Open Course Design and Development:

A Case Study in the

Open Educational Resource University

by

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THESIS SUBMITTED IN PARTIAL FULFILLMENT

OF THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

in the

Curriculum Theory and Implementation Program

Faculty of Education

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SIMON FRASER UNIVERSITY

Fall 2013

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ABSTRACT

The purpose of this comparative case study is to explore and examine the practices of open course design and development as they are being undertaken in the Open Education Resource university (OERu) network, an international partnership of member post-secondary institutions. With a focus on the design and development of an OER-based university-level course, the study identifies and describes features of OERu open design and development processes and compares and contrasts them to similar practices in traditional instructional design and the open source software (OSS) development field.

The study was conducted in three parts. First, a detailed description of the OERu project and its explicit purposes, structure and logic models was provided. Second, a review of the literature traced conceptual roots of the OERu in the history of reusable learning objects, open educational resources, sharing of learning design knowledge and OSS development, interwoven with the functions of social processes and mediating artifacts in collaborative design settings. Third, data were collected though interviews with developers and analysis of communications, artifacts and developer contribution histories within the OERu WikiEducator development environment.

The study concludes that the goal of enabling achievement of university credit through study of free OER-based courses imposes important considerations on the planning stages of open design and development at both course development team and partner institution levels. Further, attention to community development is key to the success of open design and development in the OERu.

Keywords: open educational resources; learning design; collaborative design; open source software; OERu

DEDICATION

I dedicate this study to Justin, Erika, Chad, and the love of my life and soul companion Jean. Your love and encouragement sustain me and bring me joy.

ACKNOWLEDGEMENTS

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LIST OF ACRONYMS

ADDIE	Analysis, Design, Development, Implementation, Evaluation
AVI	Academic Volunteers International
CC	Creative Commons
cMOOC	Connectivist Massive Open Online Course
FLOSS	Free/Libre/Open Source Software
GNU	"GNU's Not Unix" operating system
GPL	General Public License
MOOC	Massive Open Online Course
OER	Open Educational Resource
OERu	Open Educational Resource university
OSS	Open Source Software

Chapter 1

INTRODUCTION

This comparative case study explores open design and development practices taking place in the recently formed Open Education Resource university (OERu) network, and compares them to both traditional design and development of online learning in higher education and to relevant practices in open source software (OSS) development.

There has been a global proliferation of awareness and use of open educational resources (OERs) in higher education over the past decade. However, the processes used to design and develop distance university-level courses — whether or not using OER content — have typically followed what I term a "traditional" instructional design and development model in online course development, one that takes place as a formalized and institutionally bounded process. Such development typically includes faculty working either on their own or in small collaborations, and in some institutions with access to instructional design support and technical production and media teams. Development teams with access to instructional designers typically engage in planning processes using formalized instructional design methods such as those available in single mode (distance) institutions (e.g., the U.K. Open University) or in dedicated distance education divisions such the one in my own university. With the increased complexity of online course development in higher education, requiring new techniques and skills, working in teams with the participation of an instructional designer has grown in prevalence (Hixon, 2008). Further, a traditional instructional design process, particularly with the involvement of multiple experts such as instructional designers and media producers, takes place in a systematic process characterized by detailed planning and specifications for learning situations (Richey, Klein & Tracey, 2011). Finally, I also include in the description of traditional instructional design the "messiness" (Conole, 2008) of instructional design in actual practice, where the complexity of design challenges is confronted by iterative cycles of knowledge building and adaptations to situational contexts and events (Rowland, 1992).

In an emerging model of collaboration in higher education and with the use of OERs, the Open Educational Resource university (OERu) has broadened the scope of traditional instructional design process with a method termed "open design and development" where not only are collaboration and teamwork an essential component, but also they are conducted transparently in a wiki environment and undertaken by a distributed membership community of volunteer developers using content based on OERs. My use of the term "volunteer" refers to community members who either volunteer on their own time, or are provided at no cost to the OERu by member institutions (e.g., post-secondary institutions) that wish to support the project. The OERu's intention is to use this process to facilitate the development of open online courses designed to receive credit from member post-secondary institutions toward credible degrees, with the larger purpose of addressing the expanding need for low-cost higher education particularly in developing countries (Taylor, 2007).

In the OERu, volunteer developers individually undertake or collaboratively share with others multiple roles that may include finding, writing, adapting and formatting course content, as well as creating or sourcing media assets and structuring content using wiki syntax. They work and communicate unhindered by geographical location, using various types of social software with membership that is open to anyone in the design team, and content that is freely available for anyone to see. In contrast, traditional instructional design as described above is characterized by paid staff who typically work in institutionally based teams, following well-defined roles and processes. Traditional instructional design takes place in a fixed setting, usually for a predefined body of learners in one institutional context, whereas open design and development considers other possible uses, contexts and cultural settings both initially and later as the course forks and evolves for different purposes. A preliminary comparison of traditional instructional design and open design and development is provided in Table 1.1.

In the OERu, content is developed or repurposed in the WikiEducator (2013) platform with the use of alternative licensing regimes such as those available through Creative Commons, without the usual restrictions of traditional publishing and course design and development licensing. Because of the voluntary and varied roles of developers in the OERu, the design and development processes are more informal and non-standardized as opposed to those which are more formalized in traditional settings, and the content

developed is intended to be exportable to numerous online delivery environments rather than to one official and, usually, proprietary platform.

Table 1.1: Initial comparison of open design and development and traditional instructional design

Aspect	Open Design and Development	Traditional Instructional Design
• Participants	• Volunteer – either individual or institutional	• Paid, institutionally based
• Makeup of design team	• Volunteers from global WikiEducator community – individuals or institutions	• From within one organization
• Roles of design team members	• Varied, overlapping	• More clearly circumscribed
• Content copyright	• Open licensing with some rights reserved	• Mostly rights reserved
• Content versions	• Multiple simultaneous	• Single official version
• Intended learners	• Multiple constituencies, many unknown in advance	• Predefined
• Design processes	• Informal design processes	• Formal design processes
• Authoring environment	• Generally open source software – e.g. WikiMedia, OpenOffice	• Generally proprietary; e.g. Word, Photoshop
• Delivery environment	• Multiple options, based on those used by member institutions	• Usually a single dedicated platform – e.g. BlackBoard, Moodle

Thus, while it is difficult in an abstract way to provide a simple definition of "open" as used in open design and development, a comparison with traditional instructional design illustrates its fundamental characteristic. In contrast to traditional roles and structures, in open design and development participants and teams form and work voluntarily in self-selected roles and configurations, using informal and collaborative processes, and other developers, including students, have opportunities to add their own contributions over time. Communication among OERu developers is visible to anyone with Internet access, and all content is developed and repurposed under alternative licenses allowing largely unhindered access to its reuse for multiple purposes, learners and contexts. Much like Wikipedia, which uses the same MediaWiki platform as WikiEducator, the environment is openly accessible to any volunteer member who wishes to contribute to a project.

Because characteristics of open design and development as described above appear to be similar in many ways to open source software and development (OSS) (see e.g., Mockus, Fielding & Herbsleb, 2002; Scacchi et al., 2006; Xu, Jones & Shao, 2009), and also because OSS has had a wide range of

successes over multiple decades, such as Apache Web Server, Linux operating system, Firefox browser and Android (Sen, Subramanium & Nelson, 2011), for purposes of a comparative case study the processes and products of the OERu course selected for this study are compared and contrasted not only with traditional instructional design as described above but also with processes and products in OSS settings.

BACKGROUND

In order to explain the recent growth of the concept of the OERu and its component concepts such as open design and development, three related yet distinct historical developments are identified in this study. These developments occurred over roughly the same time period, involving the sharing of learning content in the form of learning objects, ways of sharing learning design knowledge, and the emergence of OERs.

These three developments gained prominence with the rapid growth of the Internet in the form of the World Wide Web in the '90s, which opened up new opportunities for distance education. Until then, distance education was confined to using print and mail services, audio and video conferencing, radio and television broadcasts, and physically distributed media content. The Internet enabled the delivery of distance education courses online and more broadly allowed for widespread sharing of digital content in a highly scalable manner. Subsequent developments in Web 2.0 technologies and the massive growth in the use of social media led to new ways of collaborating, communicating, and sharing ideas and content at a scale that was previously impossible. Increasingly available communication technologies including mobile devices created new opportunities for educators and learners to build social networks and share ideas and content at any place and time.

Given these developments, both educators and technologists explored ways in which the vast amount of educational content on the Internet could begin to be shared and used in new ways for educational purposes. These explorations took a number of forms, beginning in the late 1990s and continuing through the following decade.

One such effort was an intensive exploration of methods and technologies for sharing and reusing modular units of educational content, generally known as learning objects. This approach was seen as a possible way

of reducing duplication in the development of learning content. Many small and large scale projects were undertaken to build learning object repositories, develop schemata for tagging learning objects with metadata, and automate as much as possible their importation into and export from learning management systems.

In addition to this interest in learning objects was the sharing of instructional design knowledge, in the form of "learning designs," where processes and tools were sought that would enable the sharing of not only content such as learning objects, but also instructional patterns for organizing this content or, in other words, learning objects combined in a curricular context. Over this time there emerged much activity around enabling the sharing of "pedagogical know-how" or learning designs (Dalziel, 2008, p. 375) by representing and sharing instructional design knowledge.

A further development was the OER movement, an ethos and practice built on "the simple and powerful idea that the world's knowledge is a public good and that technology in general provides an extraordinary opportunity for everyone to share, use and reuse knowledge" (Atkins, Brown & Hammond, 2007, pp. 5–6). While on the surface there may appear to be much similarity between learning objects and OERs, the former were driven primarily by a technological interest in the mechanics of content sharing, whereas the OER movement was rooted in open content licensing and commitment to reduced barriers to learning by making free or low-cost learning opportunities more widely available (Friesen, 2004).

The term OER became broadly defined as "Teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use or re-purposing by others. Open educational resources include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge" (Atkins, Brown & Hammond, 2007, p. 4). As is discussed in more detail in Chapter 2, the OER concept was much wider than that of learning objects, involving a more extensive definition of the types of resources as well as including methods in addition to content, and referencing alternative forms of licensing.

Earlier roots of OER can be found in the free software movement which began in the early '80s with the growth of Stallman's Free Software movement (Fogel, 2005), followed by Raymond's Open Source Definition in 1998 (Wiley & Gurrell, 2009). Shortly thereafter, Wiley published the Open Content License,

the intention of which was "to advocate openness in creative works, based on the practical benefits openness would bring in education and other areas" (Wiley & Gurrell, 2009, p. 13), and Creative Commons emerged soon afterward. It was in this milieu that a key marker in the genesis of the OER movement took place. This was the inauguration of the MIT Open Courseware Initiative in 2001, when the institution, in a project backed and funded by the Hewlett Foundation, began opening up access to its course materials by placing them freely online (MIT, 2011). Shortly thereafter, the United Nations Educational, Scientific and Cultural Organization (UNESCO) coined and defined the term "Open Educational Resources" (OERs). Today hundreds of universities, along with countless other educational organizations, private investors and foundations, have made content freely available online, in forms ranging from media objects and lesson plans, to full sets of course material provided under various open content licensing regimes.

In convergence with shareable content, new approaches to collaboration, open licensing practices and the philosophy and ethos of the OER movement, opportunities have opened up to look at new ways of sharing, developing and delivering educational content in higher education. These developments are outlined further in Chapter 2, the review of literature.

Finally, it should be noted that beyond the roots of these developments in the growth of the Internet are deeper educational philosophies based in efforts to open up learning and educational processes and technologies for the broader purposes of cultural and political engagement and consciousness (Friesen, 2009a).

OPEN DESIGN AND DEVELOPMENT

In these historical developments we have seen possibilities for major changes in the delivery and use of content, but these have not been accompanied by significant changes in the way content is designed or developed. While some OER providers now provide tools for users to rearrange, edit and remove content that is already present, and to add their own content, the process of development is generally limited to working within proprietary technical environments by confining users to working within the provided platform and tools.

Thus while making OERs openly available has introduced novel approaches in the delivery of courses, the process of their design and development has for the most part been undertaken using traditional models for development, such as faculty taking on their own course development, in some cases with the support of technical teams subsequently placing the courses online after the fact, or individual designers working with faculty or with course teams whose members may have distinct and separate roles. In stark contrast to growing availability of open content, the parallel and critical activity of design and development often continues to be performed under institutionally defined processes involving content developers, instructional designers, and editorial, media and production personnel. It should be noted, however, that improved interface designs with some authoring tools, self-publishing software and learning management systems have in some cases reduced the need for extensive production teams in larger scale course development projects.

The emerging process termed "open design and development" is being undertaken in the early stages of a recently established international collaboration of universities known as the Open Education Resource university (OERu) network. As described earlier (Table 1.1), within this process, anyone within the participating community of WikiEducator volunteer developers may engage in the development and design process in any or all related roles, within an editable wiki environment where developed content can be exported into a variety of other formats or learning management systems (LMSs). While institutionally designated volunteer developers typically take on a primary role in developing the course(s) contributed by their institution, other community volunteers are invited to participate or at minimum review progress and provide feedback.

This model implicitly challenges the traditional assumption that course development and design are necessarily undertaken by a sole individual or dedicated team in traditional, fixed settings and with the use of open social media for collaboration. Beyond that, a deeper implication is that both the initial development and the ongoing evolution of the course through its lifecycle, rather than being fixed in one time and place and in a particular cultural setting, becomes open for repurposing by learners, instructors and others interested in repurposing the course for new cultural, instructional and technological settings. Rather than a being a one-time product delivered from a particular place and perspective to a largely predefined audience, the intention is that the initial and ongoing design of the course becomes open for multiple purposes and settings.

PURPOSE OF THE STUDY

The purpose of this comparative case study is to explore and examine the practices of open course design and development as they are being undertaken in the Open Education Resource university (OERu) network, with a specific focus on the design and development of one university-level credit course, *ART100: Art Appreciation and Techniques.* The study identifies successes and challenges in the OERu open design and development processes, and identifies and compares relevant practices from the open source software (OSS) development field.

Because the OERu is still at an early stage in its development, this study is undertaken as a preliminary exploration of open design and development, and is also intended to identify avenues for further study and research in this new and emergent area.

STATEMENT OF THE PROBLEM AND SIGNIFICANCE OF THE STUDY

Open design and development constitutes one of the critical initiatives identified in the OERu project, and is still at an early stage in its development. Therefore this study compares the development of a course by this method with relevant development processes in OSS. OSS has a 30-year record of many successes in mobilizing volunteers to develop numerous projects, including large-scale software products that have been broadly adopted by organizations and individual users. For instance, Apache was reported in a survey to hold 41.6% of web server market share in October 2012 (Netcraft, 2012), and Firefox was found to have 20% browser market share in September of the same year as reported in *PC World* (Noyes, 2012). In comparison, the emerging practice of open collaborative design and development undertaken by the OERu project has been in existence for less than two years at the time of this writing. While OSS has more clearly defined technical standards than OERs, the longer-term successes of the open source software movement invite comparison with open design and development. This study investigates whether the OERu open design and development approach similarly suggests a workable model for the development and design of open education at a large scale, as well as what can be learned from the challenges and successes encountered in OSS development.

As the OERu project, along with many other developing open educational resource initiatives, continues its effort to grow and supplement

traditional models of higher education, it will be critical to ensure that scalable and sustainable processes are in place to develop OER-based learning opportunities.

RESEARCH QUESTIONS

The questions this study seeks to address are the following:

1. How has open design and development been conceptualized and realized in the Open Educational Resource university (OERu)?

2. What are the currently visible features of open design and development as indicated by practices and products in the OERu prototype course projects:
   a. As compared with traditional instructional design and development; and,
   b. As compared with open source software development?

Recommendations for further research are also provided as part of the study.

DEFINING OPEN DESIGN AND DEVELOPMENT

In this case study, I explore the process of open design and development within the setting of the OERu project, using as the focus of the study the open design and development of *ART100: Art Appreciation and Techniques*, a full first year university level course in the OERu, along with reference to some other similar OERu courses under development. Because both the "open design and development" terminology as well as the OERu project have few comparable precedents, I attempt to define in more depth "open design and development" and provide a detailed background for the OERu project before returning to an overview of the study itself. Table 1.1 presents an initial conceptualization of open design and development in comparison with traditional instructional design, which is further developed over the course of the study.

The description of open course design and development in WikiEducator (2013) identifies "dynamic processes for collaborative development" as a main feature of the instructional design process for courses developed within the wiki. More specifically, the following definition is provided in the OERu wiki:

The generic design process, for instance, the ADDIE Model incorporating the five processes of Analysis, Design, Development, Implementation, and Evaluation as a dynamic system.

Open collaborative design and development models associated with the open source software development model to facilitate rapid prototyping and continuous feedback and improvement loops (WikiEducator, 2013).

To support this practice, a "node" page is provided "to support the planning, design and development" (WikiEducator, 2013) of the prototype courses. This wiki page is available for OERu participating representatives or "volunteers" who have received basic wiki training to collaborate on "ideas to inform and refine the design process and to foster collaboration for the peer review and quality assurance of OERu courses," with the design and development of each course "coordinated by a lead institution" (WikiEducator, 2013). While the node page could technically be edited by any WikiEducator member at large, as noted earlier there is a basic structure in place to give primary responsibility for the design and development of each course to the providing member institution, as well as processes for communication and sharing of ideas.

For instance, there are tools to guide communication for the OERu that extend to all participating members. These are documented in a page titled "OERu communication technologies and protocols" which outlines general communication practices as well as how to obtain technical support. The communication channels include email lists for the open community, and for staff of the OERu anchor partner university dedicated to the project. Further, clear guidelines are provided as to how to contribute to the wiki:

General thoughts, ideas and announcements are made on the relevant discussion lists.

Discussions relating to planning documents and sub-activities of the logic model are hosted in the wiki. Contributors should post all discussions relating to wiki documents using the corresponding discussion pages in the wiki….

- If you see a typo in the wiki, or can improve on the language used, be bold and edit the page.

- If you want to suggest a substantive change to a wiki page or suggest an alternative which may change the original meaning or intent, first post your ideas on the corresponding discussion page in the wiki. We aim to achieve rough consensus before making substantive changes on the main wiki pages.

- Remember that you can add individual pages in the wiki to your watch list and set your preferences to receive email notifications of changes to pages you are watching (WikiEducator, 2013).

The courses themselves are fully constituted from OER components, from content developed from the ground up and contributed to the project as OERs, or from combinations of the two.

Owing to the use of the "WikiEducator" wiki (WikiEducator, 2013), which is the MediaWiki-based development environment used for the OERu project (as well as for such prominent wiki-based projects such as Wikipedia, 2013, and Wikimedia Commons, 2013), all additions, deletions, discussions and other changes are automatically tracked in the wiki. These histories are then also visible to other viewers or participants, owing to the open nature of the wiki environment. Further, this transparency also supports the data requirements of the case study, owing to the detailed records that are automatically saved, and readily retrieved, within the wiki. Thus, in contrast to the private processes of course development in the OER tradition, the OERu is using an open and public process permitting multiple parties to engage in the very design and development process itself.

I now provide a more detailed overview and description of the OERu project in which the open design and development process is taking place.

OERu Background

History

In November 2011, a two-day meeting was held at Otego Polytechnic in Dunedin, New Zealand to formalize plans for implementation of the Open Education Resource university (OERu). The meeting was attended by representatives of 13 tertiary education institutions, known as Anchor Partners (Table 1.2), as well as of two non-teaching organizations from around the world. In addition, there were 148 registered virtual participants from 41 countries participating through live video feeds and microblogs (WikiEducator, 2013), along with an unknown number of others who were observing all or part of the proceedings through streaming video but not officially registered. Since this time additional universities have continued to join the network and thereby expand its membership.

Table 1.2: Institutional participants in November 2011 OERu meeting

Institution	Country
Athabasca University	Canada
Dr. Babasaheb Ambedkar Open University	India
Empire State College — SUNY	USA
Nelson Marlborough Institute of Technology	New Zealand
NorthTec	New Zealand
Open Polytechnic	New Zealand
Otago Polytechnic	New Zealand
Southern New Hampshire University	USA
Thompson Rivers University	Canada
University of Canterbury	New Zealand
University of South Africa	South Africa
University of Southern Queensland	Australia
University of Wollongong	Australia
Sponsors	
OER Foundation	New Zealand
BCcampus	Canada
Commonwealth of Learning	International
UNESCO, Pacific States	Pacific States

Source: WikiEducator (2013).

Planned by the Open Education Resource Foundation in New Zealand, University of Southern Queensland, Athabasca University and BCcampus in Canada, and sponsored by the Commonwealth of Learning and UNESCO Office for the Pacific States, the meeting had the goal of solidifying the first steps in the implementation of an OERu concept that had been incubating in various forms over the previous five years. An earlier meeting in February 2011 had established the foundational concepts for the OERu, with discussions that incorporated preceding public discussions and consultations with the higher education community in open online discussions coordinated by BCcampus.

Underlying the overall discussion was the concept of "unbundling" (OERu, 2012), which entails the disaggregation (or redistribution) of key elements of university courses and processes that typically take place on a single university campus, and redistributing them among multiple universities in various configurations using open education approaches as the enabler.

To give an example, in the traditional university, as described by Friesen and Murray (2011), the institution's registered students receive instruction from the university's teachers, using content developed at the university, and at the heart of these elements is the assessment and credentialing of that learning (Figure 1.1).

Figure 1.1: Model showing OER or OCW reuse ("any content")
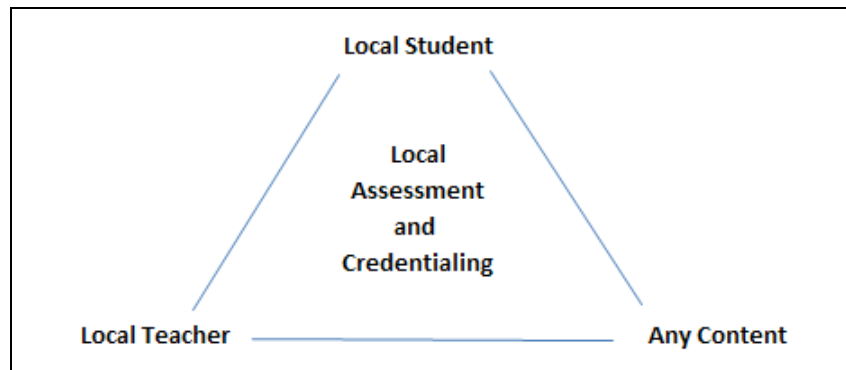
Source: Friesen and Murray, 2011. Licensed under a CC-BY-SA 3.0 Unported License.

In an alternative, unbundled model, any of these elements may occur outside the university. For instance, if open content developed elsewhere replaces course content at the university and the learning is assessed and allowed credit using non-traditional forms of prior learning assessment, content in the above formula is now disaggregated from the university.

Likewise, when learners from elsewhere study open content and apply for assessment and credit at the university, a different type of disaggregation has taken place. And for a further example, if the students noted above also find an opportunity to obtain the services of a tutor or instructor outside the university to assist in completing the course and then apply to the university for assessment and credit, yet another type of disaggregation takes place. Throughout these disaggregated processes, the intention is to enable learners to move from the "informal cloud of learning to formal study" into credible credentials offered by "the involvement of existing, reputable, accredited institutions that resonate with this approach" (Daniel, 2011). The concept of institutions operating as credit aggregators is however not new as it has been discussed for a number of years in relation to higher education institutions that might take it upon themselves to aggregate credit from multiple sources toward degrees (e.g., Chaloux, 2003).

In discussing the concept of disaggregation or unbundling, Friesen and Murray (2011) observe that

> …the basic elements of education, traditionally conceived, are redefined as placeholders and are opened up to substitution and disaggregation. Any student can study any content, supported in any number of instructional arrangements. It is important to note that … the contents at the centre of the triangle remain the same: "local assessment and

credentialing." The "local" institutional evaluation and accreditation are envisioned as remaining at the centre of the model, with the student receiving a local assessment, in order to receive a local credit, which can then be applied towards a locally-granted certificate, diploma or degree. Even though learning is achieved through flexible arrangements, it can in this sense still be rigorously assessed and credentialed (n.p.).

In referencing possible objections to such an approach, they present a number of questions that potentially could be raised on the topic of disaggregation and its impact on universities, but also note that the OERu describes its disaggregation concept as based on a "parallel universe" that operates alongside rather than in place of "traditional" university situations (n.p.) and thus is intended to complement not encroach upon the roles of member institutions.

An early iteration of this unbundling concept is evident in the original conceptions of the OERu, in the concept of a "parallel universe" (Taylor, 2007) alongside traditional higher education, where "students have free access to OCW *[open courseware]*, free access to open academic support through AVI *[Academic Volunteers International]*, and pay only for the assessment process, at an inevitably reduced fee at a member university to obtain credit" (p. 7).

These ideas were reflected in focused online discussion sessions and brought forward into the February meeting. For example, as summarized by Stacey (2012), concepts of disaggregation included,

- "unbundling" of traditional university services (i.e., course delivery, assessment, instructor support)

- development of a framework for developing new OER or assembling existing OER learning pathways for learners including paths toward degrees

- emphasis on peer to peer social learning rather than teacher/student models provision of credits based on Prior Learning Assessment processes of participating institutions (2011, n.p.).

In each of these examples, aspects of traditional university education are reconfigured in new ways that in the end still lead to formal credit granted by some institution somewhere. In the early OERu discussions, it was envisioned that each of these elements could be provided, supported or facilitated by each member university, with the main content as OERs provided in the OERu environment. Open content, and ensuring its quality and provision of credit for OER-based course completion by member institutions, would be at the core of

the OERu mission, as exemplified in open courses built collaboratively in WikiEducator. The question of standardization in the OERu was deferred back to the member institutions, which would apply their own standards to their courses offered to the OERu but also open to peer review among other member institutions and the OERu community.

Goals of the OERu

The impetus for the establishment of the OERu was the identified need to build more formal and scalable structures within the expanding world of OERs. The goal is to provide increasing numbers of formal credentials to learners who have access to informally available OER courses (Taylor, 2007) such as those that were slated by the OERu for initial development, intended to combine toward building the content for a general studies degree over time. The early OERu concept outlined by Taylor cited studies that indicated a massive growth in the need for higher education particularly in developing countries over the next decade.

In response to such concerns, the OERu project was intended to develop and maintain a "sustainable and scalable ecosystem which will provide free learning opportunities for all students worldwide using OER [and] provide pathways for OER learners to obtain credible certification and qualifications within national education systems" (WikiEducator, 2013) with "free" in this context referring to cost. Within this "ecosystem," participating institutions would contribute or repurpose courses as OERs to the OERu community; these courses would then be made available to students everywhere for free study and potential credit offered by participating universities, as well as to other universities for re-use.

Thus the aims of the OERu are articulated as follows:

Will design and implement a parallel learning universe to provide free learning opportunities for all students worldwide with pathways to earn credible post-secondary credentials.

Offer courses and programs based solely on OER and open textbooks.

Design and implement scalable pedagogies appropriate for the OER university concept.

Will implement scalable systems of volunteer student support through community service learning approaches.

> Coordinate assessment and credentialising services on a cost recovery basis for participating education institutions to ensure credible qualifications and corresponding course articulation among anchor partners. (WikiEducator, 2013)

The term "community service learning" in this excerpt is in reference to peer and volunteer tutoring. The OERu is structured to support these aims through its larger structure and processes, of which open design and development is one part.

OERu Project Structure

The open design and development stage of the OERu project is only one aspect of the overall project that is being developed in an open manner, and to place it in context the wider features of the project are now briefly outlined.

Despite its name, the OERu is not in itself a university. Rather, it is a partnership of tertiary educational institutions that have the shared goal of collaborating in building a body of open educational resources in the form of courses and programs developed collaboratively in the wiki, with the option of additional, volunteer or user-pay optional services provided by participating institutions including tutoring, accreditation and assessment of learning, and credible credentials (WikiEducator, 2013). While the OERu could also potentially provide credit for courses outside the OERu, that would be seen more as a function of the member institutions, with the OERu focusing on a body of courses contributed and peer reviewed by member institutions and designed specifically for planned degrees offered by the institutions.

The OERu is not structured in itself to deliver courses or develop and administer academic policies. Instead, in support of institutional autonomy for all partners, the OERu facilitates the collaboration of partner universities and other participants in contributing their own open education resources as well as other available OERs. Participating institutions apply their own internal educational policies in their interactions with the partnership and participating students who engage with their own universities. It was not intended to over-ride any academic policies of the partners, but rather was planned to work alongside the institutions and enable each of them to engage to the extent and in the manner that works best for the individual institutions (WikiEducator, 2013).

The conceptual structure and processes of the OERu have been illustrated with the use of a "logic model." In the OER context, a logic model has been used to depict functional relationships among elements of OER implementation programs (e.g., Atkins, Brown & Hammond, 2007; Farrell, 2001). Logic models are typically used in program planning and evaluation, and are designed to "depict assumptions about the resources needed to support program activities and outputs needed to realize the intended outcomes of a program" (Cooksey, Gill & Kelly, 2001), or to "represent the intervention program's theory and the basis upon which is supposed to lead to the desired effects" (Brouselle & Champagne, 2011). The OERu logic model (Figure 1.2) portrays the inputs, initiatives, outputs, outcomes and impact of the OERu concept.

