1-1-2016

Using R2d2 To Create Information Literacy Objects In Academic Libraries: Design-Based Research

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USING R2D2 TO CREATE INFORMATION LITERACY OBJECTS IN ACADEMIC LIBRARIES: DESIGN-BASED RESEARCH

by

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DISSERTATION

Submitted to the Graduate School

of Wayne State University,

Detroit, Michigan

in partial fulfillment of the requirements

for the degree of

DOCTOR OF PHILOSOPHY

2016

MAJOR: INSTRUCTIONAL TECHNOLOGY

Approved By:

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Advisor   Date

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DEDICATION

This is dedicated to mon cher Michel-e,

Michael Jon Lavoie, 1953-2016

Without whose love, support and belief in me this would not have been

Thank you for the blessing of loving and being loved by you

May I be the person you saw with your beautiful, loving eyes

Maam nonga fo wuwuwusego

ACKNOWLEDGMENTS

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CHAPTER 1 INTRODUCTION

Introduction to the Problem

Academic librarians are increasingly called upon to create information literacy (IL) objects for online learning, thus it is important that they use effective instructional design principles to guide them in their efforts to maximize the learning experiences of the users of these IL objects. Using instructional design (ID) principles as regular practice by academic librarians is an emerging issue in the creation of objects used for online literacy instruction; however, there is insufficient preparation of librarians for this instructional task. A large number of academic librarians are responsible for instruction but most have only a limited knowledge of pedagogical theory and instructional design. The use of instructional design principles can help bridge that gap (Davis, 2013).

A small field of literature is available which addresses the use of ID principles by academic librarians when designing online information literacy objects. Most of this small body of literature erroneously uses ADDIE as a design model. In the field of instructional design ADDIE is considered a framework (Bichelmyer, 2005). The mnemonic ADDIE is used to identify early instructional design procedures and emphasizes the five core elements of the ID process: analyze, design, develop, implement, and evaluate (Richey, Klein, and Tracey, 2011). While some of the body of literature addresses the importance of using an instructional design (ID) model when creating instruction, little research has been conducted in the field of academic librarianship which examines the best practices or strategies for creating IL objects.

The dearth of training of academic librarians in online learning and the lack of an instructional design model to guide the creation of IL objects begs for research which will help identify best practices for these purposes. Merrill's First Principles of Instruction will introduce

instructional design principles and Bonk and Zhang's R2D2 framework, which organizes online instruction by four identified phases of learning activities and considers learner needs and preferences will provide the tools necessary for academic librarians to create IL objects. This design-based research study will explore the tools and activities available in the Web of Learning which can be a guide for academic librarians to create IL objects for online instruction. The study will endeavor to discover recommendations for best practices and future implementation and incorporation by academic librarians of Merrill's First Principles of Instruction and R2D2.

Statement of the Problem

Academic librarians are increasingly called upon to create objects for IL instruction which will be used for online learning. Since few academic librarians have had formal training in either face-to-face or online instruction, it is imperative that design principles are identified which will be most effective when creating IL objects for use in online instruction. This study will explore the use of Merrill's First Principles of Instruction and the R2D2 framework by academic librarians when creating objects for online instruction in information literacy.

Purpose of the Study

The purpose of this design-based research study was to explore the role of instructional design principles using Merrill's First Principles and R2D2 to increase academic librarians' awareness of said design principles and learner preferences when creating IL objects. The framework of the study is Bonk and Zhang's Read, Reflect, Display, Do Model (R2D2) which "integrates various learning activities with appropriate technologies for effective online learning for a diverse array of e-learners (Bonk & Zhang, 2006, p. 249).

Research Questions

For the purpose of this study, the following questions will be addressed:

1. Does the use of Merrill's First Principles facilitate the design of information literacy objects for online instruction? If so, how?

2. Does the use of R2D2 facilitate the design of information literacy objects for online instruction? If so, how?

3. Does consideration of learner preferences facilitate the design of information literacy objects for online instruction? If so, how?

4. How does the IL Object Design Guide facilitate the design of information literacy objects for online instruction?

Definition of Key Terms

For the purpose of this research study, the following definitions will be used:

1. *academic library and academic librarian*- libraries affiliated with institutions of higher learning such as community college, undergraduate and graduate schools and the librarians who work at those libraries.

2. *design-based research*- "combines research, design , and practice into one process, resulting in usable products that supported by a theoretical framework" (Bowler & Large, 2008, p. 39).

3. *information literacy*- "Information literacy is the set of integrated abilities encompassing the reflective discovery of information, the understanding of how information is produced and valued, and the use of information in creating new knowledge and participating ethically in communities of learning" retrieved from: http://www.ala.org/acrl/standards/ilframework

4. *instructional design*- "the science and art of creating detailed specification for the development, evaluation, and maintenance of situations which facilitate learning and performance" (Richey et al. p. 3).

5. *learner preferences*- in this particular study the term refers to the learning activities preferred by learners in the four phases of R2D2.

6. *learner needs*- in this particular study the term refers to the diversity of online learners and encompasses age, comfort and experience with digital tools, prior learning, gender, race, socioeconomic status and the individual needs created by this diversity of learners.

7. *learning object*- "small instructional components that can be reused a number of times in different learning contexts" (Wiley, 2000, p. 144). "...quick items of instruction or information...designed to support the learning objectives of the course or training module and at times become the primary means of delivering the lesson. The whole premise of a learning object is developed around four basic goals; reusability, interoperability, durability, and accessibility" (Keown, R., 2007, p.75).

8. *Read Reflect Display Do* (*R2D2)*-"a practical model, or framework, not an instructional design model…to help online instructors integrate various learning activities with appropriate technologies for effective online learning for a diverse array of e-learners" (Bonk & Zhang, 2008, p. 4)

9. *Web of Learning*- "learning related uses of online resources and technologies" (Bonk and Zhang, 2008, p.v)."a plethora of educationally relevant and continually evolving resources, tools, and learning materials, a focus on what is available online" (Bonk & Zhang, 2008, p.1).

Theoretical Framework

This study was informed by the research and theory of the field of instructional design, especially Merrill's First Principles of Instruction. Merrill's First Principles of Instruction, which were identified after an exhaustive review of instructional design theories, are prescriptive design principles common across different instructional design theories and models. Merrill's First Principles of Instruction are:

1. Learning is promoted when learners are engaged in solving real-world problems.

2. Learning is promoted when existing knowledge is activated as a foundation for new knowledge.

3. Learning is promoted when new knowledge is demonstrated to the learner.

4. Learning is promoted when new knowledge is applied by the learner.

5. Learning is promoted when new knowledge is integrated into the learner's world.

   (Merrill, 2002, p.43)

The interrelation of Merrill's First Principles of Instruction is a four-phase cycle consisting of activation, demonstration, application, and integration. For instruction to be effective it should include each of these activities which can be repeated as necessary (Merrill, 2002). Awareness of the cyclical nature of these principles will be fostered for the academic librarians through the iterative nature of design-based research using the framework of R2D2 to guide the creation of IL objects for online instruction. Merrill's First Principles of Instruction were chosen as the instructional design cornerstone to guide this research because they are commonly prescribed in instructional design theories and models, are intentionally general and have innumerable variations (Merrill, 2002). This generality allows the principles to be applied in diverse instructional settings and using diverse instructional products; hence, it will be highly

relevant for academic librarians applying design principles and using R2D2 as a framework to create IL objects for online instruction.

Bonk and Zhang's R2D2 model is not an instructional model. It is a framework or lens which provides instructors a focus while using Web of Learning activities. Addressing learner preferences using the infinite resources and activities available within the Web of Learning empowers students to achieve their goals. R2D2 proposes an integration of four types of learning activities: (a) Reading/Listening; (b) Reflecting/Writing; (c) Displaying: and (d) Doing (Bonk and Zhang, 2008). Each of these four types of learning activities is aligned to a specific type of learner preference. Read is for auditory and verbal learners who prefer words, spoken or written explanations. Reflect is for reflective and observational learners, who prefer to reflect, observe, view, and watch learning: they make careful judgments and view things from different perspectives. Display is for visual learners who prefer diagrams, flowcharts, timelines, pictures, films, and demonstrations. Do is for tactile and kinesthetic learners who prefer learning by active doing, experiencing, hands-on and often also group work (Bonk and Zhang, 2008).

Merrill's First Principles of Instruction will serve as the instructional design lens through which this design-based research will be conducted. Bonk and Zhang's R2D2 will serve as the framework to guide the creation of IL objects for online instruction which address learner preferences and harness the vast resources available on the web of learning to empower learners.

Rationale and Significance of Study

The figure below represents the separate fields of instructional design and academic librarianship and the common elements which serve as a bridge between. This study will serve to highlight these common elements to academic librarians resulting in greater incorporation of

instructional design principles and R2D2 framework by academic librarians when creating IL objects for online instruction.

INSTRUCTIONAL DESIGN: ACADEMIC LIBRARIANS:

Subject Matter Expert: Create Instruction   Subject Matter Expert:

Instructional Design   Use Web of Learning   Information Literacy

R2D2
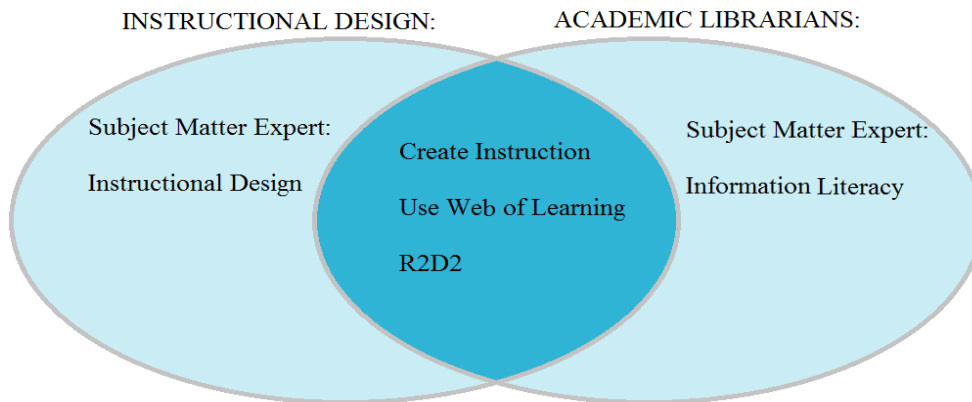
Figure 1. Instructional design and academic librarian commonalities

Limitations

Limitations of this study might be the lack of a sufficient number of librarians with the time and/or willingness to participate in study. The librarians may not understand the principles of instructional design, may not see the need to use a framework which incorporates learner preferences when creating IL objects for use in online learning, or may believe the solution rests not in a revised IL object, but rather with revised learning habits by the user. Another limitation of the study is the short life span of IL objects because of the rapidly changing nature of the web of learning and factors such as platform host, compatibility conflicts, and device neutral design considerations.

Summary

Academic librarians are increasingly called upon to create information literacy objects to be used in online learning for an ever diverse student population. Academic librarians have had little training for instruction, especially in online learning, so a clear need exists for guidance in

this task. Utilizing instructional design principles could help guide them to more effectively create IL objects. Using Merrill's First Principles of Instruction to inform the use of R2D2 as a framework, the knowledge of instructional design principles and adoption of practices of academic librarians will increase as they become more aware of instructional design principles while simultaneously practicing them when using R2D2 in their creation of IL objects.

CHAPTER 2 LITERATURE REVIEW

Introduction

This review of literature will look at the practices of academic librarians at libraries of institutions of higher learning such as community colleges and universities. The topics of this literature review include the need for the creation of learning objects for online information literacy instruction; academic librarians' preparation for instructional activities or lack thereof; learner differences and preferences and why they must be addressed in the creation of IL objects; and the importance of using instructional design models for the creation of online IL objects.

Need for IL objects in online learning

Online learning is now a ubiquitous element of post-secondary education. In 2013 there were 6.7 million students taking at least one online course in the United States (Allen & Seaman, 2013). Regardless of the type of program or institution in which a student is enrolled- distance, blended or face-to face learning-most students experience an element of online learning as part of their post-secondary education. The use of course management systems and online access to university supports and programs such as academic libraries is predominantly the norm. This makes virtually all students online learners at some point in their education regardless of the type of learning program in which they are enrolled.

As early as 2004 it was recognized that remote access to library resources was becoming a significant issue for academic libraries for two main reasons-the expansion of online learning and increasing expectations of students to be able to access library resources electronically (Tobin, 2004). Indeed, Su and Kuo (2010) further emphasize the need for online learning because of shrinking resources and flourishing distance learning which can provide a cost-effective solution for the diverse information literacy needs of college students. Diverse information literacy needs

of students vary depending on factors such as familiarity with their institution of higher learning, previous experiences with digital media and their comfort with online learning (Kumar, Ochoa, & Edwards, 2012).

Information literacy is more than just digital access to library holdings. The Association of College and Research Libraries defines it as: "Information literacy is the set of integrated abilities encompassing the reflective discovery of information, the understanding of how information is produced and valued, and the use of information in creating new knowledge and participating ethically in communities of learning." Retrieved from http://www.ala.org/acrl/standards/ilframework.

Students need to be instructed in information literacy and the vehicle for that process in online learning is termed an information literacy (IL) object by academic librarians. These IL objects, created by librarians, are reusable, digital, and often web based instructional resources used to deliver instruction. (Mestre et al, 2011). IL objects have many purposes some of which are to provide instruction, measure prior knowledge, individualize learning, provide practice of skills and ultimately stretch thinned financial and human resources (Mardis & Ury, 2008).

Increasingly, students are confident in their ability to use technology, but often use only internet search engines for scholarly research. They lack the literacy skills necessary to evaluate the information found online. This has been referred to as the "Google effect" (Brabazon, 2006). This "effect" often results in the students using the first few "hits" of an Internet search with no differentiation between fact, opinion and scholarly research (Frand, 2001). This documented habit further emphasizes the need for information literacy instruction which is increasingly accomplished through IL objects.

Despite a student's high confidence level with technology, IL objects are necessary because of the intricacies of using library resources such as electronic databases, Boolean search terms, etc. Good information literacy instruction also encompasses evaluating resources, plagiarism, style manuals, Libguides, etc. IL objects can be created which help students learn better and maximize their academic experience. Good IL objects will help students succeed academically and incorporate the traits of lifelong learners. Examples of IL objects include, but are not limited to podcasts, tutorials, blogs, surveys, quizzes, and screencasts. In 2015, aware of the research habits of younger students and their changing role and responsibility in creating new knowledge, the Association of College and Research Libraries issued a new Framework for Information Literacy for Higher Education consisting of six information literacy concepts. The six concepts which anchor the Framework are:

1. Authority Is Constructed and Contextual

2. Information Creation as a Process

3. Information Has Value

4. Research as Inquiry

5. Scholarship as Conversation

6. Searching as Strategic Exploration (ALA, 2015). Retrieved from http://www.ala.org/acrl/standards/ilframework

Simply being aware of the Framework for Information Literacy or providing online access to library resources is not enough to make students information literate and lifelong learners. Students must be instructed in information literacy using the resources of the web of learning so they are able to fully utilize the library resources thus maximizing their academic success and ability to continue to learn throughout life. By developing learning objects which incorporate web

of learning tools librarians actively engage students using learning activities which guide the students to mastery of information skills (Mestre, 2011). However, creating IL objects for online learning is not enough to guarantee information literate students. To be truly effective, academic librarians must create IL objects for online use which not only provide introduction to and practice of information skills but are reflective of learner differences and preferences.

Learner differences and preferences

Students at post-secondary academic institutions are quite diverse and this diversity is reflected in their learner preferences. The typical undergraduate student who attends university soon after graduating from high school is very different from an older student who is either attending university for the first time or who perhaps left academia a number of years ago and is returning for further training for workplace advancement or a career change. A student's information literacy needs are a result of several influences such as familiarity with the educational institution, prior experience with digital resources and comfort with online learning (Kumar, Ochoa, & Edwards, 2012).

Regardless of their comfort level and experience with online learning, students have a variety of learner preferences. