DESIGN TO LEARN, LEARN TO DESIGN

Using backward design for information literacy instruction

Bruce E. Fox
Northern Arizona University

John J. Doherty
Northern Arizona University

ABSTRACT

Using backward design coupled with a focus on intentional learning, a series of platform-independent podcasts were created to address the need to increase student information literacy competency. The design team used a collaborative process where all members of the team worked in an iterative fashion from the specification of student learning outcomes to the creation of the final assessments. As a case study, this project brought to light the importance of clearly specifying student learning outcomes, creating meaningful assessments, employing strong project management, and efficiently utilizing the composition and dynamics of the design team.

INTRODUCTION: INTENTIONALITY

The core concepts of information literacy lend themselves well to the educational scaffolding theory of the intentional learner: someone who can adapt to new environments, integrate knowledge from different sources, and continue learning throughout his or her life (Association of American Colleges and Universities, 2002). Intentional learners, however, do not easily emerge from any individual educational experience. An instructor is an expert learner in the subject she teaches. Many students, however, are novice learners who have not yet explicitly learned "how to learn" and cannot critically assess their own learning, especially when they are new to the discipline in which they are learning (Bransford, Brown, Cocking & Cocking, 2000). This is certainly the case when one considers information literacy a discipline that is hard for many students (see Fain, 2011) and faculty to grasp. Therefore, it is essential to design any intentional learning activity related to information literacy—or any other desired learning objective—with the novice learner in mind. This is, at its basic level, called backward design.

In its simplest form the concept of backward design in education is the process of defining the desired knowledge, skills, and attitudes/dispositions—*i.e.* the desired student's learning outcomes (SLOs)—associated with a course or curriculum, and then building the course or curriculum in ways that help the student achieve these outcomes. Or, in the words of Wiggins and McTighe, backward design is an "approach to designing a curriculum or unit that begins with the end in mind and designs toward that end" (2005, p. 338). They go on to identify three stages in the Backward Design process:

Stage 1: Identify desired results
Stage 2: Determine acceptable evidence
Stage 3: Plan learning experiences and instruction (pp. 17-18)

In other words, instructors decide what the students should learn and then structure the class or curriculum to achieve this goal. Such a process requires a thoughtful and intentional approach to teaching, especially when the goal is to provide a progressive (or, in constructivist learning theory terms, scaffolded) learning experience for the novice learner.

Backward design has been widely adopted in the educational community. However, the backward design process can also be found in other fields, such as in computer manufacturing (Sheu & Chen, 2007) and in the analysis of the diagnostic approaches used by medical doctors (Bonilauri-Ferreira et al., 2010). The key elements of the process demonstrated in these venues are twofold: intentionality and the focus on results rather than inputs. In the educational enterprise, replace "Results" with "Outcomes" and "Inputs" with "Teaching". Thus, SLOs, backward design, and intentionality combine to help students learn. The concept of SLOs (the specific knowledge and the skills that are desired for students to acquire at the end of some academic experience) has become the current basis for assessing student learning. At the course level, SLOs have taken the place of somewhat vague course goals such as "Students will be exposed to forest measurement techniques" to something much more concrete, such as "Students will demonstrate the ability to use standard forestry field equipment to measure correctly tree heights and diameters." At the program or academic institutional level, SLOs have replaced a more input-based

approach such as specifying a certain number and type of courses in a particular field. Institutional or accrediting body criteria, such as the information literacy standards of the Association of College and Research Libraries (ACRL) or the American Association of School Librarians (AASL), also play a role in defining SLOs. An early example of this as applied to information literacy instruction can be seen when Smith (2000) worked with two groups of librarians to develop SLOs that draw on the language of the ACRL Information Literacy Competency Standards of January 2000 to include: finding/locating information; presenting information; and a list of others that, while a first step, still need some alignment to assessments.