Figure 1.2: OERu logic model
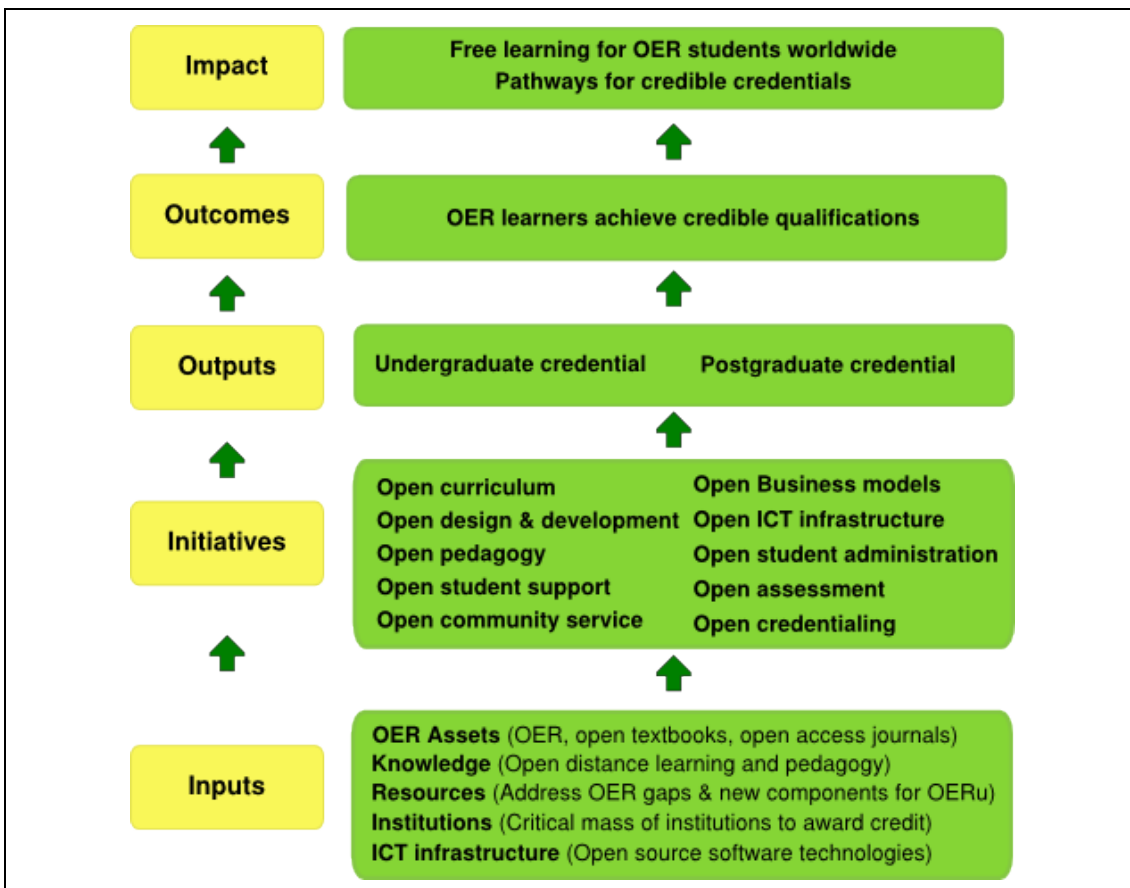
Source: WikiEducator, 2013. Licensed under a CC-BY-SA 3.0 Unported License.

As further depicted by the graphic in the Figure 1.3, the OERu network is designed to provide free, informal OER-based learning in what Taylor has

termed a "parallel universe" (2007, p. 3) that exists alongside the formal educational sector and is intended to supplement rather than replace the formal educational sector.

Figure 1.3: OERu parallel structures
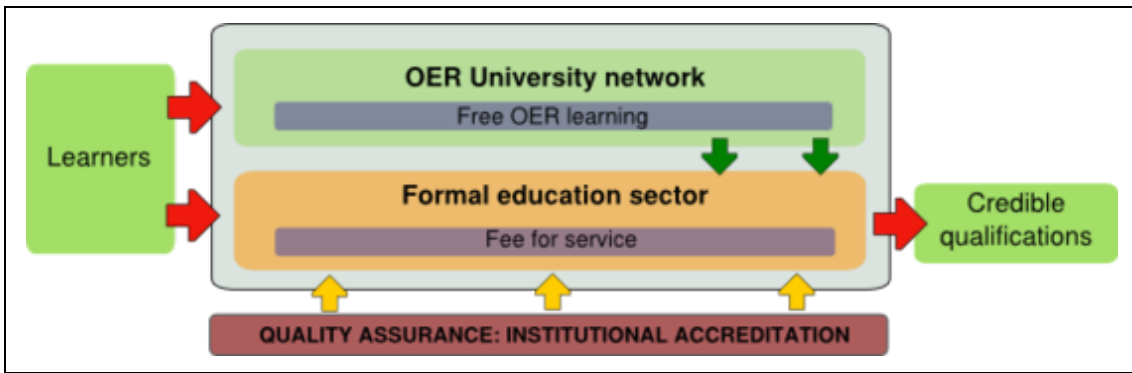
Source: WikiEducator, 2013. Licensed under a CC-BY-SA 3.0 Unported License.

As represented on the left side of the graphic, learners have opportunities to engage with the two main streams represented in the horizontal sections in the middle of the diagram. In the upper middle section, the "OER University network" offers free OER learning through courses made available either directly through WikiEducator or integrated within a Learning Management System (LMS) such as Moodle or BlackBoard. Learners from anywhere may access these courses freely. This may be seen as the "informal" learning side of the concept, where there is no direct institutional oversight or involvement in the engagement of learners with the courses. In comparison, the lower middle section represents the "formal" education sector, which in the context of the OERu involves the partner institutions who agree to provide, at their option, assessment, credit and possibly other support services on a fee-for-service or community service basis, or a combination of the two, leading to "credible qualifications" as noted on the right side of the diagram. In summary, it may be said that the graphic represents a schema for an effort to bridge a divide between formal and informal learning. It should be noted that while the original design of the OERu was to enable students from anywhere to study OERu courses and then apply to the formal educational sector for additional services, students from the formal educational sector could also engage with OERu courses, and in such a scenario the green arrows between the "OER university network" and the "formal educational sector" would need to be bidirectional.

To provide a brief overview of the larger context in which open design and development occur within the OERu network, there are a number of other components intended to be conducted in an equally open manner to that described earlier for open design and development. By prefacing each of these terms with the word "open," the intent is that each of the components of the OERu model is to be developed openly and collaboratively both among the partner universities, as well as with input more broadly among the educational community (Figure 1.3).

It is intended that the partnership continue to grow and acquire more higher education institutions over time, gradually leading to a robust and sustainable open educational "ecosystem" providing free courses with low-cost support services and potential academic credit. As portrayed in Figure 1.4, the ultimate outcome is growth in credible qualifications for learners who study through OERu OER-based courses.

Figure 1.4: OERu collaborations
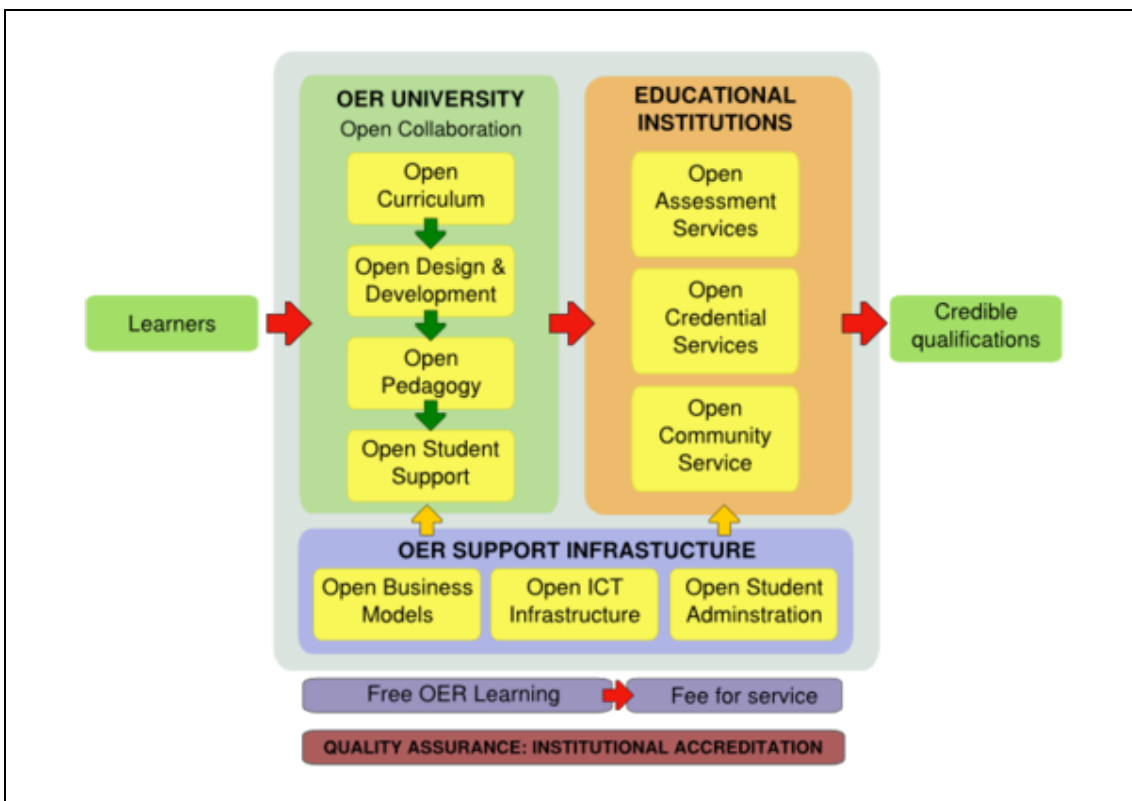
Source: WikEducator, 2013. Licensed under a CC-BY-SA 3.0 Unported License.

In an elaboration of the OERu structures portrayed earlier in Figure 1.3, the responsibilities of the OERu and educational institutions in the various

open stages are undertaken respectively via open collaboration at the OERu, or individually at their own institutions. These responsibilities are delineated in two central vertical columns. The *open collaboration* cluster facilitates the components necessary to provide opportunities to learn, while *institutional services* such as assessment and credentialing are provided individually by participating higher education institutions as they are willing and able, enabled by fee-for service models of provision in a sustainable business model. *Support infrastructure* includes the development of sustainable and scalable business models, technology infrastructure and student administration. These components are elaborated in Table 1.3.

Table 1.3: OERu Open Initiative Categories and Descriptions

Initiative category	Description
OER university open collaboration	The grouping of initiatives necessary to enable the provision of free learning opportunities.
	These services are provided through a collaboration among a consortium of participating post-secondary institutions.
	Supporting infrastructure is administered by the OER Foundation, a non-profit organisation, which generates funding through contributing partners, public gifting and donations, government contracts, support from international agencies and grants from the international donor community for the development of strategic components of the international OER ecosystem.
Educational institution services	The grouping of initiatives which are provided by registered education institutions in the formal education sector.
	Funded on fee-for-service on a cost-recovery basis or funded by government grants.
OER support infrastructure	Refers to the support infrastructure including open source software ICT infrastructure and sustainable business models.
	Institution specific services are provided on a cost-recovery basis; and
	Shared infrastructure services are funded through OER university consortium collaboration.

Source: WikiEducator (2013). Licensed under a CC-BY-SA 3.0 Unported License.

The design and development element, the component that is the specific focus of this study, is layered between and connected to open curriculum, which involves planning the comprehensive matrix of courses and credentials to be offered by the OERu, and open pedagogy, which focuses on specific instructional design considerations along with the digital literacies required to succeed in the program.

It is important to emphasize that, for the purposes of this study, while pedagogy is noted as an element in open design and development, it is the

process of open design and development that is my focus, not specific pedagogies per se. That being said, there will of necessity be some inevitable intertwining of the two, but the focus remains on the open design and development processes in a collaborative and open environment. While curriculum is separated from design and development processes in the OERu, with the former envisioned as a stage where degree and overall configurations are established as opposed to the individual development and design of each course, any design for learning will include elements of a curriculum model in the wider sense of multiple layers of interactions and influences that converge in the design of a learning event (Joyce & Weil, 2000).

Processes

All the work done in and around the OERu project is conducted openly. As described in an informal blog post by Stacey (2012), a key participant in the early planning of the OERu,

> ... all of this has been planned and published openly on WikiEducator with invited and included participation from people all over the world. Got ideas you'd like to contribute to the OERu? Log on to the wiki and add them — input from all is welcome. OERu is not only about opening education; it's modeling how to do planning and development in an open and inclusive way. For the OERu, open is not just about content — it's about all aspects of education, it seeks to engage and benefit all people everywhere, it's a way of working" (2012, n.p.).

All larger scale meetings are held using either open asynchronous forums, or video streaming with remote participation available via microblogs and email, and minutes and other records are placed in the WikiEducator wiki. All content and related discussions are also developed and edited publicly on WikiEducator, with all edits and earlier versions available for study and review by anyone.

ORGANIZATION OF THE STUDY

Following the provision of context and background of OERu in this introduction, and identification of the research problem and questions, Chapter 2 presents a review of the literature, which covers areas of interest and relevance

to open design and development of distance education within the context of the OERu project. The literature review is divided into two sections.

Because the OERu project is based mainly on the reuse of existing open educational resources more broadly defined, literature on developments in the reuse of learning content is reviewed from the time of the growth of learning objects and repositories in the early 2000s to open educational resources and more specifically variations of OERs that obtain today. Further, as the OERu is making efforts to ensure collaboration and sharing takes place in the open process of design and development, an overview of literature in the concepts and practice of collaboration in instructional design, including concepts, tools and methods, is reviewed, with a particular focus on research in collaborative and shareable learning designs.

Second, while the process of open design and development in distance education is relatively new to the field of higher education, particularly within the context of open educational resources, there is an earlier and notably successful precedent in the collaborative development of open source software (Dalziel, 2008). Thus a review of literature discussing this movement takes place for comparative purposes, along with reference to design issues in general.

The review of literature (Chapter 2) is followed by the chapter on the methodology of the case study (Chapter 3), and the next chapter presents and discusses the results (Chapter 4). The final chapter (Chapter 5) discusses the results, and presents the conclusion and recommendations.

Chapter 2

LITERATURE REVIEW

INTRODUCTION

The review of the literature synthesizes research to provide a historical context in which open design and development emerged, and is divided into two main sections. The first section reviews literature on three closely related developments: open educational resources, learning objects, and learning design. These historical threads are interwoven with traditional concepts of instructional design, and are complemented with a discussion of theoretical views and challenges. The second section reviews literature in the area of open source software development with the intent of providing a comparative context for the open design and development process in the case study. The review of literature ends with a summary and conclusions.

OVERVIEW

The literature in OERs, learning objects and learning design reviewed for this study is largely disconnected and not integrated across these areas. The OER literature tends to be qualitative and descriptive in nature, with a focus on the varying definitions of OERs, copyright and alternative licensing of content, challenges around implementation, and institutional policy and acceptance. The early literature in learning objects divides into three main areas: technical aspects that include such areas as interoperability, metadata standards, repositories and ontologies; attempts to use learning objects in pedagogical contexts with a focus mainly on sequencing of learning objects; and critical analyses emphasizing the challenges of context and reuse. Finally, studies into learning design focus on the sharing of pedagogical "know-how" (Dalziel, 2008) with the use of pattern languages and other notational or descriptive representations; research and experiments related to tools for authoring and executing learning designs; related areas of design research; and theoretical

discussions involving situated and socio-technical aspects of learning designs and mediating artefacts.

OPEN EDUCATIONAL RESOURCES

The first component of this section of the literature review focuses on OERs. In June, 2012, the United Nations Educational, Scientific and Cultural Organization (UNESCO) member states unanimously approved the 2012 Paris OER Declaration (UNESCO, 2012), which spelled out a current definition of OERs and recommendations to governments for OER adoption and implementation (Green, 2012). The Declaration defines OERs as:

> … teaching, learning and research materials in any medium, digital or otherwise, that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions. Open licensing is built within the existing framework of intellectual property rights as defined by relevant international conventions and respects the authorship of the work (UNESCO, 2012, p. 1).

The timing of this event was intended to coincide with the tenth anniversary of an earlier event: the coining of the term Open Educational Resources at a UNESCO forum in 2002. This forum took place shortly after MIT's announcement in 2001 that it would begin to publish all its course content in an online format and make it available for anyone for free (D'Antoni, 2009).

This foundational MIT initiative was supported by the William and Flora Hewlett Foundation with the underlying philosophy that "the world's knowledge is a public good," particularly within the context of the growth of the Internet for distribution to others (Smith & Casserly, 2006). The underlying intent was that anyone could use the materials in many different ways, but with the proviso that if students wanted interaction with MIT faculty or credit for their studies, they would need to register as a regular student (MIT, 2011). As described in their initial announcement, "MIT OCW [Open CourseWare Initiative] is not meant to replace degree granting higher education. Rather, the goal is to provide the content that supports an education" (Goldberg, 2001).

Over the next decade, a number of universities such as Rice, Stanford, the UK Open University and others followed suit and either joined with MIT or

established their own initiatives. Today hundreds of universities are collaborating in the advancement of openly available courses that number in the thousands (e.g., see: Open Courseware Consortium, 2012). Since UNESCO's early involvement, the OER movement has gained the attention and support of such organizations as the World Bank, OECD, the Commonwealth of Learning and the European Union. Much funding for OER development has been provided by The William and Flora Hewlett and the Andrew W. Mellon Foundations (Taylor, 2007). MIT's open courseware initiative (MIT, 2011) was a watershed event for providing not just learning objects but full open courses and making them available online. It should be noted at this point, however, that many such open courses are not necessarily offered fully or in part under open licenses.

As noted earlier, weighing alternative terms such as open courseware, open learning resources and open teaching resources, the 2002 UNESCO forum participants arrived at the "open educational resource" term and definition: "The open provision of educational resources, enabled by information and communication technologies, for consultation, use and adaptation by a community of users for non-commercial purposes" (UNESCO, 2002). Since the time of the original UNESCO definition, other definitions have continued to be proposed in the literature, and there is no one definition that captures all the various underlying concepts (OLCOS, 2012). For instance, apart from reference to the ability to adapt and reuse OERs that is encapsulated in most OER definitions, the 2007 Cape Town Open Education Declaration set the OER movement within the wider setting of open education (D'Antoni, 2009). In the words of the Declaration, "Open education is not limited to open educational resources. It also draws upon open technologies that facilitate collaborative, flexible learning and the open sharing of teaching practices that empower educators to benefit from the best ideas of their colleagues. It may also grow to include new approaches to assessment, accreditation and collaborative learning" (Open Society Foundations & Shuttleworth Foundation, 2007, n.p.).

Similarly, a number of variations and themes can be identified in the literature, each with its own particular emphasis. For example, open licensing in particular is identified as one of the keystones of the OER definition (Downes, 2007), which can permit educators to "incorporate, revise, improve and extend resources" without onerous copyright restrictions (Siemens & Tittenberger, 2009). Wiley (2004) places a focus on the ability to reuse, redistribute, revise and remix content. Definitions also emphasize a variety of

notions as to what constitutes OERs: e.g., full courses, course materials, modules, textbooks, streaming video, tests, software and other tools used to support access to knowledge (Atkins, Brown & Hammond, 2007), or along with the materials, also the tools needed for interaction and collaboration (Hylén, 2006). A description that appears to have gained frequent use in current literature (e.g., D'Antoni, 2009; Lane & McAndrew, 2010; Smith & Casserly, 2006) is provided by the Hewlett Foundation, a key funder and supporter of OER initiatives:

> OER are teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use and re-purposing by others. Open educational resources include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge. (Atkins, Brown & Hammond, 2007)

This description encompasses most of the common definitions, including an educational focus, alternative licensing, a broad variety of educational resources, and an emphasis on access to learning. With the latter element of the definition, there is an implied theme of social transformation underlying the OER movement. As described by Caswell et al. (2008), the OER movement has played a role in moving "distance education's role from one of classroom alternative to one of social transformer" (p. 2). Underlying the notion of OERs is access to learning as a "common good" (Lane, 2008; McGreal, 2004). As described by Taylor (2007), "The central tenet of the OER movement is the simple and powerful idea that the world's knowledge is a public good and that technology, especially the Internet, provides an unparalleled opportunity to increase access to knowledge and to share it, use it and reuse it" (p. 1).

Smith and Casserly (2006) describe two emerging practices in implementing OERs as "support for teaching and learning" (p. 13). One practice comprises content offered in modules similar to university courses, vetted through peer review as well as continuous review by anyone, but offered mainly as a type of textbook in that it is based on self-study without a human instructor. Self-study aids include such tools as "question sets, help buttons, review materials, assessments with feedback, multiple ways of explaining critical issues, and access to other high-quality materials that address the same topics" (2006, p. 9). This is a practice that, with some variations, has emerged quite rapidly over the past decade, as other

universities in addition to MIT have begun to offer OERs in the form of university courses made available online for individual study. Some of these courses are offered under the rubric of massive open online courses (MOOCs) (Rodriguez, 2012).

These materials are used by many individuals and institutions and for many different purposes, but for the most part OERs have been available mainly as published materials without the full range of services that universities traditionally provide in support of online learning (e.g., MIT, 2011). Services such as student support, tutoring, assessment and granting of credit are not included with most OER initiatives. More recently, projects such as the privately funded Coursera are collaborating with high-ranked universities in seeking a business model for partnering with universities to deliver massive open online courses, along with emerging arrangements for providing certificates, credit and learner support at a fee. These courses are termed by some xMOOCs, in distinction to earlier types of MOOCs based more on networking than on provision of content, known as cMOOCs, named after their underlying "connectivist" learning philosophy (Rodriguez, 2012). xMOOCs are still a newly emerging and controversial field with many rapid developments toward provision of learner support, examinations and other such features (Daniel, 2012) but for the most part without the provision of content under open licences.

The second practice noted by Smith and Casserly (2006) is based on a portal or repository containing OERs, but some with a space for developers to develop and modify content for their own purposes as well as for sharing content (Smith & Casserly, 2006). For example, Connexions (n.d.) at Rice University provides tools for individual and collaborative publishing, with content in the form of "knowledge chunks" or "collections" which are provided as a form of courses or course notes and covered by Creative Commons licenses, along with spaces for communities to develop around various content domains as well as use of content itself (Connexions, 2011).

In another example of the second practice, Open Educational Resources (OER) Commons provides links to a large number of content providers including schools and universities, as well as support to educators in the use of OERs. Along with collaborations and teacher training and support, OER Commons (n.d.) provides case studies and case study models as well as an open textbook project. The eduCommons (n.d.) initiative provides an open source open courseware management system. Beyond that, in many cases,

courses offered as OERs are usually not repurposed in terms of their learning design to accommodate informal or independent learners; most are simply restructured to meet technical requirements for online presentation and to address legal or copyright restrictions.

It is important then to note that, in contrast with the OERu design and development model, collaboration in the detailed authoring of content and courses toward formal credentials is not deeply embedded in other OER projects, and in most cases content is not fully provided under alternative licensing permitting free reuse. For instance, OpenLearn states, "our material also includes substantial extracts from other sources: quotations from books and journals, still and moving images, interviews with academic and subject experts and per-formers, and so on. We make use of these extracts under licence" (OpenLearn, 2013, n.p.). In support of collaboration OpenLearn provides the Compendium tool for collaborative modeling of learning designs using mapping and content sequencing tools, and Cloudworks (n.d.), a virtual place "to share, find and discuss learning and teaching ideas and experiences" (n.p.).

Beyond these two approaches, there is also encouragement to rethink online learning in models that are much less structured than regular university online courses. In this approach, to support the effective utilization of OERs, there is seen a need for a "decentralized learning environment" that (1) permits distributed participatory learning; (2) provides incentives for participation [provisioning of open resources, creating specific learning environments, evaluation] at all levels, and (3) encourages cross-boundary and cross cultural learning" (Atkins, Brown & Hammond, 2007). As noted earlier, the earlier cMOOCs fall more into this category. Examples include PLENK 2012, EduMOOC 2011 and LAK12 (Rodriguez, 2012).

There are significant challenges to the use of OERs such as problems of access, sustainability in particular in an environment where creators and distributors of knowledge often hoard that knowledge, and finding a sustainable funding model to maintain OERs (Smith & Casserly, 2006). Johnstone (2005) further identifies a number of potential challenges to the growth in OERs, including concerns about academic imperialism in the potential distribution of western-based curriculum around the world, and the need for faculty using OERs to reorganize or redesign existing courses for their own contexts. Concerns identified by Arendt & Shelton (2009) include lack of credentials such as diplomas or degrees, insufficient depth of coverage in a topic, lack of support by tutors and specialists, and students' feeling

overwhelmed by the materials (2009). Open eLearning Content Observatory Services (OLCOS, 2007) also affirms the need for systems of recognition and accrediting of learning and development of communities of practice, and note that finding the right business models will "remain tricky" (p. 12).

Friesen (2009b) identifies conflicts with existing institutional cultures and the need for sustainable funding models, and there are also issues related to the need for content quality assurance and supporting technology infrastructures (Atkins, Brown & Hammond, 2007). In terms of the economics of OER initiatives at a university, Gourley and Lane (2009) describe concerns about "giving away the family silver" expressed by employees at the UK Open University (2009, p. 58). Further, they identify the issue of the learning design of open courseware, which is not "readily accessible and understandable by those lacking confidence and formal qualifications. OCW [*open courseware*] is not designed explicitly for self-study" (p. 61), but rather is a set of resources and often not pedagogically designed open learning materials. As such, individuals using OCW for independent learning need to have already developed good self-study skills" (Gourley & Lane, 2009, p. 61).

LEARNING OBJECTS

The second element of this review concerns learning objects. As we have seen, definitions and practices surrounding OERs embrace a wide variety of aspects, including open licensing (Downes, 2007); reuse, redistribution, revision and remixing (Wiley, 2004); wide varieties of content and learning tools (Atkins, Brown & Hammond, 2007); as well as a wider philosophical and social movement (Hylén, 2006). In addition to the development of the OER movement, and with a much more specific focus, was the emergence of the concept of learning objects, the idea that units of educational content can be shareable rather than confined to single instances of use in learning environments (Tate & Hoshek, 2009).

The term is associated with learning technologist Wayne Hodgins, who was inspired by a building-block concept of "plug and play interoperable pieces of learning" (Saum, 2007), which arose from the seemingly obvious notion that not every instructor or developer should need to develop the same content and replicate the work of others, but could instead reuse chunks of content developed by others (Tate & Hoshek, 2009). Wiley (2006) identifies the

coining of the term "learning object" as a key element in the growth of the idea that learning content can be developed, shared and reused in different settings.

Over this period, a number of initiatives were started to provide structure to the sharing of learning content by creating standards and repositories (Philip & Cameron, 2008). For instance, the Alliance of Remote Instructional Authoring Networks in Europe (ARIADNE) was established to formalize the concept of reusable learning objects, and to develop accompanying tools and standards followed by IMS (Instructional Management Systems) in 1997 which focused largely on developing metadata standards for the description of learning objects to enable their discovery in a search tool (Saum, 2007). The IEEE Learning Technology Standards Committee commenced with the development of standards for learning objects (IEEE Standards, 1998) and other initiatives to share and promote learning objects including the Campus Alberta Repository for Educational Objects (CAREO) and the MERLOT (2013) project out of California State University in 1997, both designed to develop and distribute learning objects.

While the building-block concept of learning objects seemed intuitively simple, as compared with OERs, the focus on learning objects was driven mainly by technological challenges, and a great deal of effort went into attempts to solve these problems. For example, because of the problems of interoperability caused by many different computer based training (CBT) systems under development, especially in the aviation and military industries, the Aviation Industry Computer-Based Training (CBT) Committee (AICC) developed early specifications for CBT (Costello, 2002). As the Internet rapidly expanded over this period, a number of other initiatives were launched to promote distribution and sharing of educational resources. Advanced Distributed Learning (ADL) was established in 1997 by the US Department of Defense (DoD) to improve the coordination of information technologies and sharing of content for learning purposes within the DoD as well as among industry and academia (Advanced Distributed Learning, 2011). ADL adopted the Shareable Content Object Reference Model (SCORM), a collection of specifications and standards originally developed in Canada for use in the armed forces. The specification was adopted to "ensure consistent implementation of training across the e-learning community" (Advanced Distributed Learning, 2011).

Attention to the technical aspects of learning objects continued as vendors of learning management systems (LMSs) were urged by educators

interested in sharing of content to avoid locking content in proprietary formats and thus limit shareability (Costello, 2002). The main components of SCORM were intended to create a model for the aggregation and interoperability of content or learning objects among learning and content management systems, and focused largely on training in industry or military sectors.

However, there also grew awareness of the need to develop metadata as well as for sequencing and navigation of content, rather than for merely discovering it (Stoilescu, 2008). Thus the need for metadata that represented learning object *sequencing,* rather than just describing *content,* arose alongside growing attention on the fact that isolated learning objects themselves required pedagogical attention beyond their individual qualities. For example, Watson (2010) provides a list of pedagogical considerations that need to take place in the repurposing of learning objects:

- they are activity-centred;
- they aim to engage the student actively in reflection;
- activities allow for practice and production;
- activities are also personalized (learner centred) where possible;
- they are enhanced with significant amounts of feedback which helps to support and drive students' learning;
- the design of the LOs [learning objects] accommodates different learning approaches (pp. 44-45).

A focus beyond simple aggregation and presentation of content is clearly evident in this list.

To the present day the use learning objects as envisioned in the early 2000s, in spite of much investment in research and technology, has not achieved a widespread, mainstream adoption (Watson, 2010). The concepts of interoperability and reusability had been based largely on the engineering roots of learning object development, while a focus on learning had been generally neglected (Friesen, 2004). In fact, the early development of the learning object was largely influenced by the object oriented programming movement in computer science (Stoilescu, 2008) rather than being conceived for use by the non-technical educator. In the reusable learning object field, the question as to how content was to be reused in the context of an instructional design process was left largely unanswered (Watson, 2012). However, developments in the areas of learning designs were beginning to attempt to address exactly this problem.

Learning Design

As researchers and educators wrestled with the implementation of learning objects and how they were to be used in the instructional environment, the need for more context and information about sequencing and thus sophisticated metadata opened questions about how the interface should operate between the learning object and the instructional context (Koper, 2001) particularly in an increasingly constructivist and social constructivist educational milieu.

And so, along with the availability of shareable content, came the need to agree how to reuse this content, in terms both of the pedagogy of the design process or "pedagogical know-how" (Dalziel, 2008), and of the ability of non-technical educators to implement it in an instructional setting (Watson, 2010). Yet, in the field of learning objects, the focus had been mainly on the content itself rather than on how the content was configured into learning sequences that would include learning activities as well as content. In other words, how could not only learning objects but also knowledge about how to implement them with an appropriate learning design be shared? To address this question, we look first at literature on the pedagogical elements or shared know-how of learning design, and then on the perceived advantages and challenges of these approaches.

