the artifacts. Perhaps most importantly, the instructor time that was not spent grading artifacts and comments (or responding to inevitable appeals) was freed up for more useful tasks.

Generally speaking, the content of these reflections seems more concrete and immediate than the lengthy, more abstract reflections that are often drafted to accompany conventional portfolios, which then become artifacts themselves (and possibly require some sort of rubric to grade). These reflections also seem more likely to motivate and acknowledge engaged participation than is likely with conventionally graded portfolios. The collaboration reflections are a contrast to the corrosive discussion that often follow when artifacts themselves are graded and students compare grades. Rather than avoiding "dysfunctionally detailed" rubrics (as suggested by Popham, 1997), this principle suggests avoiding rubrics altogether.

As described next, classroom assessments help to "protect" the disciplinary engagement in drafting, discussing, and reflecting on the wikifolios. They do so by deflecting the natural desire to use them to directly evaluate students' understanding of course concepts.

4. Use Curriculum-Oriented Assessments Discreetly

The fourth principle aims to protect engagement in the wikifolios and reflections by using classroom assessments to assess individual understanding. In this context, this means relying on open-ended essay items to assess students' understanding of the primary implications in each chapter of the text book. Reflecting the overall goal of balancing formative and summative functions, such "curriculum-oriented" assessments are used primarily for assessing and improving the curriculum, and only secondarily for student accountability.

At both the mid-term and end of the course, students complete a formal exam. The first part of each exam consists of extended-response essay items

that are drawn directly from the implications in the text. Together these parts of the exam count towards just ten percent of the course grade. This level of accountability is assumed to motivate individuals to understand all of the implications and provide valid evidence of that understanding, without pushing them towards individualized test preparation. In particular, this practice aims to discourage students from memorizing the declarative content of each of the chapter implications without appreciating its implications for practice in various domains. Students are informed that part of the exam will include open-ended items covering the implications at the end of each chapter, so they should make sure they discuss each of the implications with their classmates.

These questions assess conceptual understanding of randomly selected implications from the various chapters by asking students to engage consequentially and critically with those implications in the context of the actual course (as distinguished from doing so with their specific learning goal). The assumption here is that if students successfully engage consequentially, critically, and collaboratively with the implications, conceptual understanding (defined here as what is typically assessed in open-ended classroom assessments) "comes for free." In other words, reasonable levels of engagement in the wikifolio activities described above should leave most students prepared to perform quite well on such assessments.

One of the research goals regarding these assessments has concerned the appropriate time limits. When given less than five minutes, some students who had been deeply engaged in the course argued that they needed more time; beyond ten minutes we began to suspect that some of the more marginal students might be cutting and pasting from wikifolios. Students are currently given five minutes per item and able to allocate that time as they wish across the entire set. These items have proven relatively easy to grade. Students are awarded full points if their answers demonstrate understanding of the underlying concepts (mostly by making sense). The reasoning here is that consequential and critical engagement are highly contextual and subjective, which makes them difficult to formally assess. Indeed, most exam formats are limited to conceptual engagement, which can be readily and reliably assessed using such exam formats. The concern with focusing directly on the concepts is that they encourage students to memorize definitions of key concepts well enough to repeat them on the exam, regardless of whether they connect those ideas to their own experience or other relevant knowledge.

A crucial aspect of these assessment items is that they are "curriculum-oriented." This means that they are oriented toward the way that domain concepts were represented in this particular course. This makes such items particularly sensitive to each student's engagement in the course. Because

such items are relatively insensitive to the domain knowledge that students bring, they provide convincing evidence of the relative understanding generated by individual engagement. This makes them quite useful for comparing how much each student learned in the course and for guiding refinements of the activities leading up to the assessment. However, the features that make curriculum-oriented assessment items useful for these assessment functions make them less useful for other functions. In particular, using such items to improve the course activities increases their alignment. This makes it impossible to use them to make claims about increased learning from one design cycle to the next, or comparing learning with other courses. Concerns about coverage and accountability and any comparison studies call for additional "standards-oriented" achievement test items that are independent of the way the content was presented in the particular course, and are not used to directly refine the course activities.

