

# Creating Modifiable Learning Objects for Online Modules

**Abstract:** This article showcases a cross-discipline, community driven tool that allows faculty, teaching assistants, or librarians to create content that illustrates discipline-specific research and writing practices. Any of these groups create new content, use existing content or edit content, thereby contributing to a database of quality collaboratively developed quality material to enhance student learning.

## **Résumé:**

### **1 Introduction/Background**

There are certain characteristics that define an online learning object and many of these have recently been given various definitions in the literature (Clyde 2004; Wiley 2000; Gibbons, Nelson, and Richards 2000; Shaw 2003). For example, flexibility, adaptability, and re-usability are three common attributes that have been agreed upon, yet, the meaning of these terms has not been consistently used by authors (Bridgland and Blanchard 2001; Bullard et al. 2007; Jones 2005; Kumar and Kush 2006; Wiley). Further complicating the concept of a learning object arises when one reads the various theories and discussions about what makes them both engaging and pedagogically sound.

Addressing engagement and pedagogy in library tutorials, the most cited source for effective design is Nancy DeWald's 1999 article, "Transporting good library instruction practices into the web environment: An analysis of online tutorials." Although not all tutorials are created with DeWald's concepts in mind, recent years have seen the development of hundreds of online tutorials, including, *TILT*, *RIO*, *Go-for-the Gold*, and *netTutor*, to name a few. Furthermore, several repositories are available in which tutorials can be easily found and perhaps used at individual institutions (ANTS and PRIMO are two examples of library tutorial repositories).

In recent years, several meta-analyses of both generic and subject specific library tutorials, such as patents, law, and medicine, have been conducted (Anderson et al. 2008; Baldwin 2008; Hackerson 2006; Hrycaj 2005; Somoza-Fernández and Abadal 2009). The most recent analysis was published in March of 2009 in which the authors "evaluat[ed] 180 tutorials by applying thirty basic indicators referring to general characteristics, content, teaching methodology, usability and technology" (Somoza-Fernández & Abadal, abstract, 2009).

With the plethora of choices available, one wonders why a library would ever need to make its own tutorial. Why re-invent the wheel? Perhaps it is because none of the choices possess the most fundamental, yet most difficult characteristic to achieve in an online learning object: modifiability. Instructors and librarians want online learning objects that allow them to use their own examples with their own descriptions. This would ultimately make them relevant to specific courses and disciplines and illuminate the complexity of the research process within a particular scholarly community. This desire moves beyond modifying an existing learning object (or online tutorial) with the simple addition of an institution's logo. It is about being able to use words and examples within a specific disciplinary context in order to suit particular users, at very little cost and without a need to program.

## 1.1 Reasoning for Our Project

Our group is a complement of librarians working at various locations across the University of Toronto. The decision to build our own tutorials arose from a need to have learning objects that are easily adaptable and modifiable for librarians and faculty to use in a range of disciplines.

Online tutorials, which have some characteristics of learning objects, are often static, generic, or focused on a single subject area. They are not modifiable nor are they course or discipline driven. Before we launched into the creation of an online tutorial that might result in recreating what has already been done, we scanned the environment. We discovered that some tutorials on generic content were excellent and could be reused by any institution (e.g. on plagiarism). However, we found other generic tutorials held less promise of applicability at our own institution, not to mention less applicability in the context of an institution with multiple libraries (e.g. on primary sources). Even though many of these could be reused with very little effort under common licensing agreements, they were not flexible enough for us. One site that held slightly more promise was *The Internet Detective*. This tutorial helps users evaluate information on web sites and has a certain level of modifiability in that allows authors to upload links to web sites that would suit their specific purpose. Additionally, while certainly the vendor-specific tutorials deposited in ANTS repository are excellent in their explanations and demonstrations of the mechanics of a particular vendor's interface, they lack the conceptual approach that we were looking for. Ultimately, we concurred with Somoza-Fernández & Abadal's conclusion that web-based tutorials for information literacy are at an early stage of development (Somoza-Fernández & Abadal, 2009).