There is no one, standard definition of learning design—the literature in this area is emergent and a consensus on a standard definition does not exist (Agostinho, 2009). One common use of the term, however, points toward learning design as an activity or process, a structuring of learning activities, orchestrating a "learning workflow" (Britain, 2004:3), or more broadly the process of instructional design (Conole et al, 2007; Lukusiak et al., 2005). Learning design can be articulated in the sense of a practice, or as "the set of practices involved in constructing representations of how to support learning in particular cases" (Goodyear, 2005: n.p). Falconer et al. (2007) explain learning design as consisting of "designing, planning and orchestrating learning activities as part of a learning session or programme" (p. 2). Koper and Tattersall (2005) describe it as the "human activity of designing units of learning, learning activities or learning environments" (p. 6).

In all these instances, the core of the descriptions of learning design is more or less synonymous with instructional design, although there are nuanced differences among the objects of learning-design-as-activity. For example, among the above definitions the objects of the process include a *sequence* of learning activities in the form of a *workflow* (Britain, 2004), various

units of learning (Falconer et al., 2007; Koper & Tattersall, 2005) or *representations* thereof (Goodyear, 2005). For the most part, the definition becomes clear in context of its use.

Attempts to enable the sharing of learning designs began with efforts to represent or model them in some abstract way. To support and enhance research into the learning activity side of the equation of learning objects, in 2000 a group led by the Open University of the Netherlands released their work on an Educational Modeling Language (EML) which was subsequently accepted as the basis for an IMS specification (Britain, 2004). This work was focused not so much on learning objects, but instead on how these objects fit within a learning design and in a way that would accommodate a variety of pedagogies, not just straightforward transmission of a learning object to an individual learner within a content package. For, while the earlier efforts at standards identified some of the complexities in the areas of interoperability, reusability, adaptability, accessibility and durability, this earlier work was largely focused on learning objects and assumed a simple instructional model based on a solitary learner. A new approach was required (Koper, 2001):

> … a lot of learning does not come from knowledge resources at all, but stems from the activities of learners solving problems, interacting with real devices, interacting in their social and work situation. A lot of research about learning processes provides evidence for this stance that learning doesn't come from the provision of knowledge solely, but that it is the activities of the learners into the learning environment which are accountable for the learning (2001, p. 3).

Thus the notion of learner activity and collaboration and the importance of the learning environment — in other words, pedagogy — increasingly permeated discussions about learning in general as well as in relation to learning objects, and particularly in relation to emerging models of learner collaboration in online learning (Stahl, Koschmann & Suther, 2006).

As noted above, a common use of the term learning design is related to representation. In other words, one view on learning design may be as a *portrayal* of learning activities (Masterman, Jameson & Walker, 2009). Learning design representations take any of a number of forms such as flow charts and diagrams, often with multiple layers to represent different design aspects and with visual modeling as part of the designs (Botturi et al., 2006; Derntl and Motschnig-Pitrick, 2010). Learning designs may make use of design languages (Botturi et al., 2006; McDonald, 2008) that can be used as design aids (Stubbs &

Gibbons, 2008). As with other representations, design languages may be seen as a common way of representing learning design components, a *lingua franca* for instructional designers as in notational systems, patterns or graphical representations (Botturi et al., 2006, p. 1216).

Visual representations of learning designs have also been proposed as tools for sharing instructional design knowledge, not only individually but in collaboration with others. Some methods involve tools that aid the designer in various ways to develop visual representations; for instance, a collaboration environment where designers may build a flow chart populated with icons that are dragged and dropped to portray learning activities (Agostinho, 2009).

Learning Activity Management System (LAMS) is a visually based authoring tool that supports the ability to arrange graphical representations of learning designs in such a way that the underlying code can execute in a learning management system. It "provides a framework for lesson designers to reflect in a deeper and more creative way about how they design and structure activities for different learners or groups of learners" (Cameron, 2006, p. 28). The system was designed to enable sharing of learning activities among practitioners and provide support for faculty individually and collaboratively in designing courses with pre-existing content (Dalziel, 2008). However, it is also built as a proprietary tool.

The Compendium project at the UK Open University, as noted earlier, uses iconic representations in a mind mapping tool to create learning sequences in parallel vertical columns that represent tutor assets, tutor role, student role and student assets. It also permits the concurrent development and linking of assets and support requirements and can be used in both individual and team design contexts (Conole et al., 2007). The UK Cloudworks project using a social networking site provides a space for practitioners to "share and discuss learning and teaching ideas and designs (Conole 2013). In general the intention behind these and other types of learning design supports is to document teaching strategies and designs, provide more available and flexible options for designers, and provide opportunities for reusability and adaptability (Cameron, 2006). There are many other developments in support of learning design ranging from sites for sharing designs to case studies in design, sample lesson plans, and authoring tools (see, e.g., Botturi et al., 2006; Derntl & Motschnig-Pitrik, 2008; Falconer et al., 2007; Kaufman, 2003; Koper, 2005; Tattersall et al., 2009).

In an adaptation from the profession of architecture, Alexander et al.'s (1977) design pattern approach has also been explored in relation to instructional design. The pattern approach to architecture focuses on individuals operating within in a community context and considers broader environmental factors beyond the individual structure. As described by the European E-LEN (n.d.) design patterns project, e-learning patterns may express educational values such as open, flexible learning, collaboration, communication and development of technological skills. Within a learning design context, these types of patterns are seen by some to have design implications that enable

> … a non-prescriptive, highly adaptive approach to design, a self-organizing social planning environment, a non-reductionist, emergent, holistic and generative process and the expression of values in complex learning environments. Learner participation in the development of learning design patterns also is a necessary element (Rohse & Anderson, 2006).

The intent of use of Alexander-type patterns in an educational context is seen to be rooted in an effort to democratize design, making sophisticated design concepts relatively simple and accessible to non-technical individuals. The patterns are designed to be heuristic and human-interpretable and can vary in granularity, from the level of a course to a single activity (Agostinho, 2009). They use natural language (Días 2005) and do not generally contain highly technical elements. In higher education, the concept behind the use of patterns in learning design is that non-specialist educators could potentially use learning design patterns to create unique designs that are individual and personal and yet that adhere to fundamentals of good design, particularly where instructional design support is not available (Goodyear 2005).

As with the limited success of the learning object concept (Watson, 2010), the use of learning design supports to promote sharing and improve teaching online and innovation has not taken root in a notable way in higher education (Bennett et al., 2007) and the state of technology development in this field has been described as "immature" (Zeng, 2010). Few have gone mainstream in the manner that learning management systems have done since the mid 1990s (Dalziel, 2007).

The literature reports number of reasons. Questions of granularity of learning design increase the complexity of reusability; for instance, Hernández-Leo et al. (2006) identify various levels of reuse that may be undertaken, such

as a learning design activity compared against an entire sequence of activities, as well as completeness of a unit of learning contrasted against a skeleton description. At a more pedagogical level, a problem lies in the multiple interpretations of such concepts as constructivism and problem-based learning identified in learning designs, which will be interpreted differently by different users (Griffiths et al., 2005).

Another complication with the concept of reusable learning designs may be the sheer breadth of the term and lack of clarity surrounding it (Agostinho, 2009), and in particular the range of expectations and possible uses that may be associated with it. The wide scope of projects, purposes, intentions, contexts and formats described in the present study creates a large, diffuse and confusing array of initiative, solutions and technologies (e.g., Barker, 2008; Botturi et al., 2006) in spite of the fact that the concept continues to be discussed and explored, likely because of its intuitive appeal and promise. However, as described in the Larnaca Declaration on Learning Design, "any widespread acceptance of an educational notation system will arise from a complex mixture of usefulness, social propagation and serendipity (Dalziel, 2012).

THEORETICAL ISSUES

Much of the traditional literature in instructional design flows from a rational and technical perspective, outlining sequences and steps, and much training of instructional designers is based on a body of theory. In their overview of the history of instructional design, Richey, Klein and Tracey (2011) describe instructional design's scientific foundations and summarize the field in their definition as "the science and art of creating detailed specifications for the development, evaluation, and maintenance of situations which facilitate learning and performance" (p. 3).

However, traditional views may not be consistent with the practice of instructional design (Rowland, 1992). Research in other professional areas of design practice such as building and engineering work finds that "expert designers [*work*] in iterative, knowledge-building cycles rather than in the deterministic, linear or step-by-step manner suggested by models of the process" (p. 66). In a similar vein, Schön describes the history of what he terms "technical rationality" as a paradigm that erroneously, in his view, has positioned scientific knowledge as the source from which ostensibly lower-level forms of practical and professional knowledge emerged.

Rowland (1993) describes this rationalistic tradition as a "deterministic, essentially rational and logical process, a set of procedures to be followed" (p. 79) and argues instead for an understanding of instructional design as a creative process that exhibits both divergent and convergent processes; or as a "dialogue rather than a process of optimization" (p. 79). Rather than being highly linear, the process tests solutions while exploring the design problem at the same time (Kirschner et al., 2002). This nonlinearity emerges with use of intuitive or tacit knowledge brought to the design problem by the instructional designer, with instructional design models being referenced only as a part of the designer's tacit knowledge and not necessarily followed explicitly (LeMaistre & Weston, 1996).

Thus, along with the technical and pedagogical challenges noted earlier, a prominent theme that has surfaced in the literature on sharing content and design approaches is the "design" aspect of the work (e.g., Cox & Osguthorpe, 2000; Griffiths et al., 2005; Kirschner et al., 2002). As described earlier, many of the concepts of reusable design send the designer to a particular repository, pattern, representation or other location or tool to aid them in the design process. The question then arises whether instructional designers or developers are readily able or equipped to design by locating content developed elsewhere and then interpreting and applying patterns or representations in the learning design (Griffiths et al., 2005). While there are many normative as well as descriptive instructional design models, there is little overall on the actual practice of instructional design; i.e., how instructional designers design (Rowland, 1992). Therefore, along with descriptive research of instructional designers at work, questions need to be asked as well about what "models, processes and theories...would be most helpful to their practice (Cox & Osguthorpe, 2000 p. 47).

Design in many areas has a developed body of rules or heuristics, which are derived from experience as well as research and testing. The combination of established heuristics and design factors such as aesthetics and specific purpose helps shape the development of a usable design, and constitutes what is termed the "design space" (Dijkstra, 2001 p. 276). The design space in education and instructional design is made more complex by many different views on the goals and purpose of education.

Further, there is a difference in the way that novice and expert instructional designers undertake their work, and learning design approaches may need to be differentiated between the two levels. Gustafson (2002) finds

that differences between the work of the novice and expert are profound. However, most discussions around sharing and reusability of learning designs do not refer to this differentiation.

Comparing novice and expert instructional designers' approach to solving a specific problem using "thinkaloud" protocols, Rowland (1992) noted substantial differences between their approaches on analyzing learning needs related to problems with the operation of a machine (Table 2.1).

Table 2.1: Comparison of novice and expert approaches to instructional design problem

	Experts	Novices
Problem interpretation	ill-defined	well-defined
Problem analysis	lengthy analysis solution ideas used to constrain analysis	little analysis quickly move to solution generation
Problem representation	casual network deep system understanding	literal, as given surface feature understanding
Solution generation	weak links maintained address points of attack on casual network (model of system)	strong links established early address knowledge deficits
The solution	variety of interventions	instruction
Internal resources	experiences as designer templates design principles	experiences as learner
External resources	single reading	continuous re-examination
Decision-making	base on multiple, global factors	base on single, local factors

Source: Rowland, 1992, p. 77. © 1992 International Society for Performance Improvement. Used with permission.

As described by Rowland, tacit knowledge of the experienced instructional designer leads to much deeper understanding and analysis of the design problem, as indicated in Figure 2.1, where the difference between novice and expert instructional designers is displayed in stark contrast. Whereas novices focus on a narrow set of problems in a design space, others who are experienced have an expanded understanding of the complexity of the problem to be addressed by the design. This phenomenon suggests that the rationalistic, planning-focused approach typified in most traditional instructional design theory and literature (Richey, Klein & Tracey (2011) does not shed adequate light on the processes of instructional design as it actually plays out.

Figure 2.1: Novice and expert approaches to an instructional design problem
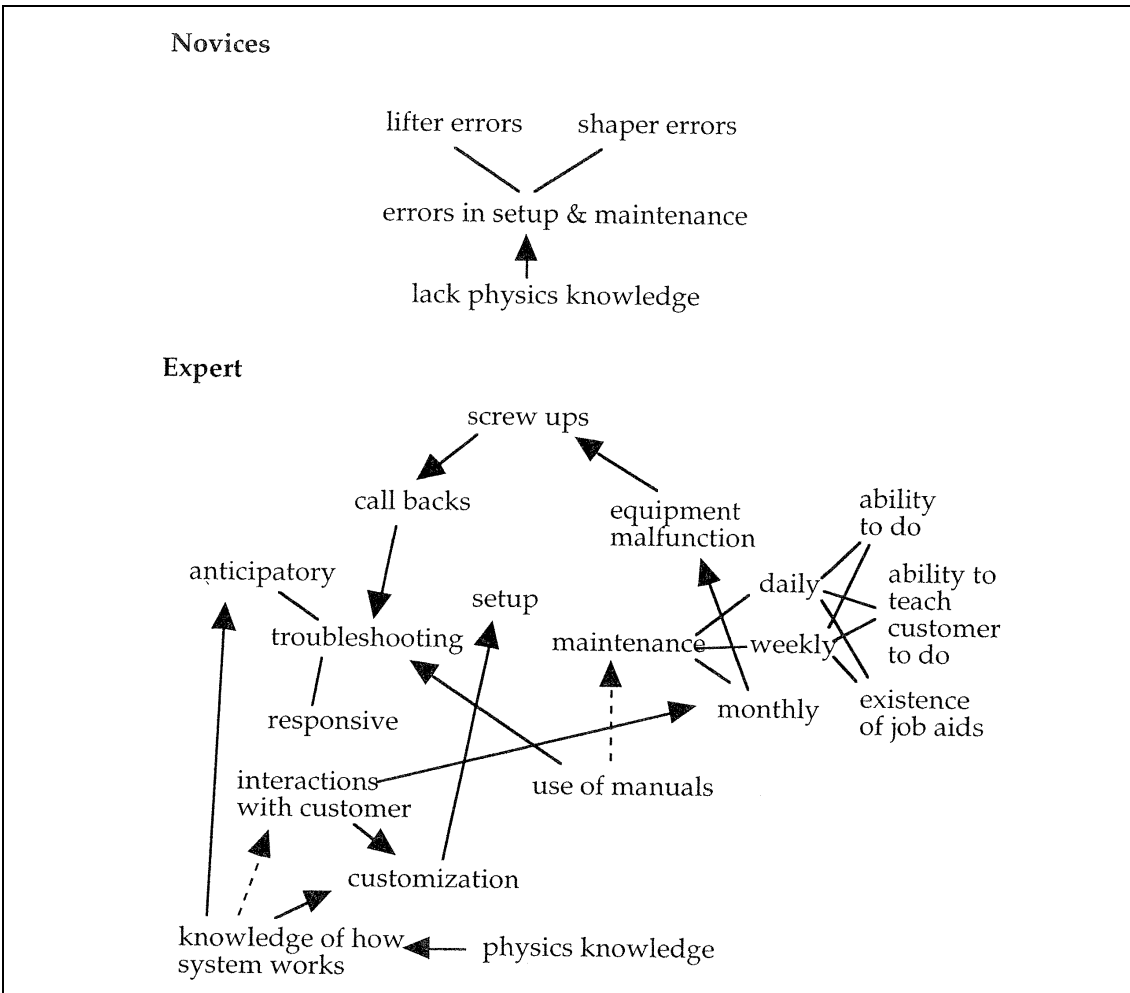
Source: Rowland (1992, p. 80). © 1992 International Society for Performance Improvement. Used with permission.

Beyond the experience of the designers in undertaking their work, the concept of reusability itself requires a closer inspection. While it is intuitively attractive to consider the benefits of reuse of resources as inherently beneficial, the history of learning objects described earlier makes it clear that moving content from one context exposes important problems of the different contexts between the original setting and the new one (Wiley, 2004). Many of the developments in learning design emerged in significant part within a technological milieu that assumed a technologically-oriented understanding of e-learning (Friesen 2004), similar to much of the research in automation of teaching in CBT in the 80s and early 90s (e.g., Halff, 1993; Spector, Muraida & Polson, 2004).

On the pedagogical level, discussing the notion of reusability in the context of learning objects, Griffiths et al. (2003) note the problematic influence of the metaphors of "conduit" and "encapsulation". The conduit metaphor fosters a notion of ideas as objects contained in words that are sent via a communication conduit, and the complementary concept of encapsulation sees learning objects as independently nested and self-sufficient within a container. These metaphors do not hold up in typical constructivist design approaches in that content is not simply transferred via a conduit from one container to another, but constructed within individual and social settings (Koper, 2005), which again is not significantly identified in the traditional field of instructional design.

Similarly it can be extrapolated that learning designs as artifacts cannot simply be viewed as containers that encapsulate instructional design pedagogical decisions that are transmitted and received for reuse in other contexts. It is for this reason that some learning design approaches are intended to be "inspirational" (Falconer et al., 2007); i.e., intended only to inspire ideas that can be subsequently applied in different settings or "generative" (Botturi et al., 2006; Rohse & Anderson, 2009). Alexander describes generativity in design as a process of unfolding; i.e., a sequence of "asking and doing" (Alexander, 2002 p. 317). These concepts in effect challenge the conduit and encapsulation metaphors as they indicate the need to process and refit a learning design within a new learning setting. Thus the notion of context becomes particularly germane in discussions about learning designs and their potential purposes, as well as the contexts in which learning occurs: "To understand context in container or relational terms has effects on how we conceptualise the mobilizing of learning across domains and associated pedagogic practices" (Edwards, 2005).

Given the "messiness" (Conole, 2008) of instructional design then, a learning design tool cannot tightly couple, in a linear and logical manner, the many pedagogies, strategies and tools at the instructional designer's disposal in an integrated package that moves, even in a more generative or inspirational manner, into a new context and by a new designer.

As another approach, Conole (2008) develops the concept of learning designs as mediating artifacts rather than as plans to be followed in a rote manner. As shown in Figure 2.2, mediating artifacts may take forms such as models, vocabularies, diagrams, patterns and case studies, as well as more general artifacts such as guidelines, repositories, planners and FAQs (Conole, 2008). The purpose of such mediating artifacts is to make learning design a more visible process by shifting it from a tacit to an explicit place: "Traditionally

design has been an implicit process, how do we shift to a process of design that is more explicit and hence shareable?" (2008, p. 187). While these concepts have already been noted, Conole further broadens the term "learning design" to embrace a holistic approach that draws from a variety of key elements in the processes of teaching and learning. These elements are "instructional design, the learning sciences, learning objects and Open Educational Resources, pedagogical patterns, and professional networks and support centres" (2011, n.p.). Conole ties these ideas together in the need to use mediating artifacts as a basis for collaboration in a rich ecosystem.

Figure 2.2: Four types of mediating artifacts
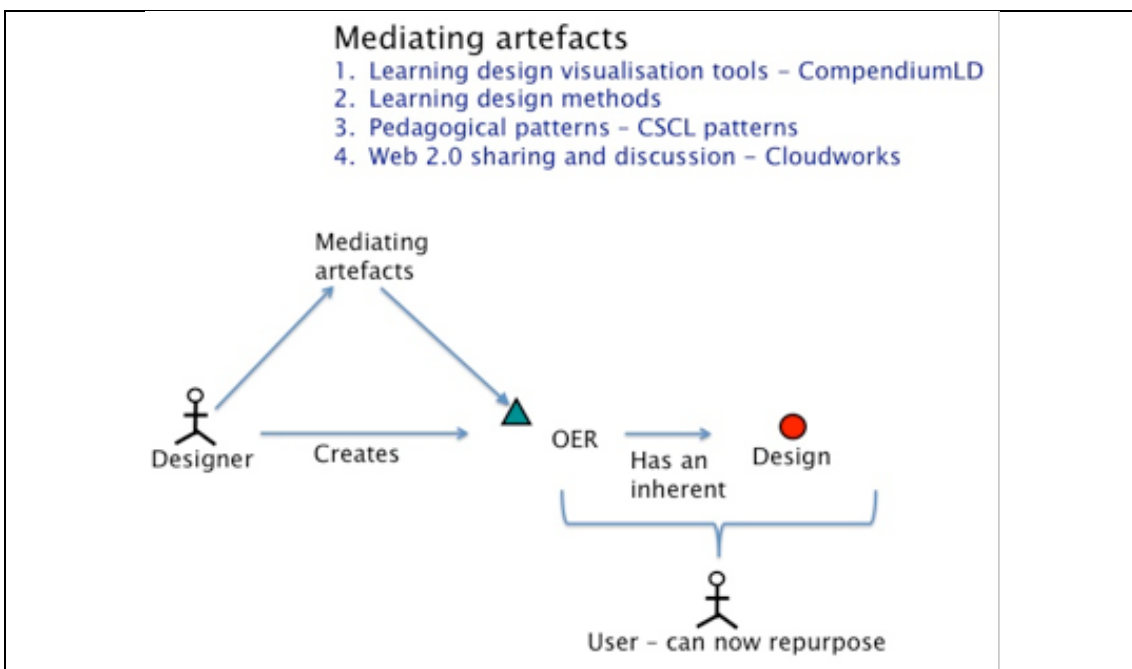
Source: Conole, 2013, p. 78. © 2013 Springer Science & Business Media, LLC. Used with permission.

The concept of mediating artifacts is focused on their role as boundary objects as described by Wenger (1999) which include artifacts, discourses and processes supporting coordination and negotiation or brokering between different domains within a community of practice. Perkins (1992) describes a somewhat similar concept in terms of distributed intelligence, which is expressed on the basis of two principles:

1. The surround — the immediate physical, social, and symbolic resources outside of the person—participates in cognition, not just as a source of input and receive of output but as a vehicle of thought. The surround in a real sense does part of the thinking.

2. The residue left by thinking—what is learned—lingers not just in the mind of the learner but in the arrangement of the surround as well; yet it is just as genuinely learning for all that. The surround in a real sense holds part of the learning (1992, p. 135).

Conole draws on Vygotsky (1978), Engeström (1999) and others in the field of socio-cultural theory in developing the concept of mediating artifacts in relation to making more explicit the tacit design embedded in learning activities as well as making it available as a site for negotiation.

Alongside Alexander's forms of pedagogical patterns and learning design as represented in Compendium LD (Conole et al., 2007) and a social networking sites such as Cloudworks for a community of those engaged in learning design, as noted Conole also views OERs themselves as providing mediating artifacts: "The benefits of the OER movement is that it is building a world wide set of high quality free educational resources, along with opportunities to build a community around these resources — to share and critically discuss good practice in teaching and learning" (2007, n.p.).

Dimitriadis et al. (2009) explore the use of case studies — i.e., brief descriptions of learning designs embedded in OERs — as mediating artifacts in the collaborative repurposing of OERs from individual to collaborative learning contexts. In this process Dimitriadis et al. hypothesize that "making design more explicit will facilitate repurposing of the OER" (2009, p. 201). As described by Zitter et al. (2009), "although an artifact appears to be a self-contained object, it is in fact a nexus of perspectives" (p. 1002) and thus opens an awareness of the importance of multiple meanings brought to an instructional design setting by different players and may also provide a clue as to why learning designs as mere plans to be followed have not borne fruit in practice. Along the same line, Suchman (2007) notes that even within an instrumental paradigm of planned action, there may be multiple ways to achieve a single goal, and the plans of others need to be taken into consideration as well: there then exists an "indeterminate relationship of intended effect to method as a problem for planning" (p. 57). She thus problematizes the cognitivist view which sees planning operating much as a computer program, generating detailed instructions as how to achieve the

desired end, with the assumption that these instructions directly steer and control the implementation in a linear and rational manner.

Insights into collaborative design may also be gained from other fields. In the area of architecture Kvan (2000) describes a model of design collaboration where designers typically engage more in parallel manner than in an ongoing process of collaboration in design. Collaborative design is undertaken in

> … parallel expert actions, each of short duration, bracketed by joint activity of negotiation and evaluation. Thus the design activity itself is discrete, individual and parallel, not intimately linked. The participants act as individual agents addressing design issues from their perspectives. Their expertise may change during a design session as their understanding is supplemented and they learn from their involvement (2000, p. 412).

Looking at organizational aspects of collaborative design, again in the field of architecture, Chiu (2002) focuses more on the importance of communication particularly where more than two people are involved in the collaboration:

> The transmission between two persons is easy, particularly by face-to-face contacts, but the transmission among multiple persons or between two groups requires coordination and management of information flows. When more persons or groups are involved, the communications become more complicated (2002, p. 190).

Chiu suggests that communication supported by technological tools need be able not only to support processes of decision-making, consultation, negotiation, evaluation and confirmation, but also to be supported by effective design sharing processes as well. In order to ensure such processes, "orientation sessions should be conducted prior to the design review to familiarize with the strength and limitations of the communications" (2002, p. 207). In other words, reflection on the sharing of design information should itself be an object of discussion within a collaborative design setting.

The importance of communication roles is reinforced by Sonnenwald (1996), who notes that design teams may consist of participants from many different backgrounds and specializations, and cautions that "design participants need to explore and integrate these differences. When the design context is not explored, project team members may make design decisions that have a negative impact on other members' work and on the artefact as a whole" (1996, p. 279). In studying design processes across the diverse fields of

architecture, expert systems, telecommunications and engineering, Sonnenwald identified the presence of five types of "boundary spanning" roles among team member roles in design settings, with foci encompassing the organizational aspect, the task level, disciplinary knowledge, personal-level information and multiple other roles. A recommendation from the study includes working toward a prescriptive framework for communication roles and strategies among collaborative design teams, along with effective information retrieval technology that "may help augment human boundary spanning activity and support knowledge exploration and integration during the design process" (p. 296). Similarly, Hixon (2008) also emphasizes the importance of communication in collaborative design for online courses, regardless of the configuration of participants or team members and their roles.

SUMMARY AND CONCLUSIONS

To conclude this section of the literature review, a number of findings may be gathered from the history, practices and challenges that face those who wish to share OERs as well as instructional design know-how.

Emerging out of a growing context of open software and open content movements, the introduction of open courses by MIT in 2002 generated momentum among universities and other educators toward making their courses openly available for study. The subsequent definition of OERs by UNESCO broadened the concept of providing free access to content to include wider definitions of content and the technologies that support and deliver it; such aspects as open licensing, ability to reuse, redistribute, improve and extend resources; and more broadly a philosophical and social movement with a focus on educational resources as a public good. Yet the implementation of OERs has encountered many practical challenges including those related to sustainability, developing a broader model of ancillary services, the need for recontextualizing content to new environments, and, of particular relevance to our present study, the need for new approaches to learning design of OERs.

In addition to OERs, developments in learning objects were dominated by attention to technical interoperability with a lack of consideration of their potential function within an educational setting. Early recognition of the need to consider the description and sequencing of learning objects evolved into attempts to create learning design tools that would manage and sequence learning objects alongside individual and collaborative learning activities.

These tools took a variety of forms, and began to focus not just on sequencing of learning objects or, more broadly, content, but in fact looking at the processes of learning within a learning environment.

These tools included representations of learning activities, visual languages, mind mapping technology, patterns and other approaches. While both learning objects and learning design approaches appeared to hold much promise, challenges were encountered in their implementation. These include such problems as the context specificity of learning objects, failure to support the actual ways in which instructional designers work in the design space, the situating of the tacit knowledge of experienced instructional designers in specific and unique problem settings, and the need to consider the social aspects of collaboration in an open design and development setting. In addition, from other fields we learn that explicit attention to communication and collaboration methods and tools is critical for the success of design collaborations.

We now approach the second section of the literature review, with a focus on open source software (OSS) and its potential parallels to open course development and design.

OPEN SOURCE SOFTWARE

Introduction

For comparative purposes, in this section of the literature review, I turn to a review of the literature in open source software (OSS) development. The reason for selecting this field for comparison is that little research is available specifically into open development and design of university courses based fully on OERs, within a collaborative setting and using an open wiki development platform. Contrasted against the relatively recent history of OERs, reusable learning objects and learning designs, the open source software movement has had time to mature and to gain a broad acceptance within industry (Garzarelli & Fontanella, 2011; O'Mahoney, 2007; Wu, Gerlach & Young, 2007). Therefore this section of the literature review examines how its practices may compare with, and possibly inform, a deepened under-standing of collaborative approaches to open design and development in a larger scale setting.

Overview

Owing to the openly available data in OSS repositories and related communication archives, data collection is relatively straightforward compared to conducting similar empirical research in traditional corporate and practitioner settings (Stol et al., 2009). The literature suggests a wide variety of potential areas of research, as well as avenues for researching theoretical foundations (Crowston et al., 2012). The main types of areas of research have been in the areas of OSS communities, development and maintenance, diffusion and adoption, and characteristics of OSS; and the main methods include quantitative analysis, surveys and case studies (Stol et al., 2009). Crowston et al. (2012) similarly note the predominance of case studies and questionnaires in OSS studies, with an emphasis on single projects and reliance on archival data.

The main findings point toward the importance of decentralized communities, methods for induction of novices, the presence of social networks, a balance of general design rules and individual autonomy in the successful design of OSS, and the use of design artifacts and conventions to mediate collaboration and ongoing maintenance of software.

Developer Communities

Oberg (2003) describes open source software development in terms of two main aspects: process (of software development), and philosophy, "how software is intended to be used and distributed" (p. 36). The process aspect involves the manner in which the software is developed, i.e., by volunteer coders; and the philosophy aspect relates to the GNU General Public License (GPL), which maintains a right of all users to "run, copy, distribute, study, change and improve" the code (GNU Project, 2012).

OSS developers are characterized largely by their volunteer nature, the way their work is organized and coordinated, how their roles are defined, their methods of communication, and the unique culture of their communities. Development communities are diverse (Crowston & Howison, 2006), and yet the nature of such communities is important to gaining an understanding of the open source software phenomenon itself. Open source software development is generally characterized as based in a unique culture: "These individuals [find] it a normal part of their research culture to freely give and exchange software they had written, to modify and build upon each other's software both

individually and collaboratively, and to freely give out their modifications in turn" (von Hippel & von Krogh, 2003, p. 209).