5. Isolate Achievement Tests

The final principle highlights the unique but limited role that Participatory Assessment assigns to conventional achievement tests. This principle assumes that a separate set of test items are needed to (a) address typical external accountability concerns, (b) compare learning in this course with other courses targeted to the same content and/or using the same textbook, and (c) document improved learning outcomes as the course is refined and iteratively aligned to the curriculum-oriented assessments. This principle aims to balance this need for a broad test of learning that is independent of a particular curriculum with prevailing concerns over the shallow treatment of course content in such tests. The second half of the midterm and final exam consists of a large number of multiple-choice items from the item bank provided by the textbook publisher. Items are selected independently of whether the topic was covered in the course; rather, items are quasi-randomly selected from the subset of items that were written in such a way that answers cannot be readily searched for in the text or the wikifolios. Such items are written in a way which would require searching for the meaning of all five of the response stems. These two sets of items also count for just ten percent of the final course grade.

While multiple-choice items are widely-maligned because they presumably tap shallow recognition-level knowledge, they afford tests that can efficiently assess broad knowledge of course content. Arguably, the validity of scores from such items is enhanced when used in courses such as this, where students have never been encouraged to memorize isolated specifics in each of the textbook chapters (for example, by completing regular multiple-choice quizzes). Because such items are relatively sensitive to prior knowledge, they are a somewhat imprecise indicator of actual learning when used in post-instruction exams. [v]

Such selected-response items are particularly useful in online contexts where machine-scored tests are desirable. Students must complete the exam using the same computer they used in class; the ability to check the IP address of the computer used to take the exam promises adequate test security in this and other course contexts. Students were given just one minute per item on the exam; informal testing with research assistants confirmed that this was sufficient time for students who were familiar with the topic to select the most appropriate response, but not enough for them to look up information on topics with which they were not familiar.

Observed Learning Outcomes

After two semesters of refinements, the course features described above seem to be fostering productive disciplinary engagement with the targeted concepts in ways that appear to also support enduring understanding of the targeted concepts and broad familiarity with the relevant specifics. Arguably, completing the public and persistent wikifolios and reflections has elements of engaged participation, as defined by Greeno et al., (1998). Likewise, the threaded commentary on those artifacts has elements of Engle and Conant's (2002) productive disciplinary engagement. While certainly not as dynamic as the interest-driven social networks studied by Ito at al. (2009) and Jenkins (2009), these interactions seem to feature aspects of participatory culture that are elusive in formal course contexts. From our perspective, the interactions illustrated above contrast with short fragment interactions around descriptive and surface knowledge that many argue is the norm in online class discussion forums (e.g., Dennen & Wieland, 2007; Guzdial & Turns, 2000, Hewitt, 2005). Following are some initial summaries of student engagement, along with initial evidence of the individual learning that followed.

Observed Engagement

Given the novelty of this approach, it is impossible to identify directly relevant comparisons. For example, given that the wikifolios are constructed and discussed collaboratively in a public space, should they be coded as discussion? To establish an initial reference point we turned to the Wiki Quality Instrument (WQI) used in the aforementioned study by Reich, Murnane, & Willett (2012).[5] Fourteen individual wikifolios were quasi-randomly selected from the second course. Two scorers coded them for the presence or absence of the 24 features or characteristics that make up the WQI. After checking reliability (Kappa = .98) differences were resolved by discussion. The average score was 17.8. Twelve of the fourteen wikifolios were assigned scores of 16 or more, which, according to the WQI, qualified

as a collaborative multimedia assignment or workspace. Given that just one percent of the random representative sample of educational wikis in the prior study fell into that category, we certainly can claim that these wikifolios are more interactive than typical educational wikis; the other two wikifolios received scores of 14 and 15, which put them in the category of "individual student assignment or portfolio, with minimal collaboration."

In the most recent course, the weekly wikifolios averaged 1580 words (from 411 to 3899) and the 17 students posted an average of 3.9 comments a week (with an average length of 120 words). The groupwikis averaged 3724 words (from 2100 to 6600) and received an average of 40 comments (from 26 to 59). Importantly, most of the comments were substantive contributions, and over half of the comments were parts of threaded discussions. In particular, there was very little of the serial posting of unrelated and repetitive comments that others have found to dominate the discussion forums in most online classes.