Online tutorials are in their infancy for many reasons other than modifiability: they do not offer a flexible learning environment, much less a responsive learning environment for students. Although many more today are less linear, offering a more modular approach than in the past, only 3% of the tutorials in Somoza-Fernández & Abadal study (2009) indicated to the users the level of learning among the modules. Identifying for students what is basic, intermediate, or expert is one of the most important aspects of an online tutorial because it allows the learner to skip material they already know and move on to material they want or need to learn.

In an effort to provide students with a flexible learning environment, and faculty, librarians, and teaching assistants with an easily modifiable system with truly reusable learning objects, we had to build a system from the ground up.

## 1.2 Description of the Objects

Without realizing it, we built a learning resource that was based on learning object patterns (Jones 2005) that essentially require the development of a database that holds a pre-defined framework. The framework contains the content (or records), which can be selected, modified, and re-used by authors. A pattern such as this requires assumptions about the display of information and the conceptual approach to teaching that information. These assumptions are evident in the tutorial that we are showcasing today. The basic idea is to build digital objects small enough to increase the likelihood of their

reuse. In our case, we also framed the objects within a modular system from which one can select the modules they would like to use. A similar example, without the explicit modularity that we have, is the €800,000-funded e-learning project in Scotland which

“grew out of the realisation that, based on evidence, whole e-learning courses tend not to be transferable for use elsewhere. In traditional course design educators like to be able to pick and mix a number of different texts and resources to meet the needs of their students and achieve particular learning objectives. What this project will do is to build new and assemble existing 'digital entities' that are educationally useful and can be used in a number of areas and a number of ways” (Ballantyne quoted in *Social Work*, 2004).

A similar project is being led by The Higher Education Academy in the United Kingdom.

The Scottish system was built for education within social work while ours is built for the research process. Our discussion here is not about our process in developing the tutorial, the resources, or next steps, but rather about how our system is innovative with respect to other library tutorials; models the way for students; and is based on sound pedagogy.

## **2 Pedagogical Considerations**

Pedagogically there were four key considerations in designing *Re:search*. First, the aim of the tutorial was to teach critical stages in the complex process of research and writing. Second, learners have different levels of topic experience that need to be met at their current levels of understanding if they are to gain anything from the experience, so the system had to have the flexibility that we described above. Third, the success of students transferring the skills they learned in the tutorial could only be seen through the lens of how well students performed on these tasks in course assignments. We did not feel it was necessary to measure and track their skills within the tutorial, but rather to build into each module self-reflection activities. If the students engaged in the activities, transferability should occur. Fourth, with transferability a key component, we needed to make sure that what was being transferred to assignments would be relevant in its application. This was no small feat as the humanities, social sciences, sciences and professional faculties involved in this project conduct research and writing according to different sets of rules, values and traditions. In fact, if we were to take into consideration these different aspects among disciplines, it was important that we develop a modifiable system that allows faculty to create some of the content. Not because we did not have the time as librarians (although we do not), but because the content would ideally represent the expert knowledge of the research and writing processes within disciplines.

To meet all of these considerations we needed to develop a framework that could

1. show relationships among the different phases of research and writing processes. We especially wanted to show that research is not a process of copying out of sources, but a dialogue between ideas and evidence;
2. stage content for transfer to new situations;
3. be developed further to respond to a learner's existing level of knowledge;
4. appeal to faculty in its ability to be modifiable to include their disciplinary rules, values and traditions for research and writing.

The modules within our tutorial were not simply meant to expand the body of what a student knows about library and online research within a generic context and linked from our library website. Our system is designed to improve a student's ability to perform as a researcher from a novice stage of development to something approximating expert-like behaviour and performance within a discipline. We recognized that students might encounter the tutorials in multiple classes if there was a large up-take among faculty, so the tutorial had to provide context and discipline specific examples so as to avoid redundancy. In this way, students who use the tutorials for different classes would get wider exposure and, therefore, develop a greater understanding of the complex nature of research and writing

Our work was influenced by Chi (2006) who outlined six ways in which experts excel. Experts,

1. Generate the best solutions for tasks and problems;
2. Detect and recognize patterns in tasks and problems that novices cannot see;
3. Qualitatively analyse problems for domain-specific and general constraints to develop a robust problem representation;
4. Are able to monitor their own success and progress;
5. Are more successful at choosing appropriate strategies;
6. Are better able to integrate disparate sources of information to solve a problem; and
7. Are able to expend less cognitive effort in retrieving relevant information and working through a problem.