Because most coders or developers in OSS contribute their work at no cost, motives of volunteers in OSS projects is a topic of considerable interest in the literature. In describing the motivation of volunteers, Baytiyeh and Pfaffman (2010) find that many communities are driven by a desire to contribute to the "greater good" (p. 1348) of society. Fang and Neufeld (2009) note that shorter term goals of participants involve meeting a variety of immediate needs, whereas longer term participation enables increases community and social engagement, recognition and identity construction. Crowston and Howison (2006) further find that volunteers look for intellectual engagement, knowledge sharing, the use of the product itself, ideology, reputation and community obligations as factors in motivating participation (p. 89).

Intrinsic rewards such as "boosting one's own ego, enjoyment, and community identification" are noted by Wu, Gerlach and Young (2007) and Sowe, Stamelos and Angeles (2008) as motivational factors for participation. There are exceptions: some contributors to open source software are salaried and supplied by corporations or universities for such purposes as gaining "access and legitimacy" (Dahlander & Wallin, 2006, p. 1256) and having first-hand access to the code and its development. Participation in such endeavours can become a source of innovation for the participating institution (2006).

Within developer communities there exists a high degree of social identification and a willingness to share (Ke & Zhang, 2009). Most participants are unpaid, but they often name increased social capital and prestige, better career prospects and learning opportunities along with such factors as personal satisfaction, the freedom to choose their own roles and the ethos of sharing as reasons for participation. Further, many volunteers work on the very products they hope to benefit from and use (Scacchi et al., 2006).

Open source software projects typically operate in a decomposed or modular manner, where knowledge is contained in specific modules but not necessarily accessible to all programmers, thereby enabling developers to maintain a view of the overall project at high abstraction level. To ensure communication and cooperation toward a common goal, however, there must also be visible design rules that guide a high-level view while suppressing the detailed information in each individual module from overwhelming the programmer (Baldwin & Clark, 2000). Hossain and Zhu (2009) note Gestalt-like patterns within the workings of the groups, with interplays between individual

efforts recombining with the larger work of the whole and forming the larger picture. Within an open source software development project, programmers work together in interaction with the developing software and in response to the environment in an open system (Yu, 2008).

One of the elements of successful OSS projects is seen as an appropriate balance of experienced and new developers, with the idea that "FOSS ecology is open to all" (Krishna Raj & Srinivasa, 2012, p. 11). In following the process of induction of open source software development volunteers to developer communities, von Krogh, Spaeth and Lakhani (2003) find progress from initial lurking to contributing and then to specialization. Participants typically follow a "script" (p. 1229) or an implicitly expected process that begins with contributions based on prior knowledge and progressing to specialized code contributions.

Along with the characteristic of volunteerism, the organization of OSS development differs from traditional, hierarchically managed processes in a number of ways, including exhibiting a high degree of visibility of the development processes, where iterations and artifacts are available to all via the Internet, the lack of formal project management, and the developers also being end users of the products that they are developing (Sack et al., 2006). Community-developed projects typically exhibit principles that respect independence, pluralism, representation, decentralized decision-making and autonomous participation, although may feature the existence of a "formal leadership role, a representative body of decision-makers and a no-profit foundation to protect the community's interests" (O'Mahoney, 2007, p. 2).

While they typically meet face-to-face, volunteers exhibit strong group, social and cultural patterns with their social context, working within a decentralized, knowledge-intensive and interactive community (Hemetsberger & Reinhardt, 2006). The loosely knit groups that typically work on open source code are decentralized, yet the formality of the work group structure may vary somewhat from this generalization. Garzarelli and Fontanella pursue the question, "How can a number of individuals around the world who mostly rely on open standards and an ethos of code sharing lead to a stable production process?" (2011, p. 929). They posit a "counterintuitive" concept that focuses on division of labour in a "parallel and overlapping form" (p. 930) rather than based on specialization, and describe learning processes at the organizational level that guide the work of the various niches.

OSS projects can also be smaller in scale; but without a stable core of developers as well as users, smaller projects may well stagnate. In particular, the lack of good communication and documentation are detrimental to attracting and maintaining developers in smaller projects (Ezeala, Kim & Moore, 2008). As noted by O'Mahoney (2007), "when code and community do not develop in parallel, the learning curve can be steep, which can affect external developers' ability and motivation to contribute" (2007, p. 142).

There is in general a lack of detailed software documentation in OSS projects (Magdaleno, Werner & Araujo, 2012).

Xu, Jones and Shao (2009) identify the factors of informal leadership, interpersonal contact and shared community ideology as supporting the successes of open source software development. In their view a high degree of involvement is critical to the quantity and quality of contributions to the source code; and higher degrees of involvement by individuals lead to improved performance as coders. The volunteers decide for themselves which work to undertake on the software, and there is often no "explicit system-level design, or even detailed design" as well as no "project plan, schedule or list of deliverables" (Mockus, Fielding & Herbsleb, 2002, p. 309). However, cooperation in providing frequent peer review of code changes, when conducted early, frequently and at small stages or iterations, by other developers asynchronously, leads to an effective technique for peer review ensuring quality control (Rigby, German & Story, 2008).

O'Reilly (2005) cites a number of lessons learned from the processes of open source software design, including the need to support loose coupling of services, the use of syndication rather than coordination of services, and design for "hackability, and remixability" following a principle of "innovation in assembly" (p. 33), where value can be created by remixing components in new ways.

Reuse of code is quite common (Oberg, 2003). As described by von Hippel (2001), there are potential benefits of sharing in work of open software design: "Individual users in an innovation community do not have to develop everything they need on their own but can benefit from others' freely shared innovations" (p. 82). One study on reuse of code estimates that at the high end up to 30% of open source software development consists of reused code (Haefliger, von Krogh & Spaeth, 2008). Alternatively, programmers who like to solve problems tend to generate their own code rather than reuse existing code; however, larger personal networks increase the re-use of code among open

source software programmers (Sojer & Henkel, 2012). These results may vary based on the culture of the developer community, the tools they use and the way code development is managed.

Reuse of OSS code into other projects raises issues that are not unfamiliar in the OER community. For example, identifying quality products, lack of time to evaluate products, maintaining custom changes, need for modifications, incompatibility between components or existing systems, complex licensing situations, concerns about intellectual property and rights, and lack of clear business models are but a few identified challenges to reuse in a review of the literature (Stol & Babar, 2010, p. 19). Design patterns, as discussed earlier in the context of learning design, are also referenced in literature in OSS. Stevens (2000) defines a design pattern in software development as a "structured description of a good, well-understood solution to a common problem in context" (p. 160). The use of design patterns remains controversial (Stevens, 2000), owing mainly to a perception that they may be seen as distracting programmers from dealing with the specific the problems at hand (Atwood, 2007).

Maintenance of OSS over the longer term is an important consideration in the ongoing success of OSS. Tasks such as handling problems and issues, discussing problems and assigning them to coders, review and acceptance followed by testing and release, all need to be conducted in a manner that ensures the continuing smooth operation of the software (Koponen & Hotti, 2005). While there is variation between the quality of OSS projects in the ability to maintain quality over time, Stewart, Darcy and Daniel (2005) find "some empirical support for the notion that the OSS development process may lead to on-going quality improvements" (p. 4). Those in particular that maintain a high level of organization around files and labeling may facilitate the growth of the project "by influencing the level of difficulty that new developers or users may encounter when joining a project" (p 4).

Roots of OSS

As is the case with OSS, the more recent conceptual or philosophical roots of the OERu movement are traced to Richard Stallman's release of the GNU project in 1983, which was intended to develop free Unix-like software (Caswell et al. 2008; Krishna Raj & Srinivasa, 2012). The GNU Project was focused on developing a complete free operating system, which along with other software development became available under Stallman's "four freedoms":

1. To run the software for any purpose;

2. To study how the software works and adapt it;

3. To redistribute copies of the software; and

4. To improve the software, and release those improvements (Downes, 2007).

In 1998 the Open Source Initiative was established to oversee the Open Source Definition, which included consideration for free redistribution, available source and compiled code, derived works and a number of other requirements (Open Source Initiative, 2012). This early open source software development project came to be viewed by many as a social movement (Scacchi et al., 2006) with development undertaken by loosely organized communities of committed volunteer developers.

Reflecting on the nature of OSS development, Raymond (2000) describes the "bazaar" style of programming modeled by Linus Torvalds ("release early and often, delegate everything you can, be open to the point of promiscuity," p. 2), where the development community resemble more a "babbling bazaar of differing agendas and approaches … out of which a coherent and stable system could seemingly emerge only by a succession of miracles" (p. 2) than it does the "cathedral" containing a small group of expert programmers hived away from the world and working within a structure characterized by hierarchy and control.

Contributing factors to the growth of open source software have been the rapid growth of the Internet, web hosts such as SourceForge and GitHub that provide planning and download services, the generational shift in the software industry to software as a service (SaaS), increasingly cloud-based applications, and widespread acceptance among mainstream users (Xu, Jones & Shao, 2009). Many large scale open source software products have entered the mainstream of everyday software used at both enterprise and desktop levels in industries, governments and universities. Examples of such projects include Linux, Apache, Mozilla, Android, Perl and Sendmail (Sen, Subramaniam &Nelson, 2011; Wu, Gerlach & Young, 2007). Any hypothetical concerns about the ability to build and maintain high quality software in an open source model on principle are seen to be countered in practice by its many large scale and long term successes (Mockus, Fielding & Herbsleb, 2002).

Theoretical Aspects

Community and social networks appear to be key elements in the open source software movement. The social aspects of open source development communities invite perspectives derived from social and cultural constructivist views, with a developmental model based more in interested and engaged communities rather than in formal structures such as traditional organizational hierarchies (Hemetsberger & Reinhardt, 2006). Hendry (2008) notes the important role of community and its attendant "rich, evidently creative and reflective conversations," (p. 554), recalling Schön's (1983) notions of reflective practice. Theoretical approaches in this stream would identify the presence in open source software development of a "strong group culture with clear rules, norms and patterns of behavior *[that]* enhance commitment and foster high-quality teamwork" (Hendry, 2008, p. 188).

Investigations into the workings of communities rather than just individuals in a collaborative environment, and the creation of knowledge within community settings, are rooted in situated learning theories e.g., (Lave & Wenger, 1991; Wenger, 1999) in which members within communities embody and make visible tacit knowledge and also share explicit knowledge. Scacchi (2007) found what he termed "informalisms" in his study of 24 OSS projects. In formalisms were described as "informal narrative resources codified in lean descriptions that … often capture the detailed rationale, contextualized discourse, and debates for why changes were made in particular development activities, artefacts or source code files" (p. 73), very similar to descriptions of certain types of narrative mediating artefacts described by Conole (2008) and also found across the OERu wiki site.

As described by Brown and Duguid (1991), community participants become practitioners rather than just receive instruction on how to undertake practice: "In order to achieve a convergence of meaning, knowledge has to be acquired by doing and experiencing—becoming a reflective practitioner" (Hemetsberger & Reinhardt, 2006, p. 189). Owing to the nature and definition of tacit knowledge, i.e., that it is not able to be captured or transmitted in an explicit way, platforms used for community collaboration in the development of open source software are designed primarily such that "the activities of members can be displayed and lead to discourse" (p. 192).

Early explorations in the use of data visualization are opening up new ways of understanding collaboration through social networks in OSS development at a higher level, particularly now that there are many thousands

of coders working across such hosting services as Google Code, Source Forge and Gather (Heller et al., 2011). The resulting patterns that emerge from visualization of data patterns "enable rapid hypothesis formation and are accessible to a wide audience" (p. 226). The authors note that the strength of visual patterns is in pointing to areas for further study, not necessarily for drawing conclusions.

Crowston et al. (2004) developed a theoretical model (Figure 2.3) based on work team effectiveness as represented in studies on work team effectiveness in OSS. The key element in their approach is that most open source software "is developed by self-organizing distributed teams. Developers contribute from around the world, meet face-to-face infrequently if at all, and coordinate their activity primarily by means of computer-mediated communications…. These teams depend on processes that span traditional boundaries of place and ownership" (p. 18). Because of these challenges, a focus in OSS on such team dynamics as communication practices, mentoring, task coordination and other work team factors is needed in ongoing research in the improvement of team performance in highly distributed conditions.

Figure 2.3: Constructs studied in the reviewed FLOSS research papers and their relations
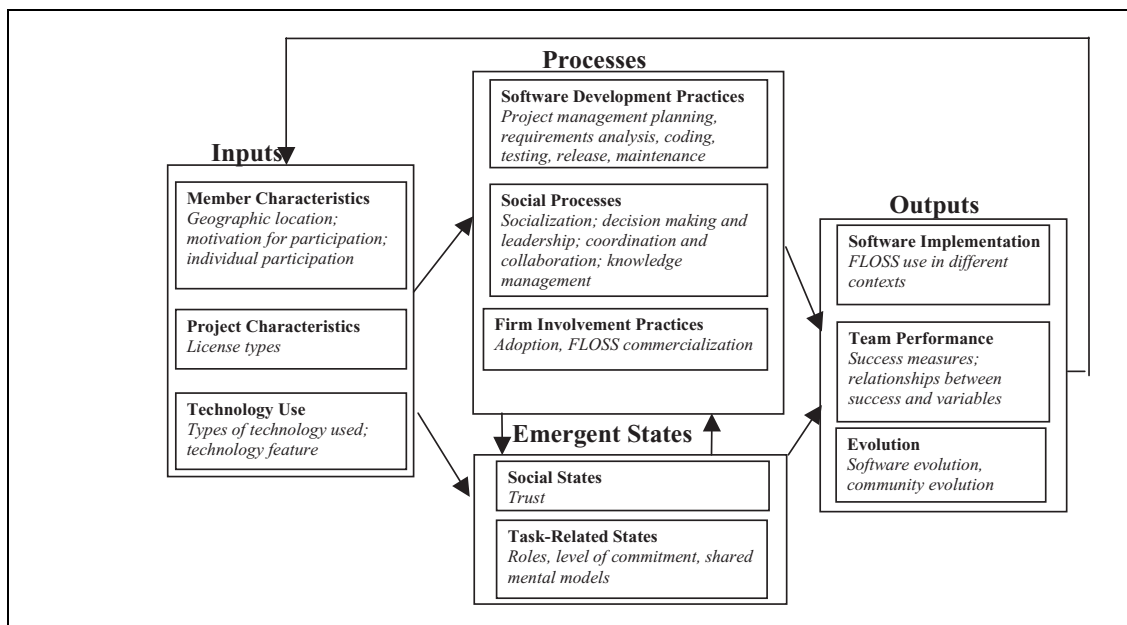
Source: Crowston et al., 2012. (c) 2012 Association for Computing Machinery, Inc. Used with permission.

Extending analysis and visualization processes beyond code development, Goeminne and Mens (2010) focus on a wider picture of how software

development progresses and improves over time. Thus they advocate all human interactions within the wider software "ecosystem" (p. 42) be included in visualization and analysis of OSS development. They define ecosystem as complementing "source code information with knowledge about the community (consisting of developers and users) that surrounds it" (p. 24) and have developed sophisticated tools to analyze and visualize these various layers of data.

In a similar vein, Poderi (2012) looks beyond project mailing lists with their threading and quoting capacities to discussion boards and spreadsheets used as project infrastructure for project planning and related conversations. Using Grounded Theory approaches, conversational practices tying together different aspects of the community are setting a positive atmosphere, positioning or providing context for comments, linking scattered resources, and constructing citizenship (pp. 45-46). Collaborative tools become "potential mediating infrastructure" (p. 4) for the challenges faced by developers.

Along similar lines, Björgvinsson and Thorbergsson (2007) present an overview of information tools and flows in OSS projects. Figure 2.4 displays three information spaces: archive, discussion and implementation spaces. The discussion space lists the communication tools and methods typically used in communication between people. The implementation space comprises the various techniques and tools that provide the basic mechanisms for ongoing development, and records of decisions and opinions, as well as information available to the public, are located in the archive space (p. 137). The arrows delineate the flow of the main types of communication that moves between the relevant spaces. Thus to facilitate success within the informal nature of OSS community roles and structures, certain features are also required for capturing and transmitting rich information about the project to others at different places and times.

Figure 2.4: Information flow in free and open source software projects
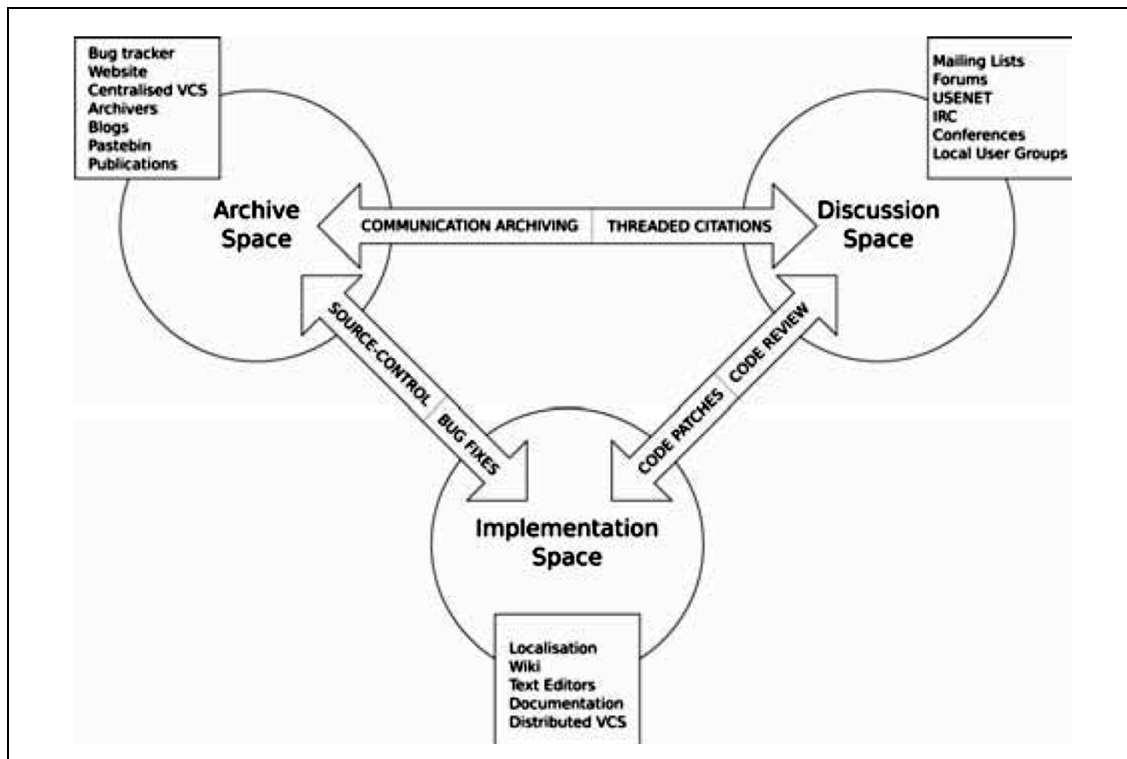
Source: Björgvinsson and Thorbergsson (2007). Used with permission.

SUMMARY AND CONCLUSIONS

The literature in OSS reveals many similarities to how open design and development has been conceptualized in the OERu. In Chapter 1, I identified aspects that were unique to the intended approach to open design and development, in comparison with traditional instructional design. These aspects have been found to be reflected in the literature on OSS. OSS is characterized by communities of volunteers, self-organized and distributed networks of developers with roles that may change or vary within projects. Many OSS projects are organized in a highly decentralized manner with autonomous participation, but some may have somewhat more formal leadership who manage general processes for gradual induction into the community, along with arranging for structured mentoring. Licensing of OSS is based on alternative open licensing, similarly to OERs in open design and development.

      Communications and conversations are critical to the success of OSS. While design processes are generally informal, we have learned that in OSS,

concisely formulated artifacts are critical to the success of projects, and well organized versioning and file naming conventions contribute greatly to the success of novice volunteers as well as software maintenance. Developers must be able to view general design rules at a high level of abstraction, as well as at the same time having access to a limited amount of detail at the project level at which the developer is working. In the same way, interactions need to occur both between participants, and among the group as a whole. A balance of novices and experienced developers is necessary for the ongoing sustainability of the project.

With this background, we now proceed to a description of the research methodology employed in this study.

Chapter 3
RESEARCH METHODOLOGY

INTRODUCTION

The methodology employed in this study is that of a comparative case study. To introduce the primary case study, I provided a description of the Open Educational Resource university (OERu), its context and background was provided in Chapter 1, and the process of open design and development was singled out as the component under study. To explore the origins and original intentions of open design and development as identified in the first research question, I undertook a synthetic literature review in Chapter 2 to focus on the broad history of OERs, and then more specifically on the methods to support sharing of educational content and, learning design knowledge, along with issues in collaborative design. For comparative purposes, these sections were followed with an overview of literature on open source software (OSS) development, providing a background to the comparator case.

I begin this section with an explanation of the naturalistic and quantitative research paradigm or tradition in which the research design is situated. This is followed by an overview of the case study and comparative case study research design and the research methods used within it. Then the framework and procedures used for data collection and the types of data collected are identified and described.

Because I conducted much of the research using the Internet for data gathering, I discuss Internet as a virtual locale for data collection, along with the question of research ethics in the virtual environments specific to the case under study. Finally, this chapter addresses strategies employed to enhance the trustworthiness (Guba, 1981) of the results.

THE NATURALISTIC QUALITATIVE RESEARCH PARADIGM

The primary case study is rooted in a naturalistic and qualitative research paradigm. Guba and Lincoln (1982) contrast paradigms of rationalistic against naturalistic inquiry with paradigms being defined as assumptions or foundational concepts on which research methods are based. In advocating for the value and legitimacy of naturalistic and qualitative research designs, they moderate the claims of rationalistic or interventionist inquiry, noting that "Finding a paradigm that can tolerate real world conditions surely makes more sense than manipulating those conditions to meet the arbitrary design requirements of that paradigm" (p. 234).

As described by Guba, "The naturalist does not attempt to form generalizations that will hold in all times and in all places, but to form working hypotheses that may be transferred from one context to another depending on the degree of 'fit' between the contexts" as opposed to rationalistic assumptions that render "chronological and situational variations irrelevant to the [research] findings" (1981, p. 81). The reason that naturalistic paradigms of inquiry are suited to study of many specific phenomena with a social and time-bounded context, as in the case under study, is that in social settings "generalizations of the rationalistic variety are intimately tied to the times and the contexts in which they are found" (1981, p. 81) and not necessarily applicable in all places and at all times. Thus caution needs to be exercised in making broad generalizations or sweeping recommendations based on naturalistic studies.

Qualitative inquiry in a naturalistic setting does not lead to the types of truth claims as those aspired to by research grounded in a positivist paradigm. Rather, researchers in qualitative paradigms must be prepared to accept a degree of uncertainty tempered by wisdom. In qualitative research, "the researcher is the primary instrument for data collection and analysis. Data are mediated through this human instrument, the researcher, rather than through some inanimate inventory, questionnaire, or computer" (Merriam, 1998, p. 7). Rather than conduct their investigations as detached scientists, researchers in qualitative paradigms acknowledge that they bring to their studies a stance, "the way that researchers position themselves in relation to their subjects, their participants and their own belief systems, and the way in which they locate themselves across the qualitative paradigm" (Savin-Badin & Major, 2010, p. 4).

Particularly in the global setting as well as in the virtual spaces of the OERu project, involving participating universities from five different con-tinents and from vastly different contexts and motives, the researcher must

remain sensitive to "notions of culture, voice and social space, and how they shape approaches to inquiry, and then onto virtual spaces as a medium for conducting research" (p. 5). Reflexivity includes personal awareness of the researcher as to personal stances initially assumed and as evolving in relation to the wider setting of the OERu project.

COMPARATIVE CASE STUDY RESEARCH DESIGN

The purpose of a research design is to link the research questions to the data collected and ultimately to the conclusions and recommendations of the study. It addresses the problems of "what questions to study, what data are relevant, what data to collect and how to analyze the results" (Philliber, Schwab & Samsloss, 1980, cited in Yin, 2009, p. 26). A case study was the type of inquiry chosen for the research purpose and questions of this study. Case studies have been prevalent in the field of education for many years, allowing an "intensive, holistic description and analysis of a single instance, phenomenon or social unit" (Merriam, 1988, p. 21).

The specific case has been selected because the OERu is a new international collaboration among multiple universities, and thus it merits description and further study. As a complex and potentially significant new phenomenon, the emergence of the OERu and its multi-faceted logic model (described in Chapter 1) are appropriate subjects for this case study for several reasons:

- the phenomenon under investigation can be established within a bounded system;

- an in-depth understanding is required of a specific individual, group, program, activity or other event; and,

- the object of study is bounded within a limited time frame (Creswell, 2007).

In relation to the requirement of a bounded environment (Merriam, 1998; O'Toole, 2012), the case itself is readily confined to a clearly delineated stage within the OERu project logic model, restricted to one course and its associated participants and processes, and set within a defined time period. More specifically, the case is limited to the initial open design and development of one complete course, *ART100: Art Appreciation and Techniques,* within the OERu.

To satisfy the requirement for an in-depth understanding of a specific individual, group, program, activity or other event (Creswell, 2007), the scope of the bounded system under study is focused on one prototype course, *ART100: Art Appreciation and Techniques.* The requirement for a time limit to the case under study is addressed by limiting the research to the time spanning the initial planning to the completion of the design and development of the prototype project over an 18 month time span.

RESEARCH METHODS

A comparative case study method for data collection and analysis of case studies is termed "cross-case" synthesis Yin (2009) or analysis (Khan & VanWynsberghe, 2008). Cross-case analysis is a technique for the study of multiple cases, where "… the findings are likely to be more robust than having only a single case" (Yin, 2009, p.156). The technique is applicable either where the multiple cases are part of the original research design, or where a previously conducted case study authored by another, independent author, is used as a comparator case. In this study, I utilize the option of a previously conducted case study. Multi-case methods, as used in this study, centre upon on a common, holistic focus comprising "case studies that have common and unique issues" (n.p.) and that are approached with common research questions, resulting in assertions that can be applied to the cases (Stake, 2006).

Among the potential benefits of employing a cross-case analysis is the ability to extend the knowledge gained in one setting to another, prompting new questions and alternatives; and the capacity to highlight relationships, contrasts and similarities and thereby seek explanations (Khan & VanWynsberghe, 2008). Two approaches to cross case analyses are possible. One is variable-oriented, a controlled comparison which focuses on one variable across multiple cases. The other is case-oriented, which may focus on comparing most different designs, typologies of particular phenomena, process tracing or multi-case methods.

Because the research design is based on a comparative case study, a search of the literature was undertaken to identify an appropriate case for comparison with the OERu case. The main criteria developed for selection of the comparator case were as follows:

- naturalistic case study research design
- focus on open source software development

- bounded within a scope similar to that of the OERu project
- in-depth study of a single case
- limited time frame
- relatively new project characterized by innovation
- well documented research methodology

While an extensive search did not produce a case study in OSS that could be characterized as an exact analog to the OERu project (nor was such a precise match expected), one case meeting the above seven criteria was located in the study of the development of Freenet, an open source "peer-to-peer platform for censorship-resistant communication" (Wikipedia, 2013). The case study, by von Krogh, Spaeth and Lakhani (2003), focuses on open source software development. It is bounded within an in-depth single case study of a new project, with a temporal scope confined to the first year of the project, a "critical phase in establishing sufficient momentum for the project by mobilizing newcomers" (p. 1219). In these ways the two cases are very similar. It is also helpful that this is one of the few candidate case studies that documented its research methodology in some detail.

Although the Freenet case study follows a naturalistic case study research design, its focus is more on volunteer developers and generation of theory, whereas the exploration of the OERu case is somewhat more broadly focused on processes and products rather than theory *per se.* While the OERu case study is not primarily focused on the development of theory, as discussed shortly a similar process of data collection and analysis was used and some theory naturally emerged based on the nature of themes elicited during data analysis (Soldaña, 2011). Also, theory developed in the Freenet case was highly practice-focused, and findings of the OERu case study similarly developed potentially transferable "working hypotheses" (Guba, 1981, p. 81).

The Freenet study commenced with an initial round of semi-structured telephone interviews with volunteers, in which questions focused broadly on such elements as the following:

- developer background information
- overall structure of the project
- reason for joining and working on the project
- specialization
- particular challenges in the project (2003, p. 1219)

These areas of questioning allow for the possibility for similar interviews in the OERu study to open up additional avenues for study to those (i.e., developer induction) that took prominence in the Freenet study. In this first round of interviews, "basic understanding was gained of such factors as the technical characteristics of the project, critical events, and philosophy" (p. 1219). Subsequent analysis of the interview transcripts led the researchers to home in on a central concern of the interviewees, which was "the joining and specialization of newcomers" (p. 1219). Following a similar process of initial interviews to obtain central concerns, the OERu questions incorporated both sets of questions in the interviews, with some modifications more relevant to the research questions of the OERu study. This process placed both studies on a similar methodological footing at the outset but allowed for potentially different outcomes.

In both cases considerable emphasis was placed on the nature of the volunteer community. When elements for comparison fell outside the scope of the Freenet study, these were referenced to findings in the review of literature on OSS characteristics to compensate for this variation between the two studies. Any concerns beyond these compensatory factors intended to reconcile differences between the two case studies were of necessity declared as limitations to the study.

DATA COLLECTION AND ACCESS

Data from the Freenet comparator case were collected from four main sources (von Krogh, Spaeth and Lakhani (2003), and similar types of sources were used in the OERu case. Where applicable and feasible, parallel processes for data collection were used between the two cases. Similarities and differences between the data courses and processes used in the two cases are discussed below.

1. Interviews with developers. These semi-structured interviews, conducted by telephone in the Freenet case, were recorded and transcribed, and elicited developer background information, overall structure of the project, reason for joining and working on the project, specialization, and particular challenges in the project.

Similarly, the OERu study began with in-depth, semi-structured interviews (Creswell, 2007) conducted via computer videoconference with key informants (Marshall, 1996; Yin, 2009). These were three participants involved

in open design and development in the OERu who were intimately acquainted with the *ART100: Art Appreciation and Techniques* project, and were involved more broadly with the OERu as well. They were purposively selected by means of their role in the project and OERu. The technique of interviewing key informants "is pre-eminently suited to the gathering of the kinds of qualitative and descriptive data that are difficult or time-consuming to unearth through structured data-gathering techniques such as questionnaire surveys" (Tremblay, 1957).