Although in education this movement to SLOs came to the fore in the mid 1990s, the concept can be traced back to at least the early 1960s with discussions of measuring learning outcomes in instructional technology (Glaser, 1963) and criterion referenced measures of student learning (Popham & Husek, 1969). Smith (2001) also discussed the role of the university library in the identification, definition, and assessment of learning outcomes. Specifically, he noted that the educational experience needs to focus on student learning outcomes, specifically skills, abilities, and attitudes. This emphasis on SLOs significantly changed the educational paradigm from a focus on what faculty TAUGHT to one of a focus on what students LEARN. Education became a learner-centered partnership—although not necessarily an equal partnership—between the faculty and the students. In librarianship, Oakleaf (2010) sums up the parallel adoption of SLOs to drive information literacy instruction in the 1990s and 2000s, while also noting that the assessment of such outcomes should also demonstrate library impact on student learning.

With this change came the need for much greater intentionality in the educational enterprise. For students this intentionality involves taking a greater active role in their educations—to work towards becoming intentional learners—while for faculty the intentionality manifests itself in more deliberate and straightforward connections among SLOs to course structure, content, delivery, and then to assessment—what the present authors term intentional teaching and design. This intentionality extends beyond the classical classroom setting to such venues as service learning, co-curricular activities, and to student interactions with the library. In this last venue, learning-centered education requires librarians to give up control of the access to information and instead help students learn to access information in ways that best fit the needs of the students (Doherty & Ketchner, 2005). Implicit here are the skills and outcomes defined in the ACRL and AASL information literacy competency standards. In a somewhat hackneyed (but nevertheless apt) phrase, the role of the librarian becomes one of helping the students learn how to fish rather than just handing the students a fish—the librarians become the intentional teachers and designers.

Intentionality in teaching, learning, and design has five key elements:

- The importance of what students learn rather than what faculty teach; i.e. the value of student learning outcomes rather than on topic "coverage"
- A need to design curriculum to help students achieve these outcomes

- The recognition that topic expertise does not necessarily closely track with course design, thus the need for collaborations;
- The understanding that different delivery modes may necessitate radically different course designs
- An explicit recognition of the value of education that occurs outside the classroom

These elements are clearly important to the development of learning activities, assessments, and SLOs in relation to information literacy. Information literacy is a key part of the curriculum, as well as key to lifelong learning in a learning society (see Jarvis, 2006 for an overview of the literature on the learning society).
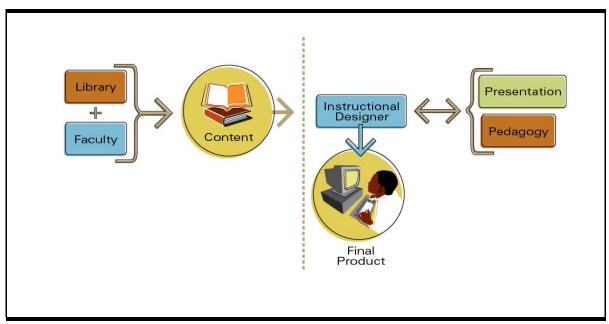
This paper explores intentionality of learning, teaching, and design as a best practice in education that has the goal of moving students and faculty from novice to intentional learners. The author applied intentionality to the design, development, implementation, and evaluation of a set of out-of-class learning modules created to serve a dual role: to provide students with an area of knowledge, information literacy, as well as a particular skill, effective approaches to find and evaluate professional literature. The paper's approach is also informed by the well-documented and integrative design processes of the private sector (Adler, 1995; Hauser & Clausing, 1988; Wang, Han, Spoerre, & Zang, 1997). In such processes, a team composed of representatives from engineering, design, production, and marketing collaborate from product concept and product specification to marketing, advertising, and delivery to help ensure both the efficiency and the efficacy of the final product. Such processes have been used successfully in fields as diverse as the "Whole Building Design" of green buildings and the construction of an underground environmental display (Smith, Sanders, Demirbilek, & Scott, 2005; Whole Building Design Guide, 2009).