Another indication of engagement levels was the amount of interaction within the discussion forums associated with the collaborative groupwikis. Each group's discussion forums showed dozens of lengthy and substantive posts. In the most recent course, the groups averaged 67 posts (from 35 to 88) while working on the groupwikis, mostly in the 2-3 weeks leading up to the group's assigned week. In one group in each of the two classes, the emergent discussion leader(s) privately expressed concern about flagging participation of one or two other group members. In both cases, the situation was resolved via carefully worded private messages reminding recalcitrant members that their input was valued and to the discussion leader reminding them that a range of experience and ambition was to be expected in a course like this.

These levels of engagement are encouraging given the goal of keeping the course workload manageable for both the instructor and the students. Students were reminded regularly that they were never expected to spend more than twelve hours per week on class (except for the week when their group was posting its groupwiki). When "submitting" their assignments to let the instructor know they had posted their wikifolio, students were invited to indicate how many hours they spent and whether they had to spend more than twelve. While most students declined to indicate, the students who did indicate typically reported 5-7 hours to read the chapter and draft the wiki and planned to spend another 2-3 hours discussing and commenting.

Analyses of Reflections

Analyses of the reflections while assigning points to the wikifolio entries provided an initial sense that the reflections provide useful evidence of

engagement in the drafting and discussing of the artifacts. Locating the reflections directly on the wikifolios and comments makes it simple to verify both the artifact and the discussion upon which the students are reflecting; the public and persistent nature of all three elements seems to discourage shortcuts and plagiarism. Tracking the progress of wikis via the history file showed numerous examples of students going back and forth between their reflections and their wikis. This suggests that the act of drafting the reflections did indeed compel students to further refine their artifact and likely expand their knowledge. To reiterate, our (currently unproven) assumption is that students must have or develop at least the level of conceptual understanding that is typically captured with more formal classroom assessments. And because students are never actually asked to directly describe the course concepts, there is little incentive or reward for simply memorizing the definitions of concepts. In the context of the instructor's prior participation, it seems that coherent reflections provide initial evidence of individual understanding, but are relatively easy for the instructor to evaluate.

We are currently exploring methods for coding reflections to more formally examine our assumptions about reflections. For now, we believe that the reflections provide a good example of how the underlying participatory assessment framework can help balance formative and summative assessment goals. Whether or not the wikifolio entries and reflections *in and of themselves* provide valid summative evidence of enduring conceptual understanding is certainly an open question. The more far-reaching assumption is that the summative function of the reflections is less crucial because of the existence of the formal course exam. This is what we mean when we say that the formative function of one level of learning outcomes is "protected" by the summative function of the outcomes at the next level.

Exam Results

Evidence of individual understanding is provided by the fact that most students were awarded full points on the open-ended exam items regarding the chapter implications. Admittedly, the exploratory nature of the course and the items discouraged the instructor from scoring these items strictly during these courses; a detailed scoring rubric has been developed for use in subsequent courses, and is expected to yield scores that are more varied and more reliable.

Evidence of broad coverage of course content is shown in the high midterm and final exam scores across the two courses on the sections of the test that featured multiple choice items drawn from the textbook item bank. The average scores across the four tests were 92, 96, 91, and 85 percent; the lowest scores across the four tests were 66, 80, 72, and 79 percent.

While there was essentially no explicit test preparation or even discussion of the knowledge that would be covered on the multiple choice items, no students in either course disagreed with the statements *the content of the exams were appropriate and what I expected* and *the form of the exam was fair and what I expected.* Given the small number of students and lack of a pretest, this data cannot be used to examine improved learning outcomes from one semester to the next, as the various features were fine tuned. In the subsequent semester, a short multiple choice pretest was included to provide more precise indications of achievement gains.

BROADER IMPLICATIONS AND FUTURE RESEARCH

This paper introduced a framework for using simple wikis to accomplish broad learning outcomes with diverse students. The five principles were enacted here using technologies that are included in most online course management systems and that are freely available to any instructor or student who has access to the Internet. While further refinement and analysis is certainly warranted, these initial outcomes suggest that this research has resulted in a promising framework for broad online learning that does not overwhelm students or instructors.