In the specific case of conducting research, novices have been shown to struggle with how to successfully

1. identify their information need (Cole et al. 2005)
2. formulate and revising search strategies (Hsieh-Yee 1993)
3. evaluate results (Vakkari 2000)
4. accurately assess their position in the research process (Vakkari and Hakala 2000)

### **3 Expert Behaviour and Cognitive Apprenticeship Applied**

The research process is essentially a long, complicated problem. A complex task such as this can be defined as an open-ended problem with an ill-defined goal state where the inputs and outcomes are based on decisions and cannot be determined in advance (Bystrom and Jarvelin 1995). Using expert behaviour, such as identifying underlying patterns, processes and structures, rather than means-end analysis, can improve the performance of novices (Dufresne et al. 1992). However, novices must first be given guided access to this knowledge in order to deploy it.

The *RE:search* modules adopt a strategy of cognitive apprenticeship that exposes expert structures, reasoning and decision-making processes to the learner with the aim of “encultur[ing] students into authentic practices through activity and social interaction” (Brown and And Others 1989). As Collins, Brown and Holum suggest this “apprenticeship derives many cognitively important characteristics from being embedded in a subculture in which most, if not all, members are participants in target skills” (Collins, Brown, and Holum 1991). In our modules, students can, essentially, apprentice with several scholarly subcultures depending on the courses in which they are enrolled

and the degree of difference or similarity among the activities that typify each of the scholarly communities that represent these courses.

As we mentioned earlier, the *RE:search* modules are built by adding discipline-specific material which is customized for courses and is entrenched in the language and ideas of the discipline students are studying. This model of cognitive apprenticeship “adapts some of the features of traditional craft apprenticeship to instruction in thinking. It provides graduated and supported practice in cognitive skills and in a situation of actual use” (Glaser and Resnick 1989) if carried over into assignments where both use of and evaluation of these skills is assessed. The apprenticeship model support students’ learning until they are able to carry out the skills on their own. This facilitation of learning adheres to the cognitive apprenticeship model, providing significant scaffolding when students are beginning a new skill and gradually fading until they are able to work on their own through a process of modelling, coaching, and fading (Glaser and Resnick 1989). To accommodate for fading in an online environment, the *RE:search* tutorial system had to be flexible in its ability to respond to the needs of learners, rather than force learners through a series of potentially redundant exercises; the learners would have the opportunity to choose their level of learning and practice until they felt confident in their abilities.

In a person-to-person apprenticeship, once the learner has a grasp of the target skill the master reduces (or fades out) his participation, providing only limited hints, refinements and feedback to the learner, who practices by successfully approximating smooth execution of the whole skill. (Glaser and Resnick 1989). In this sequence of activities, the novice observes the master executing (or modelling) the target process, which usually involves some different but interrelated subskills. The apprentice then attempts to execute the process with guidance, and help from the master through coaching. A key aspect of coaching is the provision of scaffolding, which is the support, in the form of reminders and help that the apprentice requires to execute the approximation of the entire composite of skills. In the online environment, scaffolding appears in the form of delineating multiple levels of learning within each module and in the “Help” and “Glossary” tools that are available.

This process of modelling, coaching, and fading, which is embedded in each module, can be illustrated by looking at the three levels of Module 1 within *RE:search* entitled “Research Question”:

Level 1: Identify: This *models* a successful research questions by using any heuristic chosen, described, and illustrated by an instructor. Students can click on different elements of the question to learn more about why it is successful.

**RE:search**  
the library research modules

▶ Research Questions Sources & Citations Search Strategies Evaluating Sources Integrating Sources Home

▶ LEVEL 1: IDENTIFY LEVEL 2: EVALUATE LEVEL 3: FORMULATE

**Identify elements of a successful research question**  
☆ Hide ☆

**Identify elements of a successful research question**

You have just been given a research assignment and need to formulate an appropriate research question. Before you begin, learn to identify elements of a successful research question. A successful research question will include - **Population - Intervention - Comparison - Outcome**

**Instructions**

1. View a topic and example research question below.
2. Look at each element of the model that has been selected for your course.
3. Click each element in the model for a detailed explanation.
4. Click *Try Another* to see another topic and example research question.