DESIGNING PODCASTS FOR INFORMATION LITERACY INSTRUCTION

The project described below is the result of collaboration among a faculty member, a library team, and an instructional designer. As noted above, collaborative multidisciplinary partnerships have been part of the product design process for well over 20 years in a variety of fields. However, such collaborative processes have not always been part of the general landscape in the academic world, as the academy has clung closely to a "silo" model of organization and reward structures, especially for faculty. Such a silo approach has extended to other components of the academic world, including between the faculty and other academic professionals, such as librarians (see Figure 1). Indeed the use of the word between in this context is quite telling, in that it focuses on differences rather than on similarities, i.e. a focus on discrete parts rather than a well functioning system. Thus a need exists to explore processes that break out of such silo-based relationships and that foster multidisciplinary collaborations, with the ultimate goal of creating a product that provides scaffolded learning for the novice and intentional learner.

THE PROCESS

The collaboration took the form of a librarian team, a full-time faculty member (who was also, at the time, the director of the masters program referenced below), an instructional designer and a graphic

FIGURE 1 — THE SILO APPROACH TO CURRICULUM DESIGN

designer who banded together to create a series of platform independent online research learning objects that address the research process and focus on information literacy skills for both in-discipline and lifelong learning. The project was approached in terms of: defining the problem, determining if it was an instructional problem, and then, if it was, focusing on the knowledge and skills that could solve the instructional problem.

This process aligns quite well with the five-stage backward design model ADDIE: Analysis, Design, Development, Implementation, and Evaluation. While Molenda (2003) notes that ADDIE is not, indeed, a formal model of instructional design, the concepts presented are so generic as to make this criticism moot. The ADDIE concepts translate into this project's context as: the initial client charge; the design stage; final development; and, now ongoing, implementation and evaluation.

The Client Stage

The origin of this project was a workshop held in the summer of 2008 designed for our initial clients, faculty members teaching in one area of a master's program. This workshop was designed to familiarize new faculty—primarily part-time instructors—with the resources available through the library, with a particular focus on how efficiently and effectively to access high quality academic literature. At the time, the master's program had about 400 students, most of whom were enrolled halftime (two classes—six units—per semester). One entrance requirement to the program was that each student had to have at least five years of professional experience. As a result, most of the students had earned their bachelor's degrees five or more years previously. Also, because students had been away from a university setting for some time, information literacy competency (beyond very basic web searches) had been at least partially lost, if they had ever existed at all. The faculty discussed that all too often students arrived at their capstone

project with insufficient preparation to conduct library research, to find and access the relevant literature, and to assess its quality. This is what Pace and Middendorf (2004) describe as a bottleneck to learning, emphasizing the novice learner role these graduate students have when it comes to information literacy. In addition, most students had full time jobs, family responsibilities, and little to no knowledge of the university's course management system. In other words, these students were the prototypical non-traditional adult learners. The ACRL Information Literacy Competency Standards in part acknowledge such learners; therefore, leveraging these standards can establish SLOs that will help students learn how to navigate in the new environment.

The project team developed their own set of learning outcomes that were focused and could be assessed: identifying an information need, finding and locating information, selecting relevant information, and assessing and evaluating the information found. With the majority of the students enrolled in on-line courses coming from locations ranging from Iraq to Alaska, an in-person workshop to meet some of these SLOs was not even remotely feasible. So the faculty and librarians began to think of alternative approaches that would provide students with the opportunity to learn in place. This almost instantly led to the decision to employ a web-based approach, an on-line tutorial on library skills. Therefore, the first step was to identify six design criteria for the tutorial:

1. Focused on the adult learner, specifically to the students in the program, but with portability to other audiences
2. Web-based
3. Compatible with the university's

course management system, but with portability to other systems and usability outside of any system
4. Active learning oriented
5. Engaging
6. Compatible within available technical, personnel, and financial resources

The Design Stage

The design of the tutorial began with a process of collectively determining what the learners needed to know rather than having a compiled list of individual beliefs about such needs. As a result, a self-vetted suite of SLOs was developed that represented the team's combined expertise that were then aligned with the ACRL information literacy standards. For example, using the backward design process, it was concluded that the first step of any research process is to formulate a research question to use effectively library research databases. This broad statement led to the following SLOs:

- Students will generate keywords for use in library databases
- Students will test these keywords in a database of their choice
- Students will narrow their searches by adding modifiers or synonmous terms

Thus, a framework for the products defined three major pieces for the tutorials: information, interaction, and assessment. The informational piece would not only meet both the six design criteria above but also the seven best practices for undergraduate education defined by Arthur Chickering and Zelda Gamson (1987). The team also decided that there would be some form of interaction with the content (Moore, 1989; Falloon, 2011) following the podcast. Finally, it was essential that some form of

assessment take place, designed by the content creators, that could be easily incorporated into a course as part of the student's grade, supplemental (extra credit) to the student's grade, or as an ungraded activity to be determined by the instructor. The evaluation of the learning experience would fall on the instructor, not the librarian. Where possible, it would be automated to lessen the load on the instructor.