The major question that we expect from others who might consider Participatory Assessment is whether or not particular course content lends itself to the first principle. To reiterate, the first principle is enacted by "problematizing" the domain from the perspective of the learner (rather than the expert). The specific question here is whether or not the domain allows individual learners to identify unique meaningful contexts that can be used to frame and reflect on the course concepts and skills. We are encouraged so far by the possibilities presented in the other domains where the parallel design studies were being carried out. In high-school English classes with struggling learners, students reflected on the passage that they chose to annotate when learning to engage in close readings of classic texts or the character from the story they selected when learning character analysis (Hickey, McWilliams, & Honeyford, 2012). In a hybrid undergraduate telecommunications course (Walsh & Hickey, 2011), students reflected on the abstract ideas of cinematic theory from the perspective of different production roles (e.g., set design, camera operator, film editor, etc.). As in the study described here, each of the other examples delivered examples of engaged participation and productive disciplinary engagement and evidence of individual knowledge that transferred to curriculum-oriented assessments and standards-oriented tests.

Certainly, more systematic analysis and continued refinement is called for. A rigorous test of this framework's efficiency will occur in the Fall of

2013 when the Assessment in Schools course is delivered as a "MOOC" (massively open online course) with as many as 500 students. Meanwhile, ongoing research is exploring ways of using this framework in close collaboration with secondary English and Algebra teachers to develop and refine curricular modules of their own (Hickey & Itow, 2012; Hickey, Honeyford, & McWilliams, in press). We hope that others will find these principles and practices helpful and worthy of further refinement and adaptation.

References

Anderson, J. R., Reder, L. M., & Simon, H. A. (1996). Situated learning and education. *Educational Researcher, 25*(4), 5-11.

Barab, S., Zuiker, S., Warren, S., Hickey, D., Ingram-Goble, A., Kwon, E. J., Kouper, I., et al. (2007). Situationally embodied curriculum: Relating formalisms and contexts. *Science Education, 91*(5), 750–782.

Bishop, S. C., & Hickey, D. T. (2012). Fostering e-learning discourse among professional networking groups. In R. Morgan & K. Olivares (Eds), *Quick hits: Teaching with technology* (pp. 95-97). Bloomington IN: Indiana University Press.

Brown, J. S., & Adler, J. (2008). Minds on fire: Open education, the long tail, and learning 2.0. *Educause Review, 43*(1), 16–32.

Bruning, R. H., Schraw, G. J., & Norby, M. (2010). *Cognitive psychology and instruction.* New York: Pearson.

Cobb, P., Confrey, J., diSessa, A., Lehrer, R., & Schauble, L. (2003). Design experiments in educational research. *Educational Researcher, 32*(1), 9–13.

Crovitz, D., & Smoot, W. S. (2009). Wikipedia: Friend, not foe. *English Journal, 98*(3), 91–97.

Davis, H. J., Peppler, K. A., & Hickey, D. T. (2011). Assessment assemblage: Advancing portfolio practice through assessment state theory. *Studies in Art Education, 52*(3), 213-224.

Dede, C., Jass Ketelhut, D., Whitehouse, P., Breit, L., & McCloskey, E. M. (2009). A research agenda for online teacher professional development. *Journal of Teacher Education, 60*(1), 8–19.

Delandshere, G., & Arens, S. A. (2003). Examining the quality of the evidence in preservice teacher portfolios. *Journal of Teacher Education, 54*(1), 57–73.

Dena, C. (2008). Emerging participatory culture practices: Player-created tiers in alternate reality games. Convergence: *The International Journal of Research into New Media Technologies, 14*(1), 41–57.

Dennen, V. P., & Wieland, K. (2007). From interaction to intersubjectivity: Facilitating online group discourse processes. *Distance Education, 28*(3), 281–297.

Duffy, P., & Bruns, A. (2006). The use of blogs, wikis and RSS in education: A conversation of possibilities. *Proceedings of the 2006 Online Learning and Teachings Conference* (pp. 31–38).

Duffy, T. D., & Jonassen, D. H. (1991). Constructivism: New implications for instructional technology? *Educational Technology, 31*(5), 7–12.

Engle, R. A., & Conant, F. R. (2002). Guiding principles for fostering productive disciplinary engagement: Explaining an emergent argument in a community of learners classroom. *Cognition and Instruction, 20*(4), 399–483.