The questions were semi-structured to allow for "a systematic attempt on the part of the researcher to cover completely the topic under analysis," while also preventing a "technique of limitless plasticity" with the lack of any system (p. 689). The selection of the key informants was "strategic" (p. 689) and purposive (Creswell, 2007), as they, along with myself, were participants, albeit in different ways, in the course defined in the case under study. Further, some were also active more broadly within both the OERu project and the Wiki-Educator environment as a whole and thus able to speak more widely to the broader issues generated by the case and thus fit within the scope of the study.

2. Public email conversations and archives. The researchers in the Freenet project identified the email list and archives most used by developers, excluding duplicate and irrelevant messages. Within the OERu, email postings and lists were used for discussions specifically by anchor partners, and this content was included in the data collection and analysis.

3. History of software code changes. The Freenet project used a software versioning repository that maintained a hierarchical record of commitments to a code version and developer comments separately from coders' own personal files. Commitments to a code version were only made when authorized by a select group of project administrators.

Similarly, in the OERu study, all changes were made in the wiki and tracked on separate pages; thus the entire detailed history was available, albeit using a different technology from Freenet. The equivalent to commitments to a code version in the Freenet code was saved changes by OERu developers, which were made without further authorization by administrators, with the knowledge that pages could be reverted to any previous version at any time. In *ART100: Art Appreciation and Techniques,* all initial versions of content were placed in an initial staging area for cleanup before being further organized into the final production and delivery environment. Data collection in the OERu included both areas, which were equally visible to the public.

4. Publicly available sources. These areas included Freenet project web pages, a frequently asked questions (FAQ) section, a Masters thesis on which the project was initially based, media interviews, and a technical paper authored by developers. The main purpose of data collection in this area was to provide contextual understanding to the project.

Similar sources for providing contextual understanding for the OERu were project pages in WikiEducator, publicly available discussions in a public forum known as SCoPE, sponsored by BC Campus (SCoPE, 2012), a seminal published paper laying out the case for the OERu (Taylor, 2007), and a collation of media coverage of the project linked from the OERu wiki. All the data sources for the study were readily available, based on the fact that the entire project was developed in the WikiEducator wiki (WikiEducator, 2013) and archives of project emails were openly available in Google Groups. The OERu project made extensive use of the wiki, adopting an open approach to all proceedings and decisions, and any registered user no matter where had the ability to modify, add or delete content.

To elaborate on access to OERu project data, the OERu wiki pages were openly available for public use including research. Further, contributors to the wiki did so under a Creative Commons Attribution and Share Alike (CC-BY-SA) license. Owing to the structure of the wiki, all pages included tabs for "behind the scenes" discussions as well as the history of every page, which could be retrieved from any point in time when changes were made to the page; the user name of the individual who made the change was also included in the history. Along with many pages of detailed technical and contextual information about the OERu project, the following types of information were available in the wiki:

Record of all OERu full partner meetings, including agendas, participant lists, lists of virtual participants, live stream video recordings of proceedings and summaries of meetings.

- OERu communication technologies and protocols
- Brainstorm page for project planning
- OERu master plan
- Upcoming activities
- OERu project evaluation
- Summary of project activities

Also included in the planning section were subsections for each stage of the logic model that provided a larger context to the open design and development stage. Detailed explanations for each of these stages were provided in the wiki.

Apart from these extensive operational and archival resources, direct access to OERu partners was available by the various media noted above, as well as emails, Skype and other electronic communication media. I also had my own meeting notes for further verification.

In summary, there was a vast and living body of planning, operational and archived materials, and there were also open communication and participation opportunities with all participants in the OERu, providing a data source equivalent to that of the Freenet project.

DATA ANALYSIS

Data analysis in the Freenet comparator case study, as documented in von Krogh, Spaeth and Lakhani (2003) began with creation of categories of participants based on analysis of their roles in the project. It should be noted that this study reflects the Freenet project at the time of that study in the early 2000s, not in its current version.

In the Freenet study, this process was undertaken by analysis of communications in the development email list. The messages were coded based on the types of issues dealt with, in a sequence of first emails onwards until the developers were granted access to the code database. Then developer activity was analyzed by the frequency of their commitments to code versions, creating a reference model by clustering them against the code repository file structure and different tasks of the software. They further reviewed their work iteratively with developers and the project founder (p. 1221).

I took a somewhat similar approach in the OERu study to document numbers of initial participants, declared volunteers and those who engaged in actual design and development in the OERu. In order to integrate multiple forms of content, analysis of the email archive as well as wiki pages was combined. Initial descriptive codes (Soldaña, 2011) of emails and wiki pages and discussions were then grouped by issues, activities and processes relevant to the design and development stage of the OERu case. This process was undertaken in multiple iterations resulting in a qualitative, narrative portrait

(p. 72) using a number of themes (Auerbach & Silverstein, 2003). Throughout the process reference was frequently made back to primary codes and documents to crosscheck assumptions.

Internet-based Research and Ethics

Both the wiki and Google Groups tools are predominately asynchronous environments, with few integrated tools for real-time interaction. However, there were also multiple Skype or phone meetings for discussing and solving specific problems, and two major international face-to-face planning meetings supported by streaming video and accompanying chat and microblog-based interactivity — and online written notes and summaries were kept of these events. Most of day-to-day work of the project occurred asynchronously, leaving a rich record of both discussions and iterations of content, highly conducive to thick description and capturing of artefacts.

Because virtually all the OERu project was conducted online and participants were from locations around the world, most of the study was conducted online as well. Hine describes the Internet as "both cultural context and cultural artifact" (2005), which invite virtual ethnographic and/or interpretive descriptive methods of study, similar to the case study methodology. Owing to the online nature of most of the project as well as the research techniques, discussion of research ethics for the study included Internet-based research. Access to the case was non-problematic because the investigator was a participant in the OERu project as a representative of his home university. All aspects of the development process were open to the public as the wiki could be viewed by anyone with Internet access through a standard browser. Thus research ethics approval granted for this study included aspects of both Internet-based research and the conduct of the interviews as well as privacy and security of data.

Trustworthiness

When used in research, naturalistic and qualitative paradigms must maintain a standard of "trustworthiness" (Guba, 1981, p. 75). As considerations to maintain the trustworthiness of the research design, Guba identifies four aspects of naturalistic inquiry as credibility, transferability, dependability and confirm-

ability. These roughly correspond to measures of internal and external validity, generalizability, reliability and objectivity in more scientific research settings.

Following is a description of how Guba's four aspects are taken into consideration in maintaining the trustworthiness of the case study results, and how these are addressed in the research methods.

Steps to build *credibility* strengthen the plausibility of findings, which is enhanced by prolonged engagement with and close observation of the phenomenon under study (Guba, 1981). In the present study, this element was addressed by the fact that I was intensively involved with all aspects of the OERu project as the formally appointed representative of my home university to the project, both in its natural setting and over the full chronological period of its occurrence. Further, I participated as one of multiple developers directly engaged in the design and development of the ART100 course under study, as well as interacting with many others who are working on other courses in the OERu.

Factors such as peer debriefing and triangulation (Guba & Lincoln, 1982) occurred on an ongoing basis through communications and meetings during the open design and development phases of the project, as the environment is predicated on collaborative decision-making and reference to documented processes, policies and decisions. During data analysis, coding and categories were developed by constant cross-reference to the multiple data sources within the wiki as well as the larger pool of data gathered from communications in Google Groups and other records. Thus the data analysis was integrated and triangulated across these multiple streams of content and communication.

For specific components of the data gathering involving interviews with key informants and to confirm accuracy of descriptions, member checks with key informants (Marshall, 1996; Tremblay, 1957) were conducted to confirm the accuracy of information gained and its interpretation by sending transcripts of interviews for review to the interviewees, as well as selected sections of drafts to for verification.

The second aspect of trustworthiness, *transferability* (Guba, 1981), is supported by thick description (Geertz, 1973). The intent of thick description is that a detailed representation of the situational uniqueness of the case under study within a naturalistic paradigm enables comparison for fit with other, possibly similar settings. In the study, thick description was provided in both the context and the background of the case, and of the processes and products involved in the open design and development of the course under study. These

were rooted in my detailed reading and analysis of all the relevant project documents and artifacts throughout the course of the study, personal undertaking of the interviews, and by personal immersion in the project throughout the entire period of the study.

The rich information available through the wiki-based development environment and related communication processes supported a detailed recounting of the processes and decisions undertaken during the stage under study, and as described earlier I had full and unfettered access to the data.

Dependability is described as the aspect of "consistency" (Guba, 1981, p. 80), a concept that "embraces elements both of the stability implied by the rationalistic term 'reliable' and the trackability required by explainable changes in instrumentation" (p. 81). Using multiple (overlapping) methods and stepwise replication increases the dependability of results. In the study, overlapping methods of data collection and analysis included content analysis across multiple data elements throughout the wiki and over time, and related communications, buttressed by interviews with key informants involved in the design and development of the course under study. Any changes in instrumentation were trackable through the records kept of all stages of the data collection and analysis process as well as analytic memos.

The final element of trustworthiness, *confirmability,* is characterized by "data (and interpretational) confirmability" (Guba, 1981, p. 87) and is opposed to investigator objectivity in scientific/rationalistic research paradigms. Confirmability is enhanced through methods such as triangulation, maintaining a reflexive approach, and having an audit trail. Particularly suited to the present research project, an audit trail was achieved by maintaining a database of case study research notes and other relevant materials (Yin, 2009). Further, as noted earlier, where key informants were interviewed in the study, the interview transcripts were checked with them to ensure accuracy and correct interpretation. Finally, as described by Guba and Lincoln (1982), "reports of research typically include discussion only of the problem and the method; *[Reinharz, 1979]* suggests that it is equally important to discuss the inquirer and to document shifts and changes in his or her orientation" (1982, p. 87). Because of my intensive involvement in the project, reflective notes as well as analysis of my own communications over the period of the study helped to determine subjective orientations and changes during the research. This was done by reviewing work conducted, archived discussions and communications and personal shifts in views over time, as well expressing assumptions and biases

where possible such that the same data under study could remain open to alternative interpretations by others with different assumptions and biases. This was accomplished through writing reflective notes throughout the analysis of data and including their content in the analysis phase. The audit trail method in particular was well suited to the wiki environment.

Chapter 4
RESULTS

INTRODUCTION

The primary questions to be answered in this study are as follows:

1. How has open design and development been conceptualized and realized in the Open Educational Resource university (OERu)?

2. What are the currently visible features of open design and development as indicated by practices and products in the OERu prototype course projects:

   a. As compared with traditional instructional design and development; and,

   b. As compared with open source software development?

I responded in Chapter 1 to the first part of the first question by identifying through documentation and explanation how open design and development have been conceptualized in the OERu with a detailed overview of the project background, history, aims and logic models (Brouselle & Champagne, 2011; Cooksey, Gill & Kelly, 2001). In the literature review in Chapter 2 I brought forward common and divergent themes of OERs, learning objects and learning design initiatives as conceptually and historically related developments providing a context for the birth of the OERu and its approaches. In addition, in the literature review I looked at traditional instructional design including collaboration in design, as well as open source software development for the purposes of comparison with the open design and development processes in OERu. It thereby laid a foundation for the empirical data gathering and analysis in this study to address the remaining questions. Also I identified theoretical aspects in the literature review in order to further inform the results and discussion.

I collected data from OERu wiki web pages, wiki-based discussions and history pages; from project communications including emails and microblogs; and from transcripts of interviews with OERu developers. I then undertook a multi-stage coding process with the assistance of Atlas.ti, a qualitative data analysis QDA tool, with subsequent refinement leading to code categories, and out of this process two main themes emerged:

1. Designing for openness. Designing a course in a manner in keeping with the ethos and practices of openness in the OERu introduced new considerations to the design process, in distinction from traditional instructional design as described in Chapter 1. There were also aspects of traditional instructional design that were found to be potentially helpful in this new and emerging process and environment.

2. A community of volunteers. The nature of the development team, how it began, how members operated and how they communicated among themselves were found to be critical elements in the success of open design and development, and problematic if and where these elements were not intentionally addressed.

In this chapter, I explore these results and themes to inform the first research question as well as the second question: What are the currently visible features of open design and development as indicated by practices in the OERu prototype course (*ART100: Art Appreciation and Techniques*)? Table 4.1 provides an overview comparison of open design and development, traditional instructional design, open source software development and the Freenet case study. I compare and contrast these elements throughout the presentation of results in this chapter, and integrate insights developed in the review of literature in Chapter 2.

Table 4.1: Development project comparisons

Aspect	Open Design and Development	Traditional Instructional Design	Open Source Software	Freenet Case Study (as in 2002)
Contributors	Volunteers, motivated by open philosophy and personal /organizational benefit	Paid faculty or staff	Volunteers, motivated by open philosophy and personal benefit	Volunteers, motivated by open philosophy and personal benefit
Makeup of design team	Distributed	Centralized	Distributed	Distributed
Induction into the development team	No specific method	Employment orientation and training	Based on skill and level of involvement	Graduated based skill and level of involvement
Access to contribute	Member community open to public including students downstream	Private — but some possible input by students	Member community open to public — access to committing code versions varies	Member community open to public — controlled access to committing code versions
Roles of design team members	Loosely defined, overlapping, broad skills	Specialized, clearly defined	Varied, overlapping, specialized skills	Specialized skills
Organizational structure	Flat, collaborative, representational, some meritocratic	Hierarchical or faculty based	Meritocratic	Meritocratic
Communication	F-F and virtual meetings, mailing lists, wiki pages, microblogs	Mostly business communication tools (email, meetings)	Mailing lists, forums, USENET, IRC, conferences, local user groups	Mainly email lists, also concurrent versions system (CVS)
Intended uses	As originally intended or repurposed for multiple uses and settings	Defined purpose determined in learner, job, institutional or market analysis	As is or modified for other needs, for open public and personal or employer use	For specific intended purpose by project administrators and community
Content copyright	Open licensing (CC) with some rights reserved	Mostly rights reserved	Free cultural works licensing, mostly GPL	Free cultural works licensing, mostly GPL
Content versions	Multiple possible via forks	Official version	Multiple possible via forks	Multiple possible via forks
Design processes	Informal design processes	More formal design processes and documentation	Informal design processes	Informal design processes
Authoring environment	Open source social software	Proprietary	Open source CVS management tools	Open source CVS management tools
Delivery environment	Wiki, LMS, other options	Dedicated proprietary application	Varies	Peer-to-peer networks
Pedagogy	Varied, depending on individual development teams and their preferences	Generally in line with overarching institutional model	N/A	N/A
Structure	Modular	Generally more linear	Modular	Modular
Maintenance	Ongoing, community based	Episodic, managed	Ongoing, community based	Ongoing, community based

Designing for Openness

In this section I describe the theme of "designing for openness" within the context of the design and development processes and products identified in the collection and analysis of data from the OERu case study. I also compare aspects of this theme with traditional instructional design and open source software (OSS) development, along with reference to relevant literature in Chapter 3. I have structured this section according to the development steps outlined in the planning pages of the OERu wiki:

- Open Curriculum
- Initial Prototypes
- Design Blueprints (Plans)
- Course Outlines for Materials
- Review Existing OERs for Remix
- Develop Representative Sample of Materials
- Complete Development of Course Materials
- Review and Refine Draft Materials
- Peer Review and Quality Control

The processes of open design and development bore both similarities and differences with traditional instructional design. The similarities appeared mainly in the fact that a high level of advance planning is the most prominent feature in traditional instructional design, while at the same time studies into how developers actually work reveals a much less linear approach than that represented in typical design models such as the formal ADDIE (Gustafson, 2002) model. The same types of nonlinear patterns appeared in the actual work of OERu developers as reflected both in the visible processes and their own reports in interviews. The main differences were that in traditional instructional design the developers generally work with many more known factors, whereas in open design and development many aspects were much more open-ended. Because the OERu concept was founded on a plan to develop OER-based courses that could be shared and credited by partners, advance planning was necessary to ensure that course elements would meet the requirements of receiving institutions. Course plans, learning outcomes, content outlines, learning activities and assessments were designed as part of

the process. But the many unknown factors concerning such questions as who the students would be, what skills they would already possess, and what tools were available for their use, for instance, presented tremendous design challenges for developers, and this is where cyclical problem solving in iterations appeared to be a visible and necessary feature.

ART100: Art Appreciation and Techniques took approximately 18 months to design and develop as a prototype course. The process was preceded by an agreement among OERu partner institutions to develop a total of eight courses initially, with a particular focus on three. The courses were intended to be made available as part of one or more open degree programs that would become available over time through the OERu partnership. Learners could study OERu courses and then apply to partner universities for formal assessment and credit, along with other services if desired. All courses were to be based on OERs, with content developed in WikiEducator, the OERu's wiki environment, and with the use of free cultural works licensing, mostly CC-BY-SA.

A section for planning was made available in WikiEducator, with the following subsections:

- Open curriculum
- Open design and development
- Open pedagogy
- Open student support
- Open credential services
- Open community service
- Open business models

These subsections were described in Chapter 1 of this study as aspects of the overall OERu logic model, and this specific planning page was the entry point to implementation of these areas. The main area relevant to this study is "open design and development," but some reference is also made to other stages as necessary in this discussion. Since the process for selecting courses for development preceded the development of *ART100: Art Appreciation and Techniques,* the Open Curriculum process will be discussed first.

Open Curriculum

ART100: Art Appreciation and Techniques was selected as part of a larger process, undertaken in the open curriculum area of the wiki. The "Open Curriculum" area was used to track discussions, selection criteria and voting processes around identification of courses to be developed in the initial round of courses in the OERu, in a three-phase process consisting of nominating courses, ranking candidate nominations, and finalizing the selections. The courses were termed "prototypes" in the OERu and development was then initiated.

Within traditional instructional design as described in Chapter 1 decisions on identification of courses and their sequencing in programs and degrees take place within a structured process under a system of academic governance. In comparison, within the OERu the process was undertaken publicly and by "rough votes." Decision factors included the availability and ease of conversion of existing OERs, the potential for the prototype to lead to credit bearing courses at the developer's own institution, and specific needs for the OERu partnership such as a course focused on digital literacy skills.

The initial step in the open design and development process was a collaboration among OERu partners, along with input from the interested community who joined an open discussion using the BCcampus SCoPE Moodle site (BCcampus, 2013), to design a program of courses to be built in the OERu that could potentially lead to credit and degrees given by participating OERu members.

This initial step brought to the foreground a key issue in the process for planning the OERu. In the context of the rise of MOOCs (Rodriguez, 2012) over recent years the prospect of potentially receiving university credit at the end of OERu courses bound developers first of all to developing courses more typical of standard post-secondary courses as compared with more open-ended "connectivist" or cMOOC (Rodriguez, 2012) learning environments. Developers were bound to ensure the courses would be acceptable to receiving institutions for credit, with minor adjustments to meet the varying needs of different institutions. This topic generated some early discussion; in an email post an author wrote,

> *[The choice of the term*] MOOC or not depends on whether it is a course or not; i.e., an open learning resource or open educational resource. It appears to be something in between where it can be used either way but then it needs to be explicitly stated as to how people may use it. *[It is not]* that use needs to be confined to these uses, but at some point it's

a job of educators to create it and to some extent at least define what it is and from the educator perspective, how it is intended to be used. At the same time there's the old notion — if you love it set it free, and let it go where it may. We need to find some peace with that. The course issue is defined largely by a traditional view of *[the]* course as episodic and following some predefined and intentional structure.

The decision clearly at this stage among the partners was to focus on typically structured credit courses given the foundational concept of meeting expectations of partner universities. The upshot was that open design and development would take into account the amount of credit that may be given for the course, as well as how institutions assess courses particularly from non-traditional settings with such tools as transfer credit, recognition of prior learning, challenge exams and other such methods.

If an option was to be presented to students who complete the course to apply for credit to an OERu partner university, or for that matter to another institution, the amount of work given in the course, including content (whether supplied by the course or generated by the student), activities and evidence of learning (e-portfolios, projects, other products) had to be reasonably commensurate with the likely expectations of a variety of institutions. If learners who completed courses were to be assessed through recognition of prior learning, the outcomes achieved — and how they are demonstrated — would be emphasized, whereas turning the student's work into credit in more traditional processes might require evidence related to notional learning hours and testing. Thus at the earliest stage, it was necessary to adopt a largely traditional approach to design, which was to engage in significant advance planning to ensure outcomes acceptable by partner institutions. As will be seen in the next section, these issues all had implications for the open design and development of courses in OERu. However, a difference could be found in the open and transparent collaboration that led to the choices of courses for development, and in the types of programs that would be offered through the OERu.

Initial Prototypes

I begin this section with an overview of the processes, both as they were initially established though collaboration among the partnership, and also how they actually were performed over the development period.

After the initial courses were identified, the next step was for developers to engage in open design and development for the initial prototype courses.

Participating institutions donated the time of developers to work on their own contributed course. While there was no restriction on joining by others, there was also no formal process to invite them.

The open design and development section in the planning page was linked to four subsections in the wiki:

- OERu 2012/2013 prototype development node
- Developing an OERu course style guide
- Review of representative sample of materials
- Design of survey for new OERu learners

These elements were open to the wider volunteer community for input as invitations went out to gain input toward a "rough consensus."

An "initial prototypes" node page was also set up in the wiki to maintain a list of completed activities, with "prototypes" referring to the initial courses selected for development. This node was a key subsection in the open design and development practices and products that are the topic of this study. The prototype development linked to each course under development, and for each course listed seven main milestones:

- Design blueprints (plans)
- Complete outline for materials
- Review existing OERs for remix
- Develop representative sample of materials
- Complete development of course materials
- Review and refine draft materials
- Peer review and quality control

This list described the overall plan that the developers, by consensus, were to follow in producing their courses in WikiEducator. Following is an overview of how each of these seven milestones was achieved in the open design and development process.

Design Blueprints (Plans)

The course plan design section of the development project began with a key point: "The wiki design and development model does not require a detailed and lengthy design plan because the process is iterative and the design

becomes transparent as the development progresses." It further described the purpose of the design plan as providing only a high-level overview for collaborators, as "the detail emerges in the relevant subpages of the project plan and draft materials" (WikiEducator, 2013). This approach therefore remained consistent with the iterative nature of instructional design as described by Rowland (1992), particularly as conducted by experienced instructional designers.

As the initial design stage of the process, or what could be seen as the "analysis" component within the ADDIE process (Gustafson, 2002) the plan defined the intended audience as anyone who might be interested, and thus of necessity assumed little or no experience in the visual arts. It did, however, place some expectations on learners:

Learners should be able to:

1. Engage and take responsibility as active learners
2. Think critically
3. Communicate effectively
4. Participate in diverse environments
5. Utilize information literacy skills
6. Demonstrate computer and technology proficiency (WikiEducator, 2013).

There was at this time no overt method to assess the entry requirements, although these were slated for development at a later date. In the design process, developers provided a variety of learning activities, allowing for both individual and optional peer based activities where available, with the intent that learners could approach the course either through individual study, or with a group if such were available. They also identified possible formative and summative methods to assess learning in the course.

As the course evolved during its development, its deviations from the blueprint were not recorded back to the design plan, making this section more of an initial conceptual sketch for the course than a hard and fast plan, in some ways consistent with the original OERu intent that the design plan need not be highly detailed. In contrast, within a traditional instructional design process significant changes are re-evaluated and approved in a formal process (Gustafson, 2002).

The learning outcomes expressed in the design plan were the same as those in the OER course (Saylor, 2011) that was repurposed into the OERu course (Table 4.2):

Table 4.2: Art Appreciation and Techniques OER learning outcomes

1. Interpret examples of visual art using a five step critical process: description, analysis, context, meaning and judgment.
2. Identify and describe the elements and principles of art.
3. Utilize analytical skills to connect formal attributes of art with their meaning and expression.
4. Explain in writing the role and effect of the visual arts in societies, history, and other world cultures.
5. Articulate in writing the themes and issues that artists examine in their work.
6. Identify the processes and materials involved in art production.
7. Utilize information to locate, evaluate, effectively use and communicate information about visual art in its various forms.
8. Communicate effectively with others to understand and appreciate the variety of responses art provokes.
9. Participate in diverse learning environments including collaborative group projects and online forums to analyze and evaluate different artistic issues and perspectives.

It could be seen particularly in learning outcomes 8 and 9 that the course was oriented toward an expectation that learners would need to communicate with others. During the detailed development of the course it was then necessary to suggest ways that learners undertaking independent study could meet these requirements in a more flexible and self-directed model — e.g., finding others online or in their own community to provide assistance.

As part of the intention that collaboration with the wider OERu community should take place, a discussion page in the wiki provided feedback on the design plan, often specifically directed toward the requirements for graded discussion posts, worksheets, quizzes, self-checks and availability of extra credit points for additional activities. The suggestions noted in particular considerations as to how such activities and assessments could accommodate larger numbers of students. For example, one comment expressed concern about "using a single discussion forum vehicle — imagine a discussion with + 1000 students" … with the suggested solution of aggregating links and posts. Another option would be that students could vote on ten best posts and responses for further discussion facilitated by a peer or volunteer instructor.

In a broader discussion, developers debated whether formative quizzes should be graded automatically for feedback or merely supplied with sample responses, and the need for some sort of e-portfolio tool for the recording and

aggregation of student work became evident. As noted above, the challenge of building collaborative assignments in the open OERu environment was seen to be substantial, given the recognition that learners who wished to work in groups need to have the tools available to do so, while those who are working on their own should not be disadvantaged. Following these comments, revisions to the design plan stated the need to "minimize confusion as the independent learner is assumed" while at the same time the learners would be encouraged to collaborate with peers where possible.

An implication of this approach was the possibility that learners could create their own team-based learning community. This could potentially be supported by volunteer instructors who would moderate small groups established either locally or more globally. Alternatively the volunteer instructors could potentially moderate larger groups in a less individualized way with a focus on broad topics and problems in their interactions with larger clusters of learners. A response offered suggestions for an integrated micro-blog, "WE Notes" which is an Internet Relay Chat (IRC) channel available in WikiEducator and for forum posts, which would be optional. An aggregated newsletter was set up to "harvest various peer support leads and could be posted, for instance weekly or more regularly limiting email traffic to participants' inboxes."

In traditional instructional design, the design planning stage is under-taken with a clear sense and plan (Richey, Klein & Tracey, 2011) and the nature of the learners as either working independently from others, or structured into groups for specific purposes. In *ART100: Art Appreciation and Techniques* these elements were not able to be established early in the process, and these were questions that continued to emerge in the design and development processes. Also in comparison with open design and development planning, OSS design is focused toward a specific outcome and developers must comply with many technical requirements to have a successful product at the end. Such issues are often carefully coordinated by a small group of developers or an administrative core (O'Mahoney, 2007).

Discussions about design planning were often prompted through emails. Because many in the broader OERu email group were not directly working on courses in WikiEducator but still were intended to be drawn into collaborative decision-making, they were invited to review them and provide feedback. Requests such as the following were sent out:

1. All suggestions for improvement on the draft blueprints [*design plans]* are welcome (see details below on how to provide feedback).

2. High-level assessment on whether your institution is likely to be able to provide assessment and credentialing services for the proposed assessment strategy for the respective OERu prototype course *[is requested]* (see details below) (WikiEducator, 2013).

The "details" referenced above concerned the request to use the wiki discussion/talk pages, along with a list of links to the appropriate wiki pages of design plans for prototype courses under development." Also, the reference to institutional assessment and credentialing was intended to determine which institutions would accept the course for credit if students who had completed all the assignments would approach them for an assessment such as a challenge exam or other form of prior learning assessment and recognition (PLAR). Some responses to these questions would be handled by a reply that would go out to the email list, even though recipients were requested to enter their replies on discussion pages in WikiEducator.

After review and comments by the OERu community in the discussion pages and emails, the next step in the process was to develop course outlines.

Complete Outlines for Materials

The development of course outlines was an extension of the design planning process, much as in traditional instructional design. The process was based on division of the content into manageable clusters or sections under headings, with the purpose of maintaining consistency of terminology across the courses in the OERu. Again the outline stage was developed through "rough consensus" principles:

- OERu courses will be subdivided into Units

- Where possible, courses should not include more than three hierarchical levels

- The preferred nomenclature is Course —> Unit —> (Free choice for naming of this level, e.g. section, lesson, study unit, etc.)

- Developers will have flexibility regarding preferred naming conventions for additional sub-levels, for example, sub-section, but should be used consistently within the specific course. (WikiEducator, 2013)

Again this process was not unusual in comparison with traditional instructional design, where part of the initial design planning process is to lay out a plan for the breakdown of content.

Review Existing OERs for Remix

The next step was to review OERs for their potential for remixing into the designed course. *ART100: Art Appreciation and Techniques* was based mainly on reuse and adaptation of three sets of OERs. The first set provided core content, and for the most part already existed in the Saylor Foundation open course website (Saylor.com), along with original course documents in Word and PDF formats that were made available to the developers by request and ready for use in WikiEducator. Because the original course had been built to a set timetable, had a complex marking regime that wouldn't work in the OERu context, and was built with activities expected to take place in an LMS, much work was needed to address these elements.

The second OER was more peripheral to the course, consisting of an extensive annotated list of links to art resources available on the Internet for further study and research by students. This annotated list of art resources was also repurposed such that students would be encouraged to suggest their own resources overtime as part of their coursework, in order to address what the developers perceived as undue weight placed on American artists and resources.

The third set of OERs consisted in locating art resources—mainly photographs of art — that were free cultural works licensed. This set needed to be developed because some in the original course had been provided with all rights reserved; and in developing and contributing some original OERs under a CC-BY-SA license where acceptable alternatives could not be found.

The challenges perceived in the uses of OERs as described in the literature review included concerns about maintaining sensitivity to imposing curriculum from one culture on other cultures, and the need to recontextualize content for specific settings (Johnstone, 2005). Developers gave consideration to the first concern in *ART100: Art Appreciation and Techniques* by inviting learners and anyone else redeveloping the course to add content from other cultures to the course. In this way the developers considered such improvements as better undertaken over time by other individuals or groups who would contribute to the ongoing improvement of the course and bring their local knowledge to

revisions. Another issue was the question of recontextualization and the "reusability paradox" (Wiley, 2004), i.e., the inverse relation of reusability and educational utility. A developer described a preferred approach to dealing with this issue in OERu courses by having students apply their own context to the OER. For example, in a learning situation where…

> … learners need to learn how to develop and use a Gantt chart, let's say, or *[whatever else]* they need to know, or how are they going to know what a Gantt chart is and what it's used for and what are the things they need to do to develop that knowledge, understanding, and skill to construct one — I will focus on designing the activities and then finding resources to show them examples, step by step process of how to develop a Gantt chart — it already exists out there — and put that in context for them rather than me developing it myself.

In this example, students are also engaged in locating learning resources that are relevant to their own learning needs and context, rather than having these pre-established in a more general or universal way for all learners. This approach was frequently used in the course, in activities where students were sent off to find their examples of artwork and apply it to their own settings and interests. For example, in a learning activity on the relation between art and identity, learners were given art from two cultures to compare, and were also asked to provide a third from their own culture:

> **Themes in World Cultures**
>
> The theme of "mother and child" is common to most world cultures, but the form and content within the theme changes. View the two examples from this theme:
>
> - Mother and Child sculpture from the Bamana culture of Africa
> - Mary Cassatt's Maternal Caress from western European culture
>
> Compare and contrast them in terms of their forms and the content they reflect.
>
> Read the descriptions about each of the works to help you determine any difference, but use your own words to describe the works. Be specific in your answers. Your descriptions should include:
>
> - Subject matter: What does the work represent?
> - Formal qualities of each work and their visual effects on the viewer

- Areas of focus: What's included and what isn't?

- Issues of content: What meaning do you get out of each work? Is it different for both or the same? Why? Why not?

- In what context is each work seen? Does that make a difference in the content?

Find a third image from this theme on your own and include it in your discussion. Make sure your choice represents a different culture than the first two (African and western European). Be sure to include a link to your choice and use proper citation for any source material you refer to (WikiEducator, 2013).

In other cases, content was edited or replace with more relevant material suited toward a variety of cultures and contexts. For example, in chapters where many of the artists and art resources noted were American, developers found resources from other countries that supported the same learning objective. In order to ensure reusability from a technical perspective, a WikiEducator page elaborated with suggestions that courses be "developed and stored in editable formats using open standards and open file formats," and separating context-specific activities from content where possible to assist in reducing the "cost of recontextualization in terms of the time required to re-purpose an OER" (WikiEducator, 2013).

In terms of sustainability, a challenge to the longevity of external OERs used in the course was recognized by a developer:

The challenge … is that what is there today may not be there tomorrow. And if you want that reliability *[over time],* and making sure that these learning resources will be there for the learners to access today, tomorrow, next year, and they're pretty fundamental … then it's worth investing and developing that free content. But for me for dynamic fields, I can't see the reason why you would want to do that because the content today will be outdated in a few months. So *[you]* still need to develop some content but that too will become outdated.

Again a partial solution was to open the course to the community to maintain, update and share again, which anyone would be free to do. The comment concerning the need to "keep history" refers to the problem that when developers created temporary pages for initial formatting and high level organization of OERs, and the subsequent of this content to final pages in the course would leave a wiki version history in two different places. This was not

seen as a desirable practice in a setting where versions and change histories are considered important, particularly given that they were fundamental in the representing the collaborative construction of knowledge in the wiki environment.

This two-stage process did not follow the originally planned process of prototype development, but at the same time it appeared to be necessary to gain a sense of the flow of the content and its appropriate breakdown and lay out.

Figure 4.1: Components of the early OERu project plan

Step	Task/Deliverable		OER F. Director: Wayne Mackintosh	Steering Committee Members				Founder Member Liaison Representatives				other affiliates (OERlist)	DEADLINE
				Kevin Bell	Rory McGreal	Angela Murphy	Irwin Devreis	BC / Empire	Nelson / NorthTec	Open / Otago	UnivSA / UnivWoll		
1	Attendance in Dunedin	COMPLETE	A	R	R	R	R	R	R	R	R	R	4-11 Nov.
2	Confirm Steering Committee	COMPLETE	C	A	R	R	R	—	—	—	—	—	30 Nov
3	Confirm Institutional Contacts	COMPLETE	C	A	—	—	—	C	C	C	C	C	7 Dec
4	Brainstorm page - initial to-do list	COMPLETE	A	R	R	R	R	R	R	R	R	C	14 Dec
5	Work Breakdown Structure finalized	COMPLETE	C	A/R	C	C	C	C/I	C/I	C/I	C/I	—	5-16 Dec.
6	AWI Planning Meeting	COMPLETE	A	—	—	—	—	C	R (Yasi)	C	C	—	9Dec.
7	Ranking criteria finalized for courses (link)	COMPLETE	A	C	R	R	R	C	C	C	C	C	9 Dec.
8	Initial nominations for 2012 prototypes	COMPLETE	A	R	R	R	R	R	R	R	R	C	31Dec.
9	OERu assessment and credentialization practice survey		A	R	R	R	R	A	R	R	R	C	6 Jan
10	Fortnightly Friday - check in meeting	COMPLETE	C	A	R	R	R	C	C	C	C	C	23-27 Jan
11	Open Content Licensing for Educators course (participate)	COMPLETE	A	R	R	R	R	R	R	R	R	C	27 Jan.
12	Fortnightly Friday - check in meeting	COMPLETE	C	A	R	R	R	C	C	C	C	C	6 Feb
13	Consensus decision on which courses to move forward on		A/R	C	C	C	C	C	C	C	C	—	10 Feb.
14	Fortnightly Friday - check in meeting	COMPLETE	C	A	R	R	R	C	C	C	C	C	17 Feb
15	Wiki course	UNDERWAY	R	A	C	C	C	I/C	I/C	I/C	I/C	—	29 Feb
16	Map members' versions of Bachelors General Studies -- Straw Dog OER GS degree		A	R	R	R	R	C	C	C	C	—	29 Feb
17	Design blueprints (high level overview) - to a Portal Page		A	R	R	R	R	R	R	R	R	—	2 Mar.
18	Fortnightly Friday / Thurs pm - check in meeting		C	A	R	R	R	C	C	C	C	C	2 Mar
19	Admin / Policy Review - credit transfer / other issues at founder institutions		R	A	C	C	C	C	C	C	C	—	14 Mar
20	Review feedback on Straw Dog for General Studies degree - final decision		A	R	C	C	C	—	—	—	—	—	16 Mar.
21	Fortnightly Friday / Thurs pm - check in meeting		C	A	R	R	R	C	C	C	C	C	16 Mar
22	Course Review - policies - HOW WILL WE DO THIS?		A	R	R	R	R	C	C	C	C	—	28 Mar
23	Representative sample (of the course they are contributing) shared by each partner		A	R	R	R	R	R	R	R	R	—	30 Mar.
24	Fortnightly Friday / Thurs pm - check in meeting		C	A	R	R	R	C	C	C	C	C	30 Mar
25	Plagiarism discussion / policies shared and aligned (if necc.)		A	R	R	R	R	C	C	C	C	C	13 April
26	Fortnightly Friday / Thurs pm - check in meeting		C	A	R	R	R	C	C	C	C	C	tbd
27	Research data collected		C	C	C	A/R	R	C	C	C	C	C	tbd
28	Evaluation process		A	C	C	A/R	C	C	C	C	C	C	tbd

Source: WikiEducator, 2013
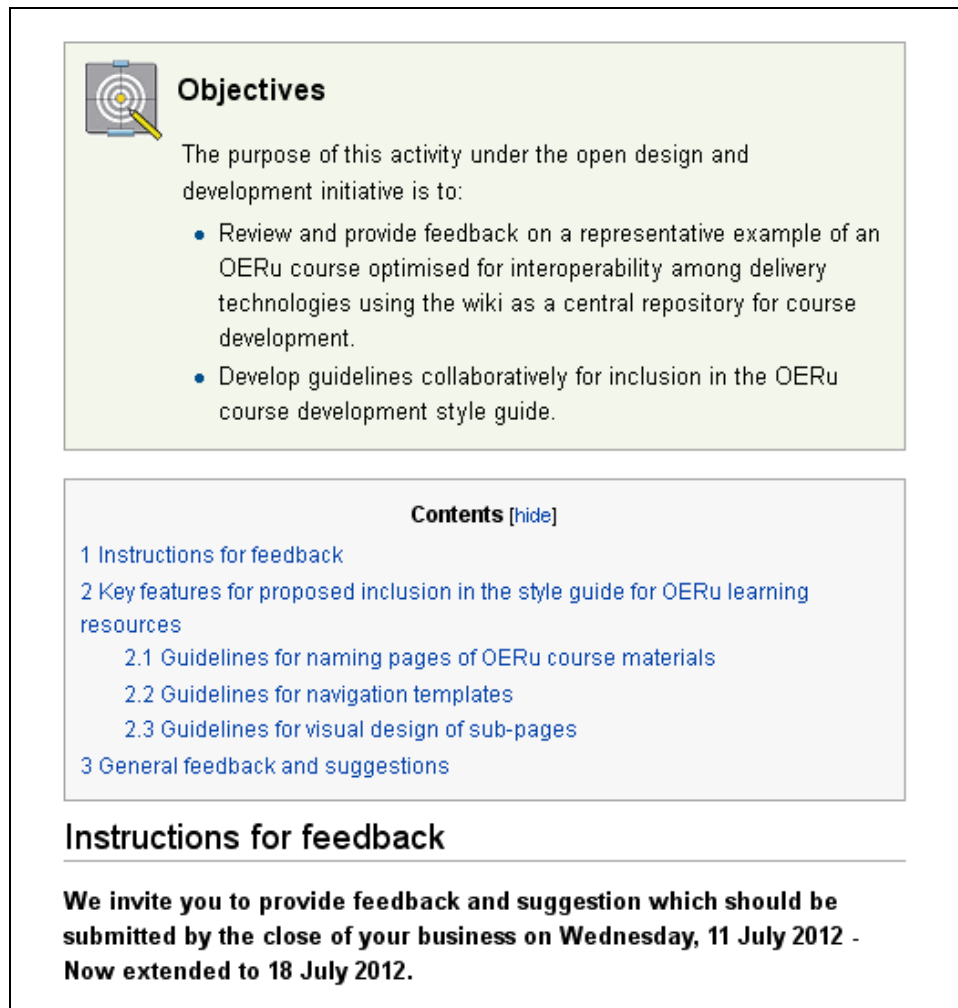
Develop Representative Sample of Materials

The fourth intended step in the prototype development process was to develop a representative sample of materials equal to approximately five study hours. The purpose was to establish a template for the rest of the course, and to invite other feedback from other community members at an early stage.

> The purpose of this activity under the open design and development initiative is to:
>
> - Review and provide feedback on a representative example of an OERu course optimised for interoperability among delivery technologies using the wiki as a central repository for course development.

Develop guidelines collaboratively for inclusion in the OERu course development style guide (WikiEducator, 2013). A call to provide feedback on course prototypes was sent to the community by email, directing them to content pages to provide content-specific comments in the discussion pages at the relevant sections, and more general comments on a general feedback page. In other words, feedback was requested both for specific pages in a prototype course, and for inclusion in a general style guide to be used as a resource by all OERu developers (Figure 4.2). Further, because the course content was also being transcluded or directly imported into a Moodle-based course, that version was to be checked as well.

Figure 4.2: Page for course prototypes feedback
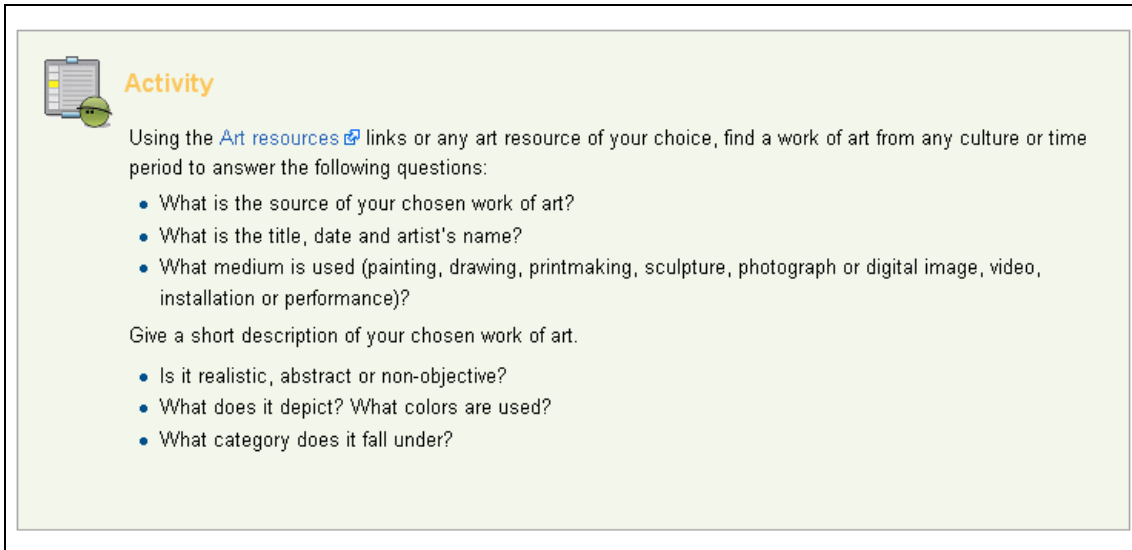
Source: WikiEducator, 2013. Licensed under a CC-BY-SA 3.0 Unported License.

In this process, comments added to the central feedback page would be available in one location for all community members to see, while those left on individual course pages would likely only be viewed by the volunteers working on the relevant course in OERu. In addition, some users could leave comments in the Moodle wiki rather than in WikiEducator, containing the feedback in a closed rather than open environment, a practice that was not encouraged as it was seen as antithetical to maintaining an open and transparent process.

Pedagogical templates were pre-formatted text boxes marked with an icon that can be transcluded or directly imported from one page into a new one and reused in different settings. An example of a pedagogical template is shown in Figure 4.3. As can be seen, pedagogical templates were provided

mainly for graphic design purposes and did not contain or suggest actual pedagogical strategies in the manner of learning designs.

Figure 4.3: Pedagogical template

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During the development of *ART100: Art Appreciation and Techniques*, pedagogical concerns or instructional approaches could not be abstracted from the practicalities of the overall OERu and the wiki environment. For example, at the November, 2011 meeting of OERu anchor partners in Dunedin, NZ, it had been agreed that pedagogies for OERu courses would not be prescribed. In the words of one representative, "Leave each OERu partner to decide on their own pedagogy." A remote virtual participant of the meeting echoed the sentiment in a message: "I tend to agree … on #oeru pedagogy — seeking to endorse a single model may sidetrack planning and implementation of the OERu." The reason for this consensus was quite straightforward: it was openly recognized that a consensus would never be achieved among the partner institutions. Moreover, the autonomy of each partner institution of the OERu was enshrined early on as a fundamental element of the partnership: "The project management planning group endorsed the principles of institutional autonomy and context specific applications, taking into account the value of open governance and open project management approaches" (WikiEducator, 2013). As outlined in Chapter 1, this principle was adopted to affirm that the partner institutions were the key decision components of the OERu. As accredited universities in their own jurisdictions, it was their quality processes and expertise that would inform the

development of courses, and therefore pedagogical flexibility would be maintained as a principle accepted across the partnership.

Nevertheless, different views on pedagogy were expressed in various fora during the design and development stages. For instance, there was interest around one course, and also gaining a wider discussion in the OERu, in a pedagogy informally termed "free-range learning," introduced by one of the anchor partner universities. This pedagogy was based on learner discovery of OERs, where students have the ability to choose their own learning resources in a "pedagogy of discovery" entailing a search for relevant OERs to respond to assignments in the course. In this particular pedagogy the learner would be highly self-directed in terms of content but less in terms of scheduling and sequencing as there was a structured timeframe for completion of the course. In the *ART100: Art Appreciation and Techniques* course, the content was more prescribed than these pedagogies suggest, but the timelines and some of the options for project work and assessment were left more to the learner to decide.

Beyond the standard categories such as learning activities, assignments and assessments, there was no consistently agreed upon pedagogical approach visible across the OERu partnership. If fact, there was explicit agreement not to seek a common approach. More broadly, however, it was agreed that "the OERu should consider opportunities for pedagogical innovation in parallel with technological innovation, rather than using new technologies to embed traditional pedagogy" (WikiEducator, 2013).

In another view expressed by a developer, characterized by a learning process approach to pedagogical design,

> I have found that I have differences in thinking and philosophy around learning. Some of the traditional … learning design approaches or learning designers are focused on content production. And that's really a significant focus, on developing content, and I've never believed that's the key to learning design. For me, it has always been designing a learning experience and what the learner, where they start, where they are into their learning journey, and what do they need to experience to move them from where they're at to the next stage of their learning journey.

Another concern was designating spaces or methods where students could demonstrate their work and receive feedback from instructor/volunteers, in a way that gives students the option of privacy and yet is able to accommodate the growth demand where the number of students exceeds available instructor/volunteers. One response emphasized the priority of not hampering

the ability to be flexible and to grow in a scalable manner as needed, thus implicitly indicating the need for some commonalities in design approaches:

> Considering that OER learners may not necessarily become students or apply for assessment, any e-tivities *[e-learning activities]* should be optional and up to the learner to choose whether to engage and what to extend. The courses need to be designed to offer opportunities for engagement and feedback if learners opt for it but they should not be a requirement as it limits flexibility and scalability (WikiEducator, 2013).

A further comment offered a critique of a course outline resembling a "fully supervised delivery model" owing to its highly scheduled outline, with the suggestion for an alternative, a "possibility of optional ways of working through the course" (WikiEducator, 2013). Discussion on whether to use an e-portfolio platform, and if so, which one, with a responding comment that proprietary tools should be avoided in the OERu: "I suggest we look at solutions which provide the freedom for institutions and learners to use the technologies of their choice for compiling e-portfolios" (WikiEducator, 2013).

In discussions on the nature and support of learning activities, the question of instructor feedback remained unanswered until the volunteer instructor program known as AVI (Academic Volunteers International) of the OERu would be in place. Some non-instructor feedback tools were available for the course, including self-marking quizzes and an FAQ that automatically searched for and presented answers to typical questions. These were not yet installed at the time of the writing of this course but the intention was to add these elements. This would be an issue requiring further consideration as the OERu project evolved.

In a related manner, questions were raised about designing for students who may prefer "step-by-step instructions and facilitator instructions via email" and then will be led to have "expectations that the course will have facilitators posting instructions and sequencing the learning experience for the learners." Additional comments included the following:

- Definitions and consistent use of nomenclature for such elements as modules, courses, objectives and learning outcomes.

- A suggestion to ensure all terms are used consistently, such as references to "your portfolio" rather than naming a specific tool

- Endorsement of a prototype feature consisting of short introductory video clips by course developers to introduce themselves to learners

- Comments on representative sample features, including:
  1. Lack of e-portfolio links to assignments
  2. Confusion about use of the wiki in the course
  3. Need for more explanation about learner-instructor interactions
  4. Clarity around how and when learners interact with one another
  5. Use of microblogs in the course

- Development or provision of resources that can work across the OERu, such as those that support the building of digital literacies among learners. (At this time discussions were still ongoing regarding assembling a core of digital literacy resources; i.e., resources that would support learners in identifying and addressing gaps in their skills in operating in an online learning environment.)

- Possible editorial guidelines

A response to these comments on representative sample features noted a "chicken and egg challenge at the moment … we need to complete the design and development in order to provide a useful support resource for learners to reduce the confusion" (WikiEducator, 2013), with the obvious recognition that all aspects of the course could not be fully defined from the outset.

Because the intent of the representative sample of materials was to establish a "rough consensus" on a broad range of issues, detailed instructions were proposed and discussed for elements to be included in an overall style guide. For example:

The navigation template should:

- Be created as a sub-page of the study unit concerned and transcluded from this subpage rather than the main template namespace. For example AST1000/Introducing_Asia_and_the_Pacific/Nav using rather than template:Introducing_Asia_and_the_Pacific/Nav.

- Provide a link back to the course homepage in the top bar using the title parameter in Template:TopicsWithSubpages

- The study unit name is included using topic parameter in Template:TopicsWithSubpages

- Where the course hierarchy requires more than one study unit for a particular "module", a link to the specific "module" can be

included by using the above parameter in Template:TopicsWithSubpages

- Provide a link back to the StudyDesk in the bottom bar using the below parameter in Template:TopicsWithSubpages

- Provide a link back to the OERu Learner support page in the bottom bar using the below parameter in Template:TopicsWithSubpages. (Note this page is work in progress and will be developed soon.)

- Provide a link to the copyright page for each study unit using the note parameter in Template:TopicsWithSubpages.

- Use state = iframe as the state parameter in Template:TopicsWithSubpages as this will ensure that the navigation template is parsed in the collapsed form in the target website using the |iframe link. (WikiEducator, 2013)

Another example was advice provided on this discussion page to consider other users who may reuse and repurpose the content at a later date, as well as to support delivery of the content in any of a variety of environments:

- Bear in mind that the wiki pages for OERu course materials will be reused in a variety of delivery websites (LMSs, CMSs, Blogs etc.) as well as print-based study-guides and will need to accommodate relatively small width screen resolutions, e.g. 500 pixels through to wide-screen displays.

- Avoid using tables with too many columns that would typically require a landscape page orientation. Assume the default of a portrait orientation for all tables.

Avoid pages with long sections of text-only presentation:

- Include interesting images to supplement the teaching text.

- Incorporate pedagogical templates to promote learner activity and improve the visual layout of the page.

- Apply the general rule that there should be text between headings to avoid two headings following each other. Remember that the page title will appear as a heading in the print-version of a WikiEducator page, so start each page with an appropriate introductory text and corresponding image where possible. (WikiEducator, 2013).

The development of a representative sample of materials provided an opportunity to raise a large number of issues, many of which could not be easily resolved at this early stage. However, a developer assembled a brief style guide in the wiki based on the collection of comments and agreements from this discussion, and this remained available for others to use although not everyone was aware of this and other resources available in the wiki, particularly if they joined later in the process.

Some issues remained open ended, such as questions around portfolios, or how to develop in a way that supports both independent learners and cohorts. A balance needed to be maintained between autonomy of individual developers, teams and institutions, and the need for consistency among courses and, more importantly, implementation of features such as modularization and content layout that would enable easier reuse of the content in different contexts and technology environments.

Further, the desire to provide multiple options for learners to work through courses in their own way needed to be considered against the need for more traditional assessments required by institutions desiring to provide credit for learners on completion of courses. All in all, many complex questions arose that typically would involve extensive planning and discussion among multiple persons and departments in a university setting. As will be discussed in more depth later in this chapter, it was mainly the experience of a relatively small number of highly experienced members of OERu and WikiEducator that guided the process forward and helped to resolve complex issues as they arose for the entire community.

Complete Development of Course Materials

After review of the representative samples of materials, the next step was to commence with the completion of *ART100: Art Appreciation and Techniques.* While the previous milestones in prototype course development involved a combination of design team and larger group interactions and discussions in common areas of communication using the email list and central feedback pages, completion of development of course materials saw development teams concentrate on development of their own courses, with occasional invitations to provide feedback from the wider community.

Therefore the following instructions were provided in the course guide:

Help improve the course. This course is only a beginning. It has already gone through several revisions since it its original release, and the course designers would like to see it continue to improve. For example, we would like to see:

- More examples of art from different cultures around the world.

- Ideas for revisions or additional content.

- Adaptations or translations for different contexts.

- New ideas for learning activities and assessments.

The work you do in this course may also be contributed to help improve the course and in fact we would encourage this. As this is an open course, if you sign up as a WikiEducator member you may also make comments or suggestions under the "Discussion" tabs on each of the course pages. Please note that, as in Wikipedia, changes are monitored and will be reviewed for their appropriateness. (WikiEducator, 2013)

The course as developed may not have met the initial consensus aspirations in that some developers found the navigation difficult and confusing in the course. For instance, there was no "home page" as such, which would be easily available to bring learners back to a central organizing place in the course. The developers made such a page (Figure 4.4), but with an awareness that in WikiEducator the general intent was to try to build courses more in the style of the open web, rather than a contained and highly pre-planned course container. Another example was that when learners clicked external links, they would actually leave the wiki environment and would need to navigate back to the wiki using their browser back button, rather than closing a window.

Figure 4.4: Home Page

WikiEducator free elearning content

Navigation
- Main Page
- Recent changes
- Random page
- Help
- Practice editing

Community
- Community portal
- Web chat
- Mailing list
- Donate now

Create a book

- Add wiki page
- Books help

Toolbox
- What links here
- Related changes
- Special pages
- Printable version
- Links
- PDF version
- Subpages

SHARE

OERuART100

Art Appreciation and Techniques

#OERuART100 - An OERu course

Home | Course guide | Definitions, artistic roles and visual thinking | The artistic process | The visual language: Artistic elements | The visual language: Artistic principles | How art speaks | Artistic media: Two-dimensional art | Artistic media: The camera arts | Artistic media: Three-dimensional art | Art and architecture | Art and our world | Art and other worlds

Home Page

Welcome to the home page of the Open Education Resource university course ART100 Art Appreciation and Techniques. This page provides helpful information and an overview of the course.

If you click on a link and get lost, every page in this course (except this page) links back to the home page from the top navigation bar, so you're never far from **HOME!**

Course identifiers	edit
Course tag	#OERuART100
Level	1st Year bachelor's degree
Notional learning hours	100
Credits	3
Enrollment status	Start anytime; there is no need to register.
Original OERu redeveloper	Thompson Rivers University Open Learning (TRU-OL)
Formal	Thompson Rivers University

Course Description edit

This course is an exploration of visual art forms and their cultural connections for the student with little experience in the visual arts. It includes a brief study of art history and in depth studies of the elements, media, and methods used in creative processes and thought. In this course, students will learn how to develop a five-step system for understanding visual art in all forms based on:

1. *Description:* Explaining a work of art from an objective point of view, its physical attributes, and formal construction.
2. *Analysis:* A detailed look at a work of art that combines physical attributes with

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In one discussion, a developer noted that "the intent behind OERs is diminished if we try to completely overhaul the materials. With that in mind I've taken a minimalist approach to redesigning it for the OERu context. However, there were many assumptions around having access to a discussion board, along with frequent access to and marking by an instructor. This has had to be reworked."

And among further issues to be considered were the unknowns. For example,

> Because of the many unknowns regarding such things as the delivery platform, access to peers, availability of tutors, etc., the state of the FAQ, I've tried to leave the wording around such matters as neutral as possible so that the different environments and tools can be provided with little if any adjustments. Also, because students may want to study individually or may do so by necessity, the course defaults to independent study but builds in an option for peer contacts. (WikiEducator, 2013)

ART100: Art Appreciation and Techniques was developed not only for interested individual learners as well as formal educational contexts, but also globally as an OER for others to reuse and repurpose. Therefore developers considered technical aspects of modularization, such as use of open file formats and other such considerations, and also provided suggestions in the course guide to other potential users as to how to engage with and use the content in ways that suited their own learning or delivery purposes. For example, a variety of ways of using the course content was expressed in the Course Guide:

Own interest and enjoyment
Read all or any part of it at your own pace, in whatever order you want, for your own enjoyment and learning.
Challenge yourself with any or all of the activities and assignments.
Join with others in a small class either locally or online to work together and share your work and explorations with others. Maybe you can find an art teacher, local artist, someone who works at an art gallery, or another community volunteer to work with you to develop your study group.

For possible credit
Study the course more formally, setting up a study schedule that fits your lifestyle and circumstances, and work through the activities and assignments.

You may do the written activities using a notebook or word processor, or use a blog or wiki if you would like to develop your work online. Other tools such as e-Portfolios may be available to you, depending on your circumstance. The important thing at this point is to do your course work in such a way that if you wish to seek credit, you are able to show the work, and to demonstrate that the work is your own and not copied from, or written by, someone else.

Approach an OERu partner college or university that may be willing to consider your work for credit. They may require additional work such as an exam, along with submission of your assignment work. They may also contact you to verify your identity and ensure that the work you submitted is your own. (WikiEducator, 2013)

Educators and others potentially willing to assist learners in similar settings including community centres and other such locations were provided ideas on how they could use this course to suit their own purposes:

Educators are invited to adopt or adapt this course for their own use in the formal classroom, blended or online setting, or as a volunteer in a community setting, among other possibilities. A group of students may work through the course as a cohort and collaborate on activities and assignments. We leave the structure of these forms of engagement up to the skills and experience of the leader and therefore have given no instructions on how these activities may be implemented for individuals or groups. The learning activities are ungraded, and may be used for practice and/or for helpful student feedback, but were not designed to be used for formal grading.

Learners may need assistance with tools for conducting their activities and assignments, ranging from basic notepads to blogs, wikis and e-Portfolios. A key consideration is to keep the digital skill levels and technology access of the learners in the forefront (WikiEducator, 2013).

As can be seen, the developers intentionally decided not to over-determine the teaching and learning processes for teachers/facilitators and learners alike. However, there was some discussion among developers on whether or not assignments should be given a value out of a total percentage of marks available. In the end it was determined that learners looking for credit at the end of their studies will typically want to have some guidance on how much of the total effort devoted to the course would need to be allocated to activities across the course. If learners were serious about taking the course for

formal credit, OERu partner institutions and others interested in providing credit were provided the following information:

> If you are with an institution considering giving credit for this course, the assignments can be used for formal grading. The assignments have been weighted to assist the student. There is no grading guide as faculty undertaking the evaluation will be able to apply their own judgment in this area. It will be up to the institution to verify the identity of the student and the originality of the submitted work. Options for additional verification may include providing your own exam or other assessments in addition to the assignments given in the course, and/or asking students to submit evidence of having completed the course work (drafts, notes, etc.) (WikiEducator, 2013).

Review and Refine Draft Materials

The "review and refine draft" stage was not as pronounced as the other stages. There was an ongoing process of review, and this took place particularly when the converted course content was staged on preliminary pages, before being redesigned and reconfigured to fit the requirements of the wiki structure and pagination guidelines. Apart from that, there were frequent meetings mainly using Skype among the developers to discuss the course content, pedagogy and technical issues. At one stage a university art professor agreed to review the course. The review of the course was positive and it was assessed as equal to a full first-year undergraduate course. An *ART100: Art Appreciation and Techniques* developer later noted that two reviews would have been more helpful, one of the original OER, as much extra work would have been saved in determining what content to keep and to leave out, and one after the fact for final quality control.

Peer Review and Quality Control

The final intended stage in the open design and development component involves review by the OERu community and any other experts in the subject area. A link to the course went out to the OERu Google Groups community list for feedback and a feedback page was set up for comments:

> Redevelopment of the OERu course *ART100: Art Appreciation and Techniques* in WikiEducator is nearing completion. This course is based fully on OERs, with a combination of repurposed content from Saylor and

newly developed content and activities. It has been designed with the intent of making it more flexible for reuse, redistribution, revision and remixing for different users and contexts, as well enabling multiple ways to engage with the course as a learner. Students and others are encouraged to continue to broaden the predominantly Western scope of the course by adding content and in particular art links from their own culture. We felt this was a better approach than trying to do it ourselves.

The course still requires some technical work as well as copy editing, which will occur in the near future. There's much more we'd like to do with it, but consistent with the philosophy of "release early, release often," at this point we'd like to invite comments and suggestions. Please make comments either directly on discussion pages at relevant sections of the wiki, or use this feedback page for your overall comments (WikiEducator, 2013).

As suggested in the message, the developers arrived at the conclusion that the course would remain a constant work in progress, and others would be able to improve and repurpose it on an ongoing basis as part of the OERu ecosystem. Early feedback indicated a number of editorial corrections as well as suggestions on how to make it more clear to learners as to how to obtain credit for the course.

A COMMUNITY OF VOLUNTEERS

The second theme in the data collection and analysis centres on the formation and development of volunteers who did the work of designing and developing courses in the OERu. I have divided this discussion of the results into four sections: ethos and motivation for participating in OERu course development; induction and persistence of volunteers; division of labour; and coordination and communication.

Motivations and Ethos

Developers interviewed were all highly educated and experienced educators, with busy careers outside their volunteer work in the OERu. In both open design and development and open source software (OSS), developers expressed strong motivations to participate. In comparison, in literature on traditional instructional design where typically developers are paid faculty or staff who perform the work as a function of their position, motivation is not

usually an overt question. All OERu volunteers interviewed shared freely their strong personal philosophies concerning reducing barriers to education and credentials, and support for the growth of open educational resources and practices. They saw benefits to their and their institutions' participation in open design and development projects, particularly where their institutions viewed such engagements as potential catalysts for innovation and transformation. Those in OSS also want to make a contribution to the public good as well as gain skills and participate in the development of software that might be of use to them personally or organizationally as well (Baytiyeh & Pfaffman, 2010; von Hippel and von Krogh, 2003).

In comparison with the review of open source software (OSS) in Chapter 2, the ethos among developers in that culture was quite similar to open design and development in the OERu in both respects described by Oberg (2003): open processes and philosophies. OERs were rooted in the ideology of sharing content in a free cultural works environment, and OSS similarly originated in the GNU General Public License (GPL) and other "open" licenses, which served as the basis for Creative Commons. Developers in OERu unanimously expressed deep commitment to the philosophies of openness and sharing. For example, "My passion *[is]* to share knowledge. I believe education is a fundamental right, and OER is a vehicle to realizing that mission of widening. … " This developer wanted to enable "more affordable access to post secondary education" and was attracted to the OERu because of the fact that "it's open in all material respects — in terms of its licensing and in terms of its philosophy, in terms of the mission of what the OERu's trying to achieve. All knowledge should be free. It's part of being, and my philosophy is knowledge is there to be shared."

All participants expressed similar commitments to a philosophy of sharing educational resources and opportunities that they reported affirming at a deep personal level. In the words of a developer,

> Well, I am just a big proponent for the philosophy of open. I just think education is meant to be shared … it makes no sense to me that someone would create something that is useful for students learning and then you put it away, lock it away in your own desktop or, I just can't compute that. So, I have my own philosophy, all my years, the minute I find something that looks interesting, whether it's an article, whether it's a media piece, I immediately take the time to find out who might find it useful. So I totally 100% believe in open. Sharing knowledge,

sharing and reaching out … not just to give but to have that community where you can collaborate, where you can ask of the people for help.

And as another developer said, "I was never hiding whatever resources or things I've developed…It's not a treasure that I have to hide and lock in my desk. So I guess it is in a way a personal philosophy…. I didn't need much of persuasion or conviction to say this is a good thing. I kind of knew it is."

Similarly in open source software (OSS), many volunteer development communities were formed to contribute to the "greater good" (Baytiyeh & Pfaffman (2010, p. 1348). Other rewards such as community, social engagement, recognition and identity construction were expressed as motivators by OSS developers (Fang & Neufeld, 2009) and were mostly also highlighted by OERu developers in their interviews. For example, one of the main reasons for one developer's joining was stated as his personal commitment to professional development as a university faculty member; but also, "I have a personal interest in all open initiatives because personally I'm very committed to bringing education to developing countries, bringing education to those who need it." In a somewhat similar vein, as reported by Dahlander and Wallin (2006), some also participate as salaried and supplied by corporations or universities to gain "access and legitimacy" (p. 1256) and access to the code. This was the case with some developers whose time was donated to the OERu by their institution, which saw a strategic advantage in making such a contribution.

Induction and Persistence

Responding to an open invitation sent to the open OERu email list, a large number of volunteers initially signed up to contribute their time and expertise to the OERu project. This number declined to a small fraction who provided substantial contributions or even comments and feedback in the course over time. For instance, 148 virtual participants signed up to participate in initial planning discussions at the November 2011 OERu meeting in Otego, New Zealand, and in the first few weeks afterward more than 30 signed up to continue to volunteer to work on the project and 24 made contributions to the wiki. In the first stage of the project, approximately one third of this number was devoted to developing two courses to completion, and not all of them were original members of the volunteers who originally signed up. A core of these course developers was designated by their institutions to work on their respective courses.

Similarly, the Freenet study (Krogh, Spaeth & Lakhani, 2003) found that only four developers contributed 53% of the accepted versions of code in that project. In comparison, in the *ART100: Art Appreciation and Techniques* course, three developers contributed an estimated >95% of the content additions and revisions in the course; in both cases a small number of developers was doing large amounts of work.

In the Freenet case study success in the OSS community of volunteers, typical of OSS development more widely, was found to be related to growth in size of the community of developers, "people who contribute to the public good of open source software by writing software code for the project" (Krogh, Spaeth & Lakhani, 2003, p. 1217). Joining behaviours of coders was a major part of the focus of the Freenet study, where it was found that there was a large discrepancy between those who announced initial interest in participating compared with those who ended up making meaningful contributions. "Joining behaviour" was defined as the pathways or "scripts" that volunteer coders would follow, from initial lurking on the project email list to making useful code contributions. One initial barrier to full participation was the difficulty of the Java programming language that was used in coding the project. Also in the OERu, there was a need to learn the wiki mark-up language and conventions as documented in shared artifacts in order to work effectively in design and development.

Seemingly obvious indicators of early interest from volunteers in OSS, such as expressing an interest to contribute, making suggestions for improvements, proposing solutions but with no code contributions, asking for a task to work on, engaging in philosophical discussions and such activities did not typically indicate a progression to subsequent code contributions. On the other hand, those who offered actual code to fix bugs, engaged in general technical discussions, and offered repeatedly to contribute, along with other such activities tended to go on to become active code contributors. Further, the match between their specialization and the work needed was an important element in joining: "An important element of the feature gift giving was that the cost of creating and giving the gift was relatively low to the newcomers. Our interviews with the developers revealed that those that had contributed feature gifts did so on the basis of prior knowledge and experience they had refined in other circumstances" (Krogh, Spaeth & Lakhani, 2003, p. 1234).

In the setting of the OERu, the continued growth of the community of developers had not yet been evident at the time of this writing but it became

evident that more developers with a wider array of skills would be necessary to increase the pace and number of courses developed. One developer observed,

> … It's a pilot project of how open is going to work…. we definitely have to open it up to many, many, many more people. That to me is how open is supposed to work. I should have been able to immediately feel that I could ask a fellow ID a question, or ask a production person a question, you know when I was stuck with all those questions.

There was a later perception by a WikiEducator developer who was initially involved that the primary role given to partner institutions in the OERu overshadowed other developers' individual interests. For instance, "I was a very enthusiastic WikiEducator, but lost my way when the OER university initiative began as it opened doors for universities, but closed doors for me as an independent educator. I will be lurking if that's acceptable as I don't represent a university." While there was no overt restriction on participation by the wider body of those who were volunteers in other parts of WikiEducator, there was also not a notable effort on the part of the community to recruit those who had initially expressed interest as the focus did indeed fall mainly upon the partner institutions to develop their courses. Nevertheless there were also many communications and invitations to the wider community to comment and provide feedback on developments.

In both OERu and OSS, a high degree of involvement by volunteers was seen as important to the quality and quantity of contributions (Xu, Jones & Shao (2009). In the Freenet study (Krogh, Spaeth & Lakhani, 2003), because growth of numbers increased with participation, there was interest in the perceived benefits that would draw newcomers to the project. Within the OERu wiki, participation of developers showed a small number (three) who were involved at the very outset in terms of producing actual page edits or comments and remaining similarly involved through the initial OERu planning stage, through the planning and completion stages of *ART100: Art Appreciation and Techniques,* indicating a relatively low level of continuity or contributors across the project, constituting only 11% of the initial group of contributors. While this finding is not necessarily unexpected, as many initial contributors may understandably have had an interest only in the bigger OERu picture. However, it does reinforce the concern expressed by *ART100: Art Appreciation and Techniques* collaborators that the lack of continuity from end to end made it difficult for developers to complete the project with a sound understanding of its original intentions.

Figure 4.5 to Figure 4.8 show the relative contributions of developers in various stages of the project, with "contributions" determined by unique days where page edits or comments per were made on unique pages (similar to "code commits" in the Freenet project) and clustered in 3-month segments. Figure 4.8 combines the two stages of *ART100: Art Appreciation and Techniques* development, showing that the remaining three participants made contributions in either the first or the second stage, but not both. One developer in particular was heavily involved in facilitating and recording in the wiki the broader OERu planning processes, as well as setting up pages and systems to keep the project structured and moving forward. Comparing this activity with that of the rest at this stage, it would appear that the project would not have been able to launch on the basis of the other contributions alone.

The patterns of persistence shown in Figure 4.5 to Figure 4.8 are of particular interest. They show both the patterns of continuity of contributors throughout various stages of the project, and the relative amounts of work provided by each. In both cases the patterns have significance in understanding some of the challenges faced by developers involved in the project.

First, in collaborative design in architecture, developers do not engage in an ongoing process of negotiation but rather in "…parallel expert actions, each of short duration, bracketed by joint activity of negotiation and evaluation" (Kvan, 2000, p. 412). Similarly, in ART100: Art Appreciation and Techniques, the most progress in collaboration occurred in occasional conference calls where issues would be settled and tasks negotiated. Developers entering the process later in a project would not have the depth of shared history and understanding as those who had been part of the discussions and negotiations from the very start. They would then need to rely more upon various artifacts in the wiki such as records of previous decisions and notes or revision histories in discussion and history pages. Similarly as discussed earlier Sonnenwald (1996) suggests having in place a prescriptive framework for communication roles and strategies among collaborative design teams, along with effective information retrieval technology.

Further, as suggested by Chiu (2002) in discussing organizational aspects of collaborative design in architecture,

"The transmission between two persons is easy, particularly by face-to-face contacts, but the transmission among multiple persons or between two groups requires coordination and management of information flows. When

more persons or groups are involved, the communications become more complicated (2002, p. 412).

If this complication is further extended along the time domain, the transmission between two persons is no longer available for those whose participation in a collaborative design does not overlap, and they then need to rely even more upon the various artifacts as described above and as noted earlier, only 11% of developers maintained a continuous overlap across all stages of general OERu planning and *ART100: Art Appreciation and Techniques.*

Figure 4.5: Contributions made in general OERu planning stage.
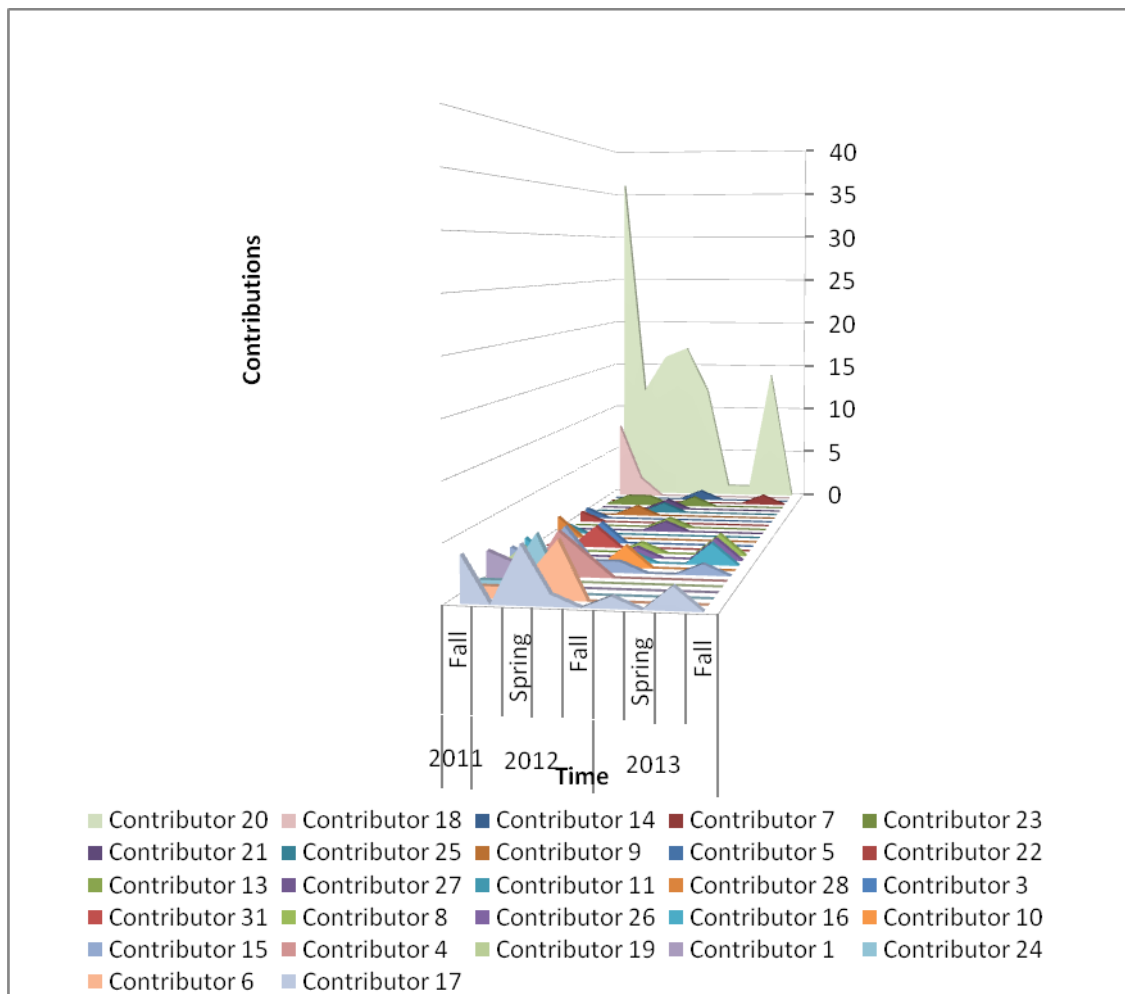
Data source: WikiEducator (2013). Prior to and alongside the development of OERu courses, overall planning for the OERu was documented in WikiEducator. A small number of contributors made the largest number of contributions, and one contributor in particular documented most of the discussions in the wiki and emails in the wiki. A large spike in contributions took place early in the project and diminished after that time.

Figure 4.6: Contributions made in *ART100: Art Appreciation and Techniques* planning stage
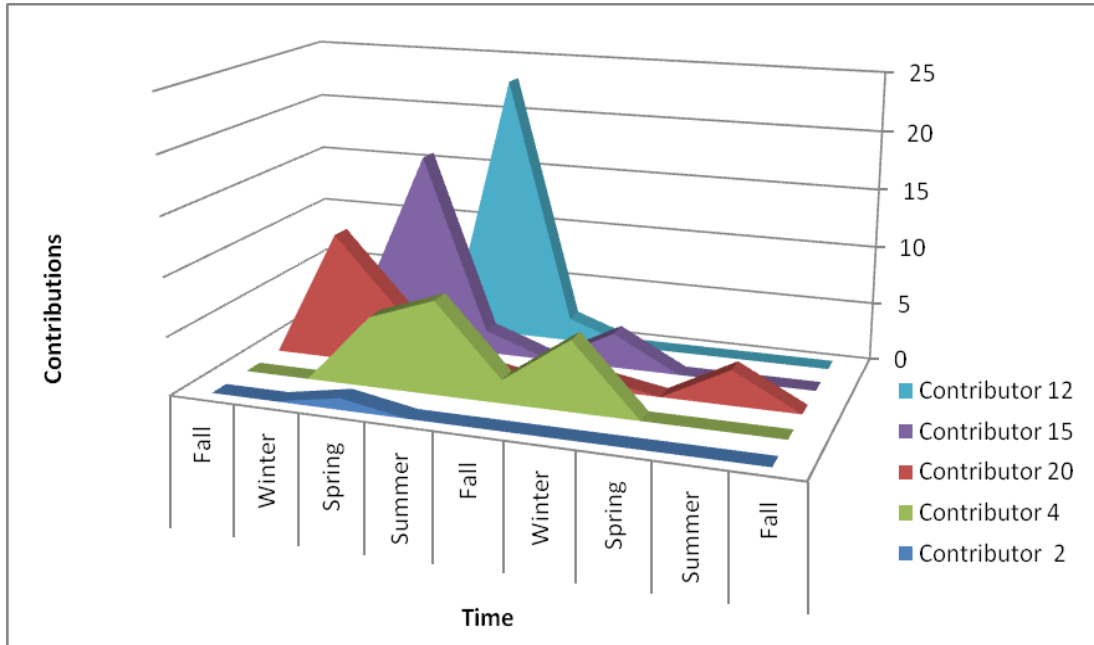
Data source: WikiEducator (2013). Compared with contributors in the initial OERu planning stages, only three continued to participate in the early design planning stage of ART100, and two new contributors joined at this stage.

Figure 4.7: Contributions made in *ART100: Art Appreciation and Techniques* final course development stage
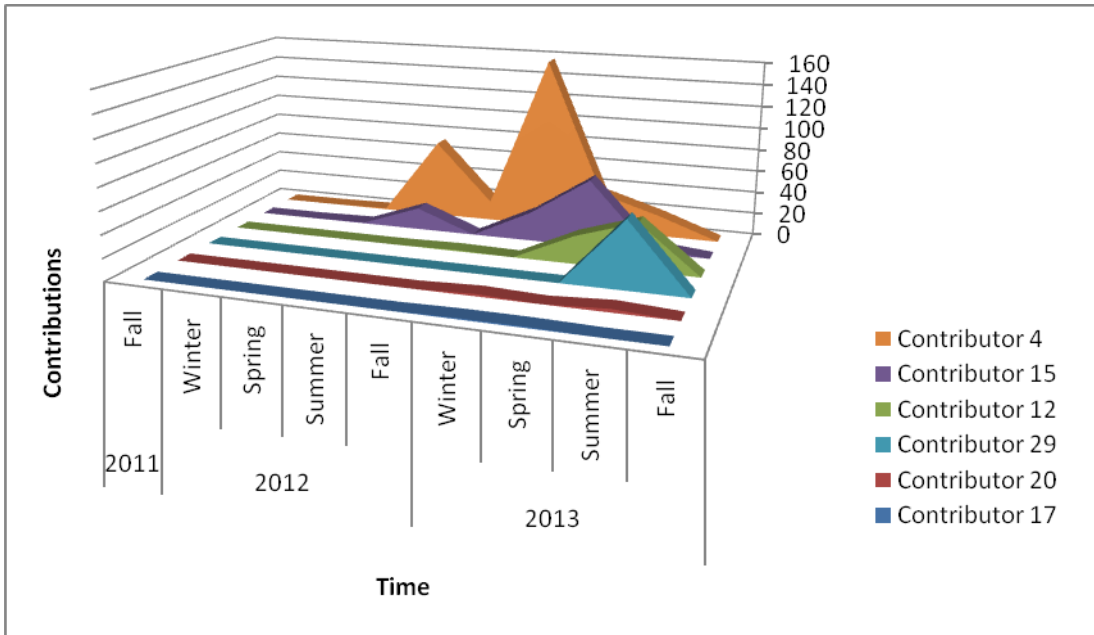
Data source: WikiEducator (2013). Four of the developers involved in the initial ART100 planning stage continued in the development of the final course. Two new contributors joined at this stage.

Figure 4.8: Combined contributions made in *ART100: Art Appreciation and Techniques* planning and final course development stages
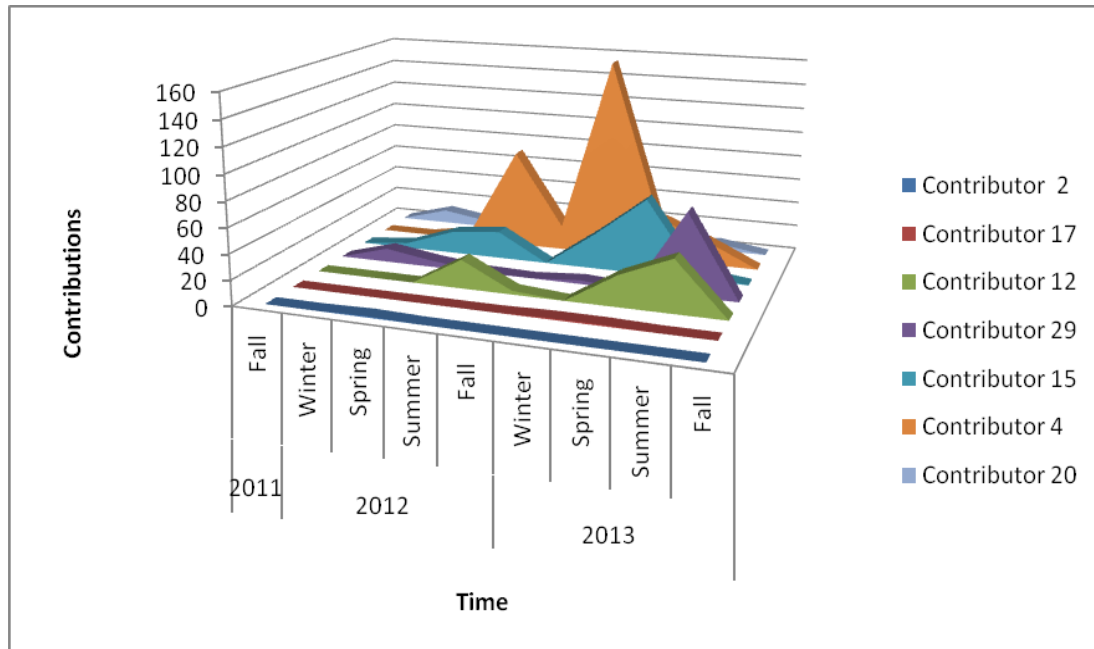
Data source: WikiEducator (2013). For all contributors, more contributions took place in the final course development stage than in the planning stage. Three of the developers involved in both stages were part of the original OERu planning discussions.

The existence and maintenance of a robust body of volunteers was identified as vital to the ongoing health of an OSS project, including the growth of established rules and a group culture that fosters commitment and constructive behaviour patterns (Hendry, 2008). A difference noted between induction into the OERu and OSS was described by a developer:

> … in an open source community if you ask a newbie question and you haven't even gone through the previous discussion forums, you will be castigated. So in open source there's this culture of, you go out and read what has been done, and then if you don't know what's happening, then you engage with the community. I've noticed there's a lot more tolerance with education folk.

However, in contrast with the OERu, in OSS "the nature of the development is such that you've got objective measures for seniority. You know, if you proved yourself, the code must work and those are the things that it must and this is an objective measure." Educational development is more forgiving in that regard and thus any challenges that might be faced by late-joining developers would not necessarily be immediately evident, given in particular that there was, by consensus, no common pedagogical approach to learning design.

In traditional instructional design, typically all participants in the project are either involved in the project from the very beginning, or if brought in later then are thoroughly debriefed on the project's history and status. Collaboration in planning is essential to the success of collaborative development teams (Hixon, 2008) and ongoing communication throughout the process is equally important, along with orientation for all participants to the processes and tools used in the development project (Chiu, 2002). However, the developer in this case was left feeling disadvantaged at the outset:

> … the next person down the road might want to do something with the course but they don't have all the same philosophy and all the same agreements that *[others]* had in the beginning. You know, all those conversations … on why you were doing what you were doing in the way you were doing it. How do we share that with the rest of the world? So I know the lessons are there in this pilot project but it's there in a messy, messy way. We kind of got it in the way of just documenting the process that you would have to clean up because not everybody wants to read through every messy meeting we had. At the end, a different kind of help guide has to come out for the open public …. A really well put together manual would be something useful for the future folks after we've learned all our lessons. It should be a little more well organized and concise for the people who come after us.

Yet as described earlier in this chapter, substantial documentation had been developed on the wiki that could have been used by developers, but they were confused by the complexity of the wiki and its flat file structure. Over time another developer pulled these documents together more tightly in one section.

To address the challenge for "newbies" beginning later in the project, a starting point for them would then be, it was suggested in the planning node, a place where some work had already been conducted. The expectation would be to make contributions and even improve others' content, while remaining consistent with the overall direction of the course design. Within this context, however, it was important to have opportunities for developers to gain an understanding of what design thinking had preceded them beyond what was evident in the designed content artifacts or other forms of distributed intelligence. As noted by one developer, there was a need to be able to provide background and context for others just beginning on the course at a later stage. The main way for doing this, apart from abstracting the design from the in-progress artifacts of content and activities, was to review design debates and decisions occurring through and across the OERu wiki and email discussions,

and comments provided by developers on talk pages in the relevant section of the course under development. However, this would take a good understanding of the wiki structure and the layout of the OERu, which is complex to a newcomer and takes time to learn.

Beyond these elements, a critical factor in working within the open design and development that did not appear in the Freenet study or in OSS literature in general was mentoring. Throughout the *ART100: Art Appreciation and Techniques* project the more experienced developers were available to provide support and assistance to the newer participants in development. This was seen by developers in the *ART100: Art Appreciation and Techniques* project as vital to its success. In the experience of one developer,

> I didn't even have my own WikiEducator page. *[A mentor]* kind of talked me through how to set up my page, how to bring the images in. She was an email away. She was very, very willing to help. So that made me feel good. [*It*] was really important because I would have given up and not taken part in the project after week 1. Week 2, if *[mentors]* weren't there to help me in that first steep learning curve, then after … just an email away. Very important because as I said the whole project was difficult for me. If *[a mentor wasn't]* 11 o'clock also online and answering my questions, I think I would … not *[be]* doing this.

Another viewed membership as a distinctive element that defined open design and development models, based on two key principles of meritocracy and consideration for others in such acts as mentorship:

> One is the principle of meritocracy, where one's seniority — in inverted commas — or respect within a community is actually developed by the expertise you've demonstrated within a community and have built up over the years. So there is this key element of meritocracy. You know is it sitting in these open communities, which is a differentiator. I think it's part of this sort of reward mechanism that's kudos that takes place in these open communities. So I think that is incredibly important.
>
> *[Second is]* the principle of paying forward. And that helps fuel this ecosystem of mentorship. It's this whole notion of…someone helped me when I was struggling. Once I've acquired the skill it's now my turn to help somebody else.

A bigger challenge encountered, was the effort involved in locating, converting, remixing and formatting the content of the original OER into the wiki. Access to a mentor in the form of a highly experienced WikiEducator

developer was seen as a crucial support to the developer. This loomed large in the mind of some developers. For example,

> I spent hours and hours doing detective work; pieces *[in the original OER]* were missing …links were broken … things were… it was a mess. That physical part of just bringing the source files over into WikiEducator before we even get going with the pedagogical, the activities and so on. The hard part was the most challenging thing because I really didn't have the training. I was using the rich text editor the most — that part was easy. But that wiki syntax in the back with the images inserting the images, the nav bar, the little special text boxes you had for all the activities, I did not have any of that expertise so I was really relying on *[a mentor]* for all of that.

Thus for those who had not started from the beginning, and hadn't arrived with prior appropriate specializations or training, there was a significant barrier to joining. At the same time, by joining at the periphery and learning and being mentored, in the manner of a community of practice (Wenger, 1999), a developer who completed a project found it a substantial learning experience and a good basis from which to move forward with many lessons learned, even as part of a larger philosophy about learning:

> … it's been a learning experience and I'm looking at everything really that I do as a learning experience because learning is life and life is learning. I'm not sure who said that but that's definitely my point of view. So it's been a great learning experience and I'm continuing to learn and If I'm passionate about others and education, I've got to be committed to keep learning.

Further, while principles of self organization are largely intended to drive the design and development processes in the OERu, the demands of the environment, the potential challenges with conversion of OERs and the need for various levels and types of expertise appear to suggest the potential advantages of some initial recruitment and negotiation of roles among volunteers and the wider community rather than a more informal processes. In the Freenet study it appeared that while there could be potential within a large enough community for a body of developers to flow in and out of projects, in the early years of the OERu it is likely that projects would benefit from the bulk of project teams being established at the beginning and working more as a cohort until a more mature community is established around open design and development specifically in the OERu.

Division of Labour

As noted, a critical component in the success of the community in the Freenet study (Krogh, Spaeth & Lakhani, 2003) was identified as specialization of volunteers, i.e., deployment of volunteer talent according to their specialization for "efficient use of knowledge" (p. 1218). In other words, coders were best utilized by working in their areas of greatest expertise, with the implication that a wider variety of types of expertise was required to supply the specific skills needed for particular aspects of the project. With high turnover as found in the Freenet community, this would become even more important, in order to maintain a "critical mass" (p. 1226) of expertise in each of the areas required to complete the project. OSS projects typically leave it mainly to new volunteers to "work their way in" based on the quantity and quality of their code contributions, and volunteers typically contribute according to their areas of specialization. In the OERu developers with their characteristic instructional design skill set spent much time working well outside their areas of specialization, owing to the fact that few others either were available to take on the various aspects of the course development work and detailed technical implementation, or developers were not aware of them. This was seen as a barrier to overcome as a developer became more acquainted with the new role of learning design in an open wiki environment. For example: "I didn't really plan to be the technology know-how person in the project because that was not my forte. I really was thinking I'd just bring my design expertise and my educational expertise."