Try Another

Figure 1: Screenshot of module 1, level 1: Identify..

Level 2: Evaluate: This *coaches* students to select the successful research question from a pair of questions, with feedback provided to explain why they did or did not choose the appropriate model.

A LEARNING RESOURCE FOR IMPROVING YOUR RESEARCH SKILLS

**RE:search**  
the library research modules

▶ Research Questions Sources & Citations Search Strategies Evaluating Sources Integrating Sources Home

LEVEL 1: IDENTIFY ▶ LEVEL 2: EVALUATE LEVEL 3: FORMULATE

**Identify elements of a successful research question**  
☆ Hide ☆

**Evaluate research questions**

You have started brainstorming some possible research questions. Which one should you choose? Evaluate possible questions so you can choose the best one for your assignment. A successful research question will include - **Population - Intervention - Comparison - Outcome**

**Instructions**

1. View a topic and both a successful and an unsuccessful research question based on that topic.
2. Select the research question you think is correct. An explanation of why each question was either successful or unsuccessful will be displayed.
3. Click *Try Another* to view another topic with sample research questions.

Try Another

Figure 2: Screenshot of module 1, level 2: Evaluate

**Level 3: Formulate:** This *fades* support by asking students to apply what they have learned by asking them to write a research question from a scenario that has been provided. When they get feedback, it prompts them to self-reflect on their ability to apply the criteria they learned in Levels 1 and 2.



Figure 3: Screenshot of module 1, level 3: Formulate

### 3.1 Developing a Collaborative Database

Jonassen's remarks that "Constructivist conceptions of learning assume that knowledge is individually constructed and socially co-constructed by learners based on their interactions in the world. The meaning that learners construct depends on their needs, beliefs, and prior knowledge" (1999). By adapting this constructivist model in *RE:search*, we aimed to create a tool that engages and motivates students by providing context-rich learning experiences that relate to the very real scholarly subcultures in which they have unknowingly found themselves once they have arrived at university.

To embed the principles of constructivist learning summarized in Peter C. Honebein's *Seven Goals for the Design of Constructivist Learning Environments* (1996), we have created a system in which

- Students are provided with a discipline-specific narrative of knowledge construction at both the macro and micro level in a flexible learning environment, which allows them to target areas where they feel they are weak and practice activities until they feel comfortable. The Modules model, coach and fade students through the process of building skills that

range from developing a research question to integrating researching into their final essays.

- Content developers — faculty, librarians, and teaching assistants are able to create content for each level in the modules which can be designed to illustrate a wide variety of problems that students may face in the research process across disciplines and provide expert narratives of how to analyse and encode this new information.
- The focus of *RE:search*'s content is the discipline-specific expert behaviour and knowledge that helps create a learning experience that is relevant to an area of study of students using the modules. By introducing students to these rules, values and traditions, *RE:search* has the potential to open up a disciplinary dialogue that goes beyond the modules and into the classroom and lab.
- Learning outcomes are highlighted at the beginning and end of each module to ensure students are aware of what they are learning.

#### 4 Conclusion

In subsequent phases of this project, we will look at embedding alternative support in the forms of video and audio, and addressing accessibility issues in order to reach our entire community. For now, the *RE:search* tutorial reflects our attempt to create a pedagogically sound framework for flexible, modifiable, expandable, and reusable learning objects within a modular framework that can be deployed across a range of disciplines at a range of skill levels. We also hope that students will find them relevant and engaging. In our usability testing, students commented on how valuable they found the feedback and in several cases suggested that they would like to receive more feedback on their work.

Collaboration is encouraged by making content shareable across courses and disciplines. The database-driven backend permits the pool of examples to grow without limit, thereby demonstrating that it is possible to encapsulate sound pedagogy and expert knowledge structures into an easily maintained online tutorial platform.

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