Forte, A., & Bruckman, A. (2007). Constructing text: Wiki as a toolkit for (collaborative?) learning. *Proceedings of the 2007 International Symposium on Wikis* (pp. 31–42).

Forte, A., & Bruckman, A. (2009). Writing, citing, and participatory media: Wikis as learning environments in the high school classroom. *International Journal of Learning and Media, 1*(4), 3–44.

Gee, J. P. (2003). Opportunity to learn: A language-based perspective on assessment. *Assessment in Education: Principles, Policy & Practice, 10*(1), 27-46.

Gee, J. P. (2004). *Situated language and learning: A critique of traditional schooling.* New York: Routledge.

Greeno, J., & the Middle School Mathematics through Applications Project Group. (1998). The situativity of knowing, learning, and research. *American Psychologist, 53*(1), 5-26.

Greeno, J. G., & Gresalfi, M. S. (2008). Opportunities to learn in practice and identity. In P. Moss, D.C. Pullin, J.P. Gee, E.H. Haertel, and L.J. Young (Eds.), *Assessment, equity, and opportunity to learn* (pp. 170-199). Cambridge, MA: Cambridge University Press.

Gresalfi, M., Barab, S., Siyahhan, S., & Christensen, T. (2009). Virtual worlds, conceptual understanding, and me: Designing for consequential engagement. *On the Horizon, 17*(1), 21-34.

Guzdial, M., & Turns, J. (2000). Effective discussion through a computer-mediated anchored forum. *The Journal of the Learning Sciences, 9*(4), 437–469.

Guzdial, M., Rick, J., & Kehoe, C. (2001). Beyond adoption to invention: Teacher-created collaborative activities in higher education. *The Journal of the Learning Sciences, 10*(3), 265–279.

Habib, L., & Wittek, L. (2007). The portfolio as artifact and actor. *Mind, Culture, and Activity, 14*(4), 266–282.

Hewitt, J. (2005). Toward an understanding of how threads die in asynchronous computer conferences. *The Journal of the Learning Sciences, 14*(4), 567–589.

Hickey, D. T., & Anderson, K. T. (2007). Situative approaches to assessment for resolving problems in educational testing and transforming communities of educational practice. In P. Moss (Ed.), *Yearbook of the National Society for the Study of Education: Evidence and Decision Making, 106*(1), 269-293.

Hickey, D. T., Ingram-Goble, A. A., & Jameson, E. M. (2009). Designing assessments and assessing designs in virtual educational environments. *Journal of Science Education and Technology, 18*(2), 187–208.

Hickey, D. T., & Itow, R., C. (2012). Participatory assessment for participatory teaching & learning in school contexts. In E. Reilly & I. Literati (Eds.), *Designing with teachers: Participatory approaches to professional development and education* (pp. 78-88). Project New Media Literacies: University of Southern California.

Hickey, D. T., Honeyford, M. A., & McWilliams, J. C. (2013) Participatory assessment in a climate of accountability. In H. Jenkins & W. Kelly, *Reading in a participatory culture: Remixing Moby-Dick in the English classroom* (pp. 169-184). New York: Teachers College Press.

Hickey, D. T., McWilliams, J. T., & Honeyford, M. A., (2011). Reading Moby-Dick in a participatory culture: Organizing assessment for engagement in a new media era. *Journal of Educational Computing Research, 44*(4), 247-273.

Hickey, D. T., Tassoobshirazi, G., Cross, D. (2012). Assessment as learning: Enhancing discourse, understanding, and achievement in innovative science curricula. J*ournal of Research in Science Teaching, 49*, 1240-1270.

Hickey, D. T., & Zuiker, S. J. (2012). Multi-level assessment for discourse, understanding, and achievement in innovative learning contexts. *The Journal of the Learning Sciences, 22*(4) 1-65.

Ito, M., Horst, H.A., Bittanti, M., Boyd, D., Herr-Stephenson, B., Lange, P.G., Pascoe, C.J., & Robinson, L. (2009). *Living and learning with new media: Summary of findings from the Digital Youth Project.* Chicago IL: MacArthur Foundation.