Within the OERu, the need for developers to venture outside their initial areas of specialization was evident. As described by a developer whose contribution to the project was initially intended to be based on expertise and interest in open education and online learning pedagogy, large amounts of time were spent on such labour intensive work as converting and correcting OER content files, fixing links, tracking down resources, reassembling content from a confusing set of original course files, and so forth. To deal with technical conversion challenges with Word files several developers used Open Office to convert hyperlinks automatically into wiki text. Because of the many hundreds of art links and illustrations in the original version, it was considered by the developers more onerous in most cases to remake all the links than to convert them. This was described by a developer as "factory work," and as somewhat distracting from the design goals that were at front of mind in approaching the project. The work was undertaken collaboratively between three developers. One undertook the technical aspect of the conversions, pasted the raw

converted wikitext into staging pages, and handled text cleanup and basic formatting. The second developer undertook more detailed page formatting and layout, correcting and adding image copyright information, and the third broke down the page into sections and moved them into new, final pages with all navigational and repetitive elements in place.

The need for multiple skill sets was outlined as follows:

> One of the challenges we got in our open design communities, is the extent that our technology people actually engaged in the process. We don't have a high number of coders or people at that level of technical skill engaging this development process which is kind of odd because if we purporting in sort of open distance learning, professional team approaches, it would be nice to see that sort of skill engaging as well.

The lack of sufficient expertise in the technical area was noted by another developer, who felt an inordinate amount of time was spent undertaking repetitive, manual tasks in converting and formatting content when the expertise this individual brought to the project was of a different nature, including design expertise and a particular interest in equity and provision of free learning opportunities to those who are disadvantaged. There was a general indication among volunteers of the need for a stronger presence of more widely varied talent in the volunteer pool, rather than mainly developers who seemed to be doing everything in the end. For example, one developer stated the need for "a lot of people that I think we could have tapped into," and another noted that "One of the challenges we have in our open design communities is the extent that our technology people actually engaged in the process. We don't have a high number of coders or people at that level of technical skill engaging this development process." Yet there was another OERu developer who didn't seem to mind applying a mixture of skills to course development:

> I did find not it too difficult to get used to the wiki mark-up, in particular; it was quite easy, and to be honest I didn't really follow the tutorials either. But they were useful at the beginning, but I just *[applied]* the same learning strategy I did when I had to learn HTML… once I got the basic grasp of tags. When I find a good feature I like in the wiki page I just go to the mark-up and copy that, and replace the text or the image with my own.

It could be said then that each team will have its unique makeup of skills and interest in performing a broad or narrow array of tasks based on interest, background, time and expertise.

Coordination and Communication

In the Freenet study (Krogh, Spaeth & Lakhani, 2003), commitments to code versions were approved by a small group of senior administrators, with increased trust placed in coders who established a record of high quality contributions. Similarly in the OERu, a meritocracy of developers was seen as a part of an ecosystem where credibility of contributions built up over time would give them increase stature and responsibility in the community.

OSS projects typically display decentralized decision-making and representation, although there are occasions where a formal leadership role or representative body in a not-for-profit foundation is established "to protect the community's interests" (O'Mahoney, 2007, p. 2). The OERu also is governed by a not-for-profit organization, the Open Education Resource Foundation with a Director who coordinates the efforts of the OERu and provided much impetus and expertise in moving the OERu community forward. Also as noted earlier, each of the partner institutions involved in developing OERu courses had a great deal of autonomy as to how the courses were developed, subject to working with the guidelines that had been reached across the partnership by means of polls and votes.

Another area for comparison between OSS and open design and delivery is communication methods. In support of this emphasis, several of those interviewed noted that it would be helpful for the community to review and further organize many valuable but distributed resources across the wiki into a more structured guide to improve sharing of information. Given the nature of developers and the amount of time that they may be involved in a project such as the OERu, this would of course need to be revisited on an ongoing basis, and it would also need to be recognized that no such system would be perfect given the decentralized nature of the community.

In the initial months of the OERu project, the ambitious cross-OERu project management process that was started could not be sustained by developers, as the main developer heading it up moved on to another institution and no others expressed an inclination to continue this role. It did not appear that a comprehensive project management process was feasible for the OERu project, owing to the breadth and complexity of the various course

development projects, and the time developers would need to contribute to their own projects let alone step up to take on larger responsibilities. Further, it appeared that quasi-regular synchronous virtual meetings among developers were particularly valuable in discussing challenges, reviewing progress, planning next steps and dividing work. These meetings and the subsequent notes kept by one or multiple participants placed in an appropriate page in the wiki were of ongoing value to developers.

Further, the practice of maintaining notes on discussion pages both to communicate asynchronously *in situ* with other developers and to leave a record for others who joined later in the process was viewed as a valuable asset. Development teams would need to become more alert to the importance of maintaining understandings at the outset that as much communication as possible should either occur within the wiki or, if external, documented in the wiki as well. For instance, virtual synchronous meetings would have notes taken and placed in the wiki in a designated page for maintaining meeting records. Also in this area a set of links to the key pages that track ongoing OERu-wide discussions within the wiki on common elements of concern to all developers would need to be maintained in order for those who join projects midstream can quickly be oriented to the essential elements of the project.

Chapter 5
DISCUSSION AND CONCLUSIONS

The purpose of this chapter is to revisit the research questions in light of the findings offered by the study, and more generally by discussing and reflecting on this research into open design and development in the Open Educational Resource university (OERu). I have divided this chapter into four sections. The first is a discussion of the results presented in Chapter 4, with connections made to the literature review in Chapter 2, including comparisons with traditional instructional design, open source software development, references to relevant theory as discussed in the review of literature, and comparison to the Freenet comparator case study (Krogh, Spaeth & Lakhani, 2003) as referenced in the research questions. The remaining three sections offer conclusions, discussion of limitations, and recommendations for further research.

DISCUSSION OF RESULTS

In this section I discuss the results under three headings, each addressing one part of the research question.

How has open design and development been conceptualized and realized in the OERu?

The first research question deals with how open design and development has been conceptualized and realized in the OERu. I address this question in two parts: first conceptualization, then realization.

 Conceptualization. In the planning stages of the OERu "open design and development" was defined as a generic design process "such as the ADDIE Model incorporating the five processes of Analysis, Design, Development, Implementation, and Evaluation as a dynamic system" (WikiEducator, 2013). Further reference was made by the OERu to design models "associated with the open source software development model to facilitate rapid prototyping

and continuous feedback and improvement loops" (WikiEducator, 2013). The conceptualization was then in effect a blend of two approaches, one acknowledging the need for a structured ADDIE (Gustafson, 2002) model which is characteristic of many formal instructional design models (Irlbeck et al., 2006), and one that borrows from a highly iterative approach such as that which has emerged in open source software (OSS) development (Magdaleno, Werner & Araujo, 2012).

Realization. To characterize the manner in which open design and development became realized in practice in the OERu through *ART100: Art Appreciation and Techniques*, I have adopted the term "designing for uncertainty." While the traditional instructional design model focuses strongly on planning and specifications with the intent of controlling the process and ultimately the outcomes (Richey, Klein & Tracey, 2011), open design and development in the OERu was more of an exploratory process that emerged alongside an ongoing discussion within the community on how the bigger pieces of the OERu model would to fit together over time. Because of the many unknowns that surfaced in the data gathering process of this study, the strengths of the traditional instructional design processes including detailed planning and specifications were somewhat inhibited. The "unknowns" that this study documents include the open-ended challenge of not knowing who the learners would be, what skills and tools they would be able to bring, what types of activities were plausible for learners, what learning environment they would use, whether or not they would have access to various forms of support, and so forth. On the other hand, the ability for experienced instructional designers such as those who volunteered for engagement in the OERu to iterate and adapt in knowledge-building cycles (Rowland, 1992) was essential in the completion of the course under construction.

A number of variables were at play during the process that together would impact the design and development process, leading to the first part of the second question as italicized as follows.

What are the currently visible features of open design and development as indicated by practices and products in the OERu prototype course projects: (a) *as compared with traditional instructional design and development*?

Because "traditional instructional design and development" could be understood in multiple ways, in Chapter 1 I offered a three-part description to establish a backdrop for the comparison with open design and development, a

view of these terms with which I am most familiar and also which forms the context of my day-to-day work. The first part of the description focuses on the people and context involved, i.e., faculty working either individually or collaborating with a small number of others in their own higher education institutions to develop online or distance education courses, sometimes with the support of instructional designers and other technical experts. The second part is what is described by Richey, Klein and Tracey (2011) as a "scientific" and planned process for creating detailed specifications for a learning situation. The third and final part was inclusion of the "messiness" (Conole & Culver, 2009) of the actual instructional design process, which occurs when the realities of design challenges drive the process toward iterative and knowledge building cycles (Rowland, 1992). While these descriptions may seem to add up to a set of contradictory elements, I believe and have documented that these are the realities of instructional design as it plays out in day-to-day situations.

Against this backdrop I have divided the further consideration of the research question addressed in this section into a series of discussion points, as follows:

- Course or something else?

- Design and development team

- Designing for credit

- Who are the learners?

- Design pedagogies

- Learner work spaces

- Sharing learning design "know-how"

- Working with OERs

I now discuss each of these points in turn, with reference to the given description of traditional instructional design and development.

Course or something else? With the recent proliferation of variations of massive open online courses (MOOCs), open educational resources (OERs) and open courseware, the opportunity for confusion exists among instructors and potential learners as to what their purpose is and how to engage in them. Within this milieu, there was much discussion within the *ART100: Art Appreciation and Techniques* developer team as to how closely the outcome would resemble a traditional university course. For example, what features

would be present in terms of traditional components such as learning activities, assessments, examinations and others elements? Would each prototype be designed more loosely as a set of OERs with expanded ability for learners to design their own goals and objectives as they worked through instructions provided in the wiki or, even further, would they be advised to locate their own OERs and design their own pathways and build their own courses? As noted in a message sent from the OERu email list, either way "it needs to be explicitly stated as to how people may use it." As the explicit purpose of the OERu is the ability to enable the achievement of post-secondary credentials for its learners among the partnership and beyond, the *ART100: Art Appreciation and Techniques* developers intentionally chose to build the course in a manner whereby learners would have an improved opportunity to obtain credit at the end, while building in flexible options for learners who wished to take their learning in more into their own hands using the existing course and possibly other resources. The challenge for developers will continue to be to find the right balance that will still support the primary objective of the OERu.

Design and development team. The team of developers involved with *ART100: Art Appreciation and Techniques* were primarily instructional designers, and once they became more engaged with the project they noticed that much of the work they were doing fell outside the scope of design work per se. The technical work in transferring OERs into the wiki was seen by some as onerous and repetitive, and a fair degree of skill is needed to format and lay out a course including its navigational structure. Additional expertise and effort are needed for developing graphics, editing text and reviewing content. Similar to traditional instructional design, a full "core" design team including such specialists as instructional designers, domain experts, graphic artists, web technicians, editors and others as needed should be recruited at early stages of an open design and development project in order to ensure the time of all volunteers is well spent.

Designing for credit. Because *ART100: Art Appreciation and Techniques* was developed primarily to ensure learners would have the opportunity to receive credit from partner institutions and others, developers observed the need to consider the link between the open design and development process and the processes for academic approval in their own institution by means of engaging teaching faculty in aligning the prototype under development in the OERu with existing processes of review. As much as the "disaggregation model" (Friesen & Murray, 2011) suggests the possibility of separating assessment of

learning from the institution offering the course, when partner institutions participate in a collaboration such as the OERu, courses developed in that context will likely be seen as closely tied to the institution from which those courses originated and that institution's curricular oversight.

Who are the learners? Traditional instructional design and development undertakes needs analyses to ensure a good understanding of the background of learners who might study the course under development and what skills they could bring, as well as how the course fits into the bigger picture of a program. Further, institutionally there are resources in place to assist students who require more support in meeting the entry requirements of the course. While the OERu model includes a support mechanism based on a combination of OERs, fee-for-service and volunteer models, these were not yet in place at the time of prototype development. Developers attempted to compensate by providing suggestions throughout the course as to options for finding resources to assist learners. To address this gap, a combination of flexible support models within the OERu and courses designed with features that encourage self-sufficiency in OERu students over the longer term should be considered.

Design pedagogies. Within the OERu, there was no pedagogical approach to course design and development that had been explicitly agreed to in advance across the partnership, and therefore no intentional sharing of learning designs and patterns outside of individual courses. Also at the individual course level, the sharing of learning designs as representations or design languages (Botturi et al., 2006; Masterman, Jameson & Walker, 2009), or as a symbolic distribution of intelligence (Perkins, 1992) was not noticeably evident in the development of *ART100: Art Appreciation and Techniques.* Nevertheless there were various pedagogical decisions expressed and modeled in asynchronous discussions both in the wiki and in email posts. One developer in particular found Salmon's (2002) E-Tivities sequences helpful and used them repeatedly in another OERu course. From the notes kept in the wiki of synchronous computer conferencing meetings among developers, most design decisions were made situationally, as Suchman (2009) has observed in planning contexts generally, in response to the nature of the content, what was understood of multiple options intended for various learners, tools available and some basic assumptions about digital and learning literacies.

Learner work spaces. Course development in traditional design and development typically is intended for delivery in either a centralized learning environment such as a learning management system (LMS), or more

decentralized in a combination of social networking tools such as blogs, microblogs and document sharing. A variety of tools is assumed such as discussion boards, e-portfolios and web conferencing, but in the open design and development of the prototype the availability of such tools was indeterminable. It is assumed in the OERu that courses will be developed in a manner that makes it as simple as possible for institutions to import or otherwise integrate the courses into their own learning environments. However, this assumption still leaves open the question of how the non-institutional learner will be served. One option is to decide on one primary model and build to that approach such that developers can be comfortably oriented in the design of OERu courses.

Sharing learning design "know-how." Collaboration was fundamental to the practice of open design and development. As with learning objects, the discussion on shareable learning designs in the literature review (e.g., Koper, 2001) described the perceived need for reusable learning content to be pedagogically designed and sequenced, with an appropriate mix of content and activities. Thus not only content but also design knowledge would need to be shareable in a wider open education ecosystem. The review of research in the sharing not only of content but also of learning designs, design patterns (Alexander, 1977) or learning design "know-how" (Dalziel, 2008) found translating learning designs from one setting to another was a complex matter. Yet research into distributed intelligence (Perkins, 1992) as well as mediating artifacts (Conole & Culver, 2009) points to how design knowledge can become more visible and thus shared in a communal work setting where collaboration is centred on representations open for discussion within the community. As noted by Dimitriadis et al. (2009), "making design more explicit will facilitate repurposing of the OER" (p. 201). Mediating artifacts include discourses and processes supporting coordination and negotiation or brokering between different domains within a community of practice (Wenger, 1999). While an "artifact appears to be a self-contained object, it is in fact a nexus of perspectives" (Zitter et al., 2009), a resource most important in a setting such as the OERu where the community is distributed globally. Mediating artifacts are both available for access by all and able to be negotiated and changed. The prototypes developed for stimulating discussions and negotiations toward consensus exemplified the concept of nexus of perspectives. They performed this function by serving first to generate, and then to record, discussions and decisions in brief summaries, in a manner to what Scacchi (2007) found in open

source software project and termed "lean descriptions" or "documentary artifacts" (p. 473). Similarly, brief descriptions of decisions had a similar function and were seen as critical to sharing an understanding of the learning design and other issues faced by the developers. The collaborative design and development process in the OERu was less involved in sharing designs as representations, patterns or languages, and more involved in a nonlinear and intuitive approach. This approach could be described as based on tacit knowledge as defined, for example by Kirschner et al. (2002) and LeMaistre and Weston (1996), shared more synchronously in the moment than over time as might occur with the use of learning design representations. Rather than highly planned approaches to design and the sharing of design knowledge, once the initial high-level parameters were established, design processes were based on heuristics within the design space (Dijkstra, 2001) such as those found in the planning pages within the wiki.

The autonomy of partner institutions in terms of learning design remained a priority in the OERu network and was established as the locus for design decisions. Yet as the body of developers grows, an increased effort toward sharing learning design ideas and experiences may help to provide nexus of perspectives (Zitter et al., 2009) with an opportunity toward increased sharing and idea generation across the OERu. New and creative design approaches must grow from the developer body working across the OERu to face the many challenges and unknowns documented in this study. A balance of dynamic design decision-making and intentional collaboration among developers in learning design will help to support such innovation.

Working with OERs. The 4 R's of OERs – the ability to reuse, redistribute, revise and remix contribute to the various degrees of openness of OERs (Hilton, Wiley, Stein & Johnson, 2010). Redistribution and revision were particularly challenging issues in working with OERs, given that much of the content to be repurposed needed to go through multiple format conversions in order to be readied for final formatting in WikiEducator. Developers found that for future projects, it is worth taking the time to assess OERs thoroughly from this perspective before undertaking their reuse in a new course project or alternatively place less emphasis on incorporating them into a new course and referring learners toward the resources *in situ.*

Having now addressed the eight points arising from the first part of the second research question, I now turn to the second part of the second research question italicized as follows.

What are the currently visible features of open design and development as indicated by practices and products in the OERu prototype course projects: (b) *as compared with similarly open software development (i.e. open source software)?*

Comparison of open design and development with OSS (open source software) projects highlighted a number of issues, which I address in a series of discussion points:

- Developer motivations
- Developer specializations
- Communication
- Late joiners
- Visible design rules
- Rapid prototyping
- A community of volunteers

Developer motivations. In the OERu, developers expressed a high level of commitment to the underlying principles and ethos of open education and worked beyond usual hours without pay to complete their project, in a manner similar to OSS developers (Baytiyeh & Pfaffman, 2010; Oberg, 2003). Also, in OSS, organizations may donate developer time in order to benefit directly or indirectly from the code under development (Dhalander & Wallin, 2006). To ensure a sustainable contribution to course development in the OERu, partner institutions wishing to contribute multiple courses over time to the OERu may benefit by treating development work for such projects as a part of the regular workflow of the design teams within the institution.

Developer specializations. Successful OSS projects attract sufficient developers with an appropriate array of skills or specializations to cover off the variety of design and technical needs in a course development project (Krishna Raj & Srinivasa, 2012), and over the longer term bring their experience to the project as mentors or administrators (von Krogh, Spaeth & Lakhani, 2003). The evidence gathered from the OERu wiki and communications points toward a similar challenge for the OERu. Developers reported that having to take on multiple roles, particularly those that would ordinarily be considered technical in nature such as page design, mark-up and production, diverted their efforts toward focusing on their design strengths. Further, they reported a concern that they had overextended the time they had available to work on the course.

While a certain degree of familiarity with the wiki environment is necessary for any wiki developer, engaging in more extensive course development was seen as somewhat onerous. Partner institutions of the OERu could consider an increased effort to recruit both internally and elsewhere a rounded team of developers to complete each course.

Communication. In OSS research it was found that successful projects had relatively well-developed processes for orienting new developers to the communication tools and practices that had proven to be successful in such environments (Chiu, 2002). This includes not only email lists, discussion boards, wikis and versioning tools, but also system-wide views and visible design rules or artifacts that promote the sharing of knowledge and intelligence. Similar tools were present in the OERu but communication habits of developers tended to spread information across the wiki and in scattered emails in a manner that made it difficult to retrace where key information could be found. Course development teams will benefit from establishing and maintaining clear guidelines for communication and documentation methods. These protocols were well documented in the wiki, and an orientation for new members would be beneficial, along with continuing reminders from more experienced developers.

Later joiners. Effective maintenance of OSS over time improves the quality of the project (Koponen & Hotti, 2005) but requires planning and organization. Above all, new developers who join the project later in its lifecycle need to be able to gain a sense of the project's history and organization quickly with the help, for example, of such factors as systematic naming conventions of files and logs (Stewart, Darcy & Daniel, 2005). Developers in the OERu prototype project similarly found it difficult to become oriented to the project in a short period of time, which would suggest practices similar to those in OSS that maintain a system for the support of new joiners in a course development project (Chiu, 2002). As noted by O'Mahoney (2007), "when code and community do not develop in parallel, the learning curve can be steep, which can affect external developers' ability and motivation to contribute" (2007, p. 142).

Visible design rules. One element in the success of open source software development (OSS) is the presence of visible design rules that guide a high-level view of the design process, while making knowledge of deeper levels of detail unnecessary (Hossain & Zhu, 2009). These may be further shared and discussed in discussion spaces in OSS development (Björgvinsson &

Thorbergsson, 2007). Similarly, Conole et al. (2013) emphasize the importance of social networking spaces where designers can discuss and share ideas on learning designs. Such spaces were in fact available in the planning sections of the OERu wiki. However, because development of learning designs was intended to remain the province of each institution and its developers rather than something shared across the partnership, a robust learning design discussion space did not fully emerge. However, rather then become lost in individual exchanges scattered across emails and wiki "talk" pages, a concerted effort to concentrate this discussion could have the potential to create a shared body of knowledge on effective learning designs for the OERu project or similar open design and development contexts.

Rapid prototyping. Rapid prototyping is common theme in OSS development, as indicated by the adage "release early, release often" (Raymond, 2000). This is an effective process in that code can be tested for early for flaws and rapidly modified for subsequent release, iterating toward increasingly robust software. It is not quite so easy to do the same in open design and development, as testing components of courses out of context of the full course is unlikely to provide meaningful information back to the developers. An alternative is to develop OERu courses as series of three or so "micro-courses" which would be full-featured but small courses that could individually be rapidly tested, improved and recombined building-block-wise with other micro-courses into courses with all parts tested. Full course development tends to be a longer-term project not easily decomposed into smaller parts for testing.

A community of volunteers. Maintaining a robust community of volunteers is a critical component in the success of OSS projects. Because there was a high attrition among the initial OERu developer recruits, there were fewer developers and other volunteers involved in completion of prototype courses by the final stages of the prototype course than desirable. In OSS some attrition occurs because of skills barriers; e.g., a programming language that is out of the skill range of potentially interested contributors (Krogh, Spaeth & Lakhani, 2003). Also, volunteers who aren't engaged don't stay around for a long time in both OSS and in the OERu (Xu, Jones & Shao, 2009), which would indicate that when new projects in open design and development are started, it would be helpful for a core of developers to have an advance plan in place to assist in directing volunteers to appropriate tasks and or mentoring and thereby intentionally continue to build the developer community.

CONCLUSION

In this study I have focused on prototype course development using open design and development in the Open Educational Resource university network. The genesis of this practice was rooted in a deeper philosophy of making knowledge and also, potentially, higher education credentials more freely available to learners around the world. The latter hold out promise particularly for those in the developing world facing increasingly prohibitive costs as well as insufficient numbers of institutions to meet their needs.

In order to study the phenomenon of open course design and development, I needed first to narrow the scope to one stage of the OERu logic model, second to contrast this bracketed phenomenon against traditional instructional design in a higher education context, and finally to find a field for comparison where similar "open" development was occurring. The topic was eventually named "open design and development" and in the end OSS appeared an effective phenomenon for comparison. This was due to many similarities to open design and development, including such development of complex products in open collaborations, the use of open licensing along with contributions and the sharing of work by a body of volunteers. Because of its extensive history, with some very well established successes, OSS had the potential to provide insights into the OERu's processes around open design and development.

I documented the development of new efforts toward providing increased access to higher education educational content enabled by open courseware, open educational resources, various forms of open online courses including MOOCs and more broadly the continuing expansion of information and communication tools enabled by the Internet. Possibilities for developing alternative models for providing increased access to higher education have expanded.

The initial days of open courseware in the early 2000s started a move toward making educational materials available freely on the Internet, although at that time there were few initiatives to obtain formal assessment and credit for their study by student users. The birth of the term "open educational resources" at the same time opened up a new awareness of the many different opportunities enabled by the four R's of OERs, i.e., the ability to reuse, redistribute, revise and remix learning content and related materials and tools such that they can be incorporated in different contexts and freely adapted for new circumstances. Further, new ways of sharing pedagogical "know how"

with the use of learning design languages, patterns and other representations could empower more content developers and educators to rework OERs into new and well-designed OER-based courses and programs.

The specific direction the OERu has taken in response to OERs has been to develop a network of existing institutions of higher education that would commit to apply some of their own resources both to develop OER-based courses and to endeavour to offer assessment and credit as well as other possible services to learners. The main focus, however, is on obtaining credit from partner institutions for courses taken through the OERu, with the goal of free or low cost credentials and degrees. With the experience gained from the history of open source software development and from OERu prototype development, open design and development may well become an indispensable part of the process of converting OERs into credentials and degrees in an open ecosystem. Today there is increasing visibility of alternative forms of offering university credit for by through such entities and processes as exam providers, prior learning assessment and recognition (PLAR), educational credit banks and credit exchanges all of which may be of benefit to OERu learners. However, there is also a great need for well-designed OERs that prepare students to achieve such credit, beyond the didactically oriented MOOCs and open courseware that is highly visible on the current higher education landscape.

As documented in this study, there are also challenges which are still very much with us today, and skills of developers working collaboratively in open design and development have the potential to make an important contribution to OERs and open education, and to learners who may benefit from such opportunities.

I believe the most important thing I learned in this study is the importance of community-building in the OERu. While other aspects described in the study have their place and importance, any individual or small team of developers intending to embark on a course development project such as those required by the OERu needs to focus on recruiting and nurturing a community of volunteers with the motivation and array of skills to complete a project successfully and without overextending any individual volunteers. If I could undertake the study again, the question of volunteers, their initiation, motivation and persistence would take front stage.

Limitations of the Study

In this comparative case study research design, as outlined in Chapter 3, direct comparisons could not be made between several aspects of the OERu and Freenet comparator case studies, owing to the fact that the former case has a number of unique features that would not be found in any other case studies. To address this limitation, similarities and differences between the case studies were explained in the research methods section of Chapter 3. Nevertheless the comparisons provided many fruitful areas for the development of insights into the OERu open design and development process that may well not have come to light otherwise.

This study was conducted at an early stage in the growth of the OERu, and it was necessary to limit the discussion to developments occurring during the intended study period. Further, over the approximately two years of time where active research was conducted into the case, there was a sudden and rapid expansion in other efforts elsewhere to provide low-cost or free educational opportunities by universities, consortia, not-for-profit organizations and venture capitalists, with the phenomenon of MOOCs gaining particular attention. These developments continue to evolve at the time of this writing and generate much discussion as well as criticism. It was outside the scope of this study to incorporate detailed discussions about these developments, which at the time of this writing were still emergent and undergoing rapid transformations. It was therefore not feasible to blend points of comparison and contrast from this comparative case study to these other cases or initiatives.

While the data collection process in this study included large quantities of documents from the OERu project, the interviews were limited to a small group of individuals involved with open design and development in the OERu. However, as explained in Chapter 3 these individuals were selected as key informants and the data collected during the interview process was triangulated against other data during the analysis stage of research.

Recommendations for Further Research

This study identified the importance of the credit-granting policies of partner post-secondary institutions in the design and development of courses within the OERu, as well as knowledge about possible characteristics of OERu learners. Because of the need to ensure that participating institutions would be

able to provide credit for OERu courses, the initial planning of courses as well as the more detailed development process was biased toward a more traditional instructional design approach, focusing more on detailed planning than on a more emergent and open-ended approach. A topic for further research then would be to develop a greater understanding of the willingness and ability of partner institutions to provide more flexible options in recognizing credit from courses or other learning experiences provided through the OERu and thus allowing for more innovative learning design strategies for developers and more study and learning options for students. And, finally, what can be learned from MOOCs in this regard?

The role of developers and availability of a variety of skill sets or specializations arose as an important consideration in the design and development processes underlying the OERu. An investigation into the broader body of OERu developers, both those who initially put their names forward but did not become further involved, and those who were involved more broadly in the OERu or WikiEducator, would have the potential to generate insights into how to increase participation and possibly suggest more ways to encourage, support and grow the body of developers over time. Further insights might be gained from discussions with other successful open education projects based on the work of developers. Research in the motivation and management of volunteers from the business or not-for-profit fields could also applied to the present topic.

WikiEducator is one of many wikis used for collaboration for educational purposes. With the continuing evolution of learning management systems, and evolving concepts in personal learning networks, continuing research on the roles of wikis and other social networking tools in education would be of much benefit. In particular, ways in which wikis can be combined with other social networking tools in an open education setting would be helpful. Particular areas of emphasis could include navigation for both developers and learners within the wiki environment, and how wider syndication and other forms of connectivity could be promoted in support of development and learning. Because of its massive growth and success, perhaps research on Wikipedia could be included in this discussion in relation to the potential of the OERu.

As learners become engaged in the OERu project, research into their perceptions and challenges would be helpful in improving the design and development of learning content and strategies. The use of learning analytics

mined from the wiki as well as through analysis of interactions internally and externally could bear much fruit, and there are indications that MediaWiki has analytic capabilities in its roadmap for future development. Again Wikipedia is making particularly large strides in this direction.

While the review of literature provided a context and history for the OERu and its features, the more recent literature in learning design, with a few exceptions, seems based mainly on theories, abstract models and ontologies, analogies and relatively small, one-off projects. The earlier literature in instructional design practice, particularly with an ethnographic or other situated approach, appeared to reflect the ways instructional designers actually go about their work and is certainly worth an update in the field. Work in the more socio-technical vein also seems a promising route for future research, i.e., progressing toward a deeper understanding as to the interactions between mediating artifacts, rules, community and other elements of an activity system and how they might help in better describing the processes and features of the OERu developer community.

Further study could be undertaken into such approaches to design as "hackathons" where clusters of developers spend a short period of time in intensive collaboration, over perhaps a weekend or a week, to build a project such as a course. This model could be explored in particular in relation to developing mini-courses worth possibly one credit instead of three.

As I progressed more deeply into this study, I began increasingly to believe that research in design fields — and it is clear that open design and development fits that category — holds much promise in researching design problems and methods for solving them specifically in education. At present most of this work must be borrowed from other fields, such as computer science and architecture, but the opportunities for adapting these to educational projects and priorities may hold enormous promise.

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