Development

The product was subdivided (chunked, in instructional design jargon) into seven different informational pieces with accompanying interactions in the form of quizzes that were mapped to the student learning outcomes and could be auto-graded or presented as self-assessments or checks for understanding to be completed by the students. While each piece built on a previous piece, they were also designed to stand alone as an individual learning module. Two product specifications drove the final development and implementation, and also the choice of delivering the pieces as podcasts:

- The individual modules would not depend on specific library database interfaces (as these change so frequently). Instead, focus was placed on using the research approach to choosing a resource, searching resources successfully, and critically evaluating content and citing content correctly, rather than showing how to search a particular database—lifelong learning being one of our major goals
- The modules would be an audiovisual tool that would be engaging to students to ensure

that the resulting modules would not need to be hosted by the library and would be compatible with the University's course management system but not dependent on it and therefore could be shared and downloaded in a variety of ways
- The SLOs would be clearly stated to provide students with direction and transparency in their learning.

For these reasons podcasts became the preferred medium, which could also be integrated into the course management system and/or shared via the University's iTunes site (http://itunes.nau.edu). The podcasts could be viewed on a computer or downloaded and viewed on a variety of portable devices, including iPods.

Product

Each podcast was designed as a road map for the development of publication-quality research based on information literacy standards and the team's collective agreement of what the students needed to know from the design stage. This resulted in the creation of six modules:

- Formulating a Research Question & Identifying Key Concepts
- Selecting Appropriate Resources
- Finding Books
- Finding Articles
- Finding Journals
- Evaluating Web Resources, and Citing Resources, and Getting Help.

For example, in "Selecting Appropriate Resources" the librarian team identified key concepts it wanted the module to impart with regards to selecting appropriate resources, which included:

- Why would a researcher use books?
- Why would a researcher use articles?
- What are the weaknesses of books? Of articles? What are the different types of periodicals and when might a researcher use each?
- What are peer-reviewed articles? What are the attributes of peer-reviewed articles? How can they be identified?

As an assessment aligned to the SLOs, a self-test accompanied each module that students could take either before or after viewing each module to ensure understanding. However, sufficient attention was not paid to the assessment component of the design because the team became focused on the goal to provide the "product" by the beginning of the fall term, which was only about 60 days away. As a result, the self-test was developed very quickly and the team did not prototype either the instrument or the protocols as rigorously as they should have.
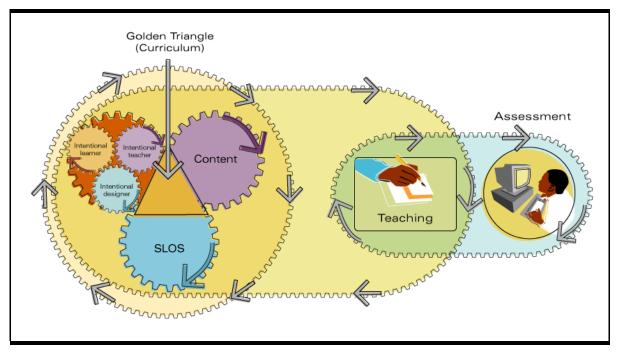
DISCUSSION

What was learned from a project of this size and duration falls into three categories: things that were done correctly; things now better understood and that will drive future work; and things that should be done differently in the future. First, from the things done correctly, the team members assumed that by intentionally working together collaboratively, well beyond the usual Librarian / Faculty / Instructional Designer roles, they would accomplish more than could have been done working as a set of individuals. The process described in this paper was successful because of the accuracy of this very assumption. The team

found a "Golden Triangle" of product development—the intersections of content, technology, and pedagogy—where everyone contributed to each component with the outcome being more robust than if they had used the more linear model illustrated in Figure 1. As displayed in Figure 2, it was an iterative process where at each step along the way group feedback was incorporated from the idea stage through final implementation.

This golden triangle became the curriculum, or the learning product,the podcasts, which were developed with the intregration of intentionality (from both the faculty and librarians), the predefined student learning outcomes, and the appropriate and available technology. For the library component, these became aligned to information literacy standards, and the learning activities or content to be presented. In ecological terms, the podcasts became an emergent property of our iterative interactions.

Second, the team now better understands the complexity of the task and the time required to develop these products. What they initially believed would require 3-4 months of development stretched to over 9 months. However, some of this delay was beyond the team's control as a series of budget cuts at the university resulted in reduced staffing available for this project.

And third, for future reference, the team should have developed a more formal work plan for the project to help keep timely progress. What began as a rather straight forward effort rapidly became much more complex. The schedules of the team members often meant that work was put on hold and when they returned to it considerable time and energy was spent regaining bearings. A well-crafted work plan and a project manager would have

FIGURE 2 — THE GOLDEN TRIANGLE OF CURRICULUM DESIGN

helped avoid these delays and help ensure continued focus on all aspects of the project including the assessment component. In addition, the actual podcast creators should have been more closely involved in the design process. Also, in any future efforts of this type, more time should be spent on working with the ultimate consumers, students, throughout the process as part of the continuing product development feedback loops illustrated in Figure 2.

An unanticipated—but very gratifying—outcome of this project work was significant curricular changes in two academic programs. In the masters program that initially sparked this project, "Information Literacy" became one of the programmatic SLOs desired for all graduates. The lead author's academic unit (forestry) is currently in the process of a total curricular review for its undergraduate program. Information literacy has been added as a top level desired outcome under one of the four educational goals desired of

all graduates.

Overall, this project brought to light the following three "lessons learned":

1. The importance of designing assessments into the project from the beginning to help determine if the students do indeed achieve the desired learning outcomes. Even with the team's conscious recognition of the importance of this aspect of the project, the team members did not always pay sufficient attention to this component of the "Backward Design" process described herein.
2. The importance of clearly articulating Student Learning Outcomes. The team members are advocates for the concept of SLOs but the initial formulation of the SLOs for this project was insufficiently specific. Over

time, in an iterative approach (one of the strengths of the golden triangle approach), they did finally settle on a set of appropriate SLOs aligned to the ACRL information literacy standards, but more attention to this aspect of the process up front would have probably saved some time and made for a better product.

3. The importance of the design team. All the team members involved in the project had worked together in the past in a variety of venues. As a result they had a good understanding of—and respect for—the expertise that each person brought to the project. The deliberate team selection helped ensure that the right combinations of skills for the task at hand were represented. But, more importantly, familiarity with each other helped ensure that team members could work together on a project that was outside their respective job duties. Hence, team members were respectful of the commitments all had and set deadlines accordingly and understood when one or more were unable to honor a specific commitment. Although it is not always possible to work with colleagues who we like and respect, in this instance the team did so, and the task was more enjoyable—and the final product more robust—than if the team lacked such mutual respect.

CONCLUSION

The Backward Design process used in this project helped to create a final podcast product that met five elements of intentionality: the importance of identifying specific student learning outcomes, the need to create a curriculum that helps students achieve these outcomes, the importance of collaboration, the recognition of how different delivery modes affect design, and the value of out-of-classroom learning. The project described above also met two product specifications of developing learning skills and portability. In addition, this work reinforced the importance of clearly articulating the "end game" of SLOs and the value of good project management.

But more than anything else, this project demonstrates the value of intentionality, from clearly defining SLOs, to the development of product specifications and design criteria, to the selection of the design and development team. This intentionality was driven by one overarching goal: helping students to acquire a body of knowledge *and* learn how to learn. One of the manuscript reviewers for this pointed out another benefit to the project: moving to the next step. Such a step would focus on developing a scaffolding process to help students of all types move from novice to expert learners, teaching students to catch bigger fish with better fishing.

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