Jenkins, H. (2009). *Confronting the challenges of participatory culture: Media education for the 21st century*. Cambridge, MA: MIT Press.

Kafai, Y. B., & Resnick, M. (1996). *Constructionism in practice: Designing, thinking, and learning in a digital world*. Lawrence Erlbaum.

Kahn, S. & Hamilton, S. (2008). Demonstrating intellectual growth and development: The IUPUI ePort. In Cambridge, D., Cambridge, B., & Yancey, K. B. (Eds.), *Electronic Portfolios 2.0.* Sterling, VA: Stylus.

Kali, Y., Linn, M. C., & Roseman, J. E. (2008). *Designing coherent science education.* New York: Teachers College Press.

Kim, P., Ng, C. K., & Lim, G. (2010). When cloud computing meets with Semantic Web: A new design for e-portfolio systems in the social media era. *British Journal of Educational Technology, 41*(6), 1018–1028.

Kimball, M. (2005). Database e-portfolio systems: A critical appraisal. *Computers and Composition, 22*(4), 434–458.

Morgan, B., & Smith, R. D. (2008). A wiki for classroom writing. *The Reading Teacher, 62*(1), 80–82.

Pittam, G., Elander, J., Lusher, J., Fox, P., & Payne, N. (2009). Student beliefs and attitudes about authorial identity in academic writing. *Studies in Higher Education, 34*(2), 153–170.

Popham, W. J. (1997). What's wrong-and what's right-with rubrics. *Educational Leadership, 55*, 72–75.

Reich, J., Murnane, R., & Willett, J. (2012). The State of Wiki Usage in U.S. K–12 Schools. *Educational Researcher, 41*(1), 7–15.

Sarmiento, J. W., & Stahl, G. (2008). Group creativity in interaction: Collaborative referencing, remembering, and bridging. *International Journal of Human–Computer Interaction, 24*(5), 492–504.

Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning, 2*(1), 3–10.

Silva, E. (2008). *Measuring skills in the 21st century.* Education Sector. Retrieved from http://www.educationsector.org/publications/measuring-skills-21st-century

Stecher, B. (2010). *Performance assessment in an era of standards-based educational accountability*. Stanford, CA: Stanford Center for Opportunity Policy in Education.

Taasoobshirazi, G., Zuiker, S. J., Anderson, K. T., & Hickey, D. T. (2006). Enhancing inquiry, understanding, and achievement in an astronomy multimedia learning environment. *Journal of Science Education and Technology, 15*(5), 383–395.

Walsh, J. D., & Hickey, D. T. (2011, October). *Designing for participation in a 125-student hybrid media production course.* Presentation at the Indiana University Center for Innovative Teaching and Learning faculty poster fair.

Wilhelm, L., Puckett, K., Beisser, S., Wishart, W., Merideth, E., & Sivakumaran, T. (2006). Lessons learned from the implementation of electronic portfolios at three universities. *TechTrends, 50*(4), 62–71.

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Notes

1. For convenience and space consideration, references are omitted for resources that are readily located via Google.

2. While the deadline was strictly enforced, the penalty for being late was quite modest—one point per day out of 100 on a 100-point grading scale.

3. This is because self-efficacy is practically a prerequisite for student engagement in mathematics classes, where many classroom learners will not even attempt problems that they think they cannot solve. Conversely, classroom learners typically bring directly relevant experience to language arts classes, so self-efficacy is typically much less of an issue for language educators. Thus the student teachers in this class who learn that the topic of self-efficacy is a less relevant language education goal are learning concrete and fundamental about self-efficacy; coming to this realization in conversations with others whose goals concern mathematics means that they all learned something even more fundamental about self-efficacy. Meanwhile, others who merely lurk in such an exchange may well take away a similar contextualized understanding of self-efficacy, particularly if they can index that exchange to their own learning goal.

4. This practice reflects the assumption and prior experience that discussion forums tend towards decontextualized and abstract discourse. Consider, for example, the tendency to make discussion forum conversations "private" via email once they become personally relevant.

5. The instrument is publically available at http;//www.edtechresearcher.com/wiki-quality-instrument/. It consists of 24 items in five categories, including *information consumption* (two items), *student participation* (four items), *expert thinking* (five items), *new media literacy* (six items), and *complex communication* (seven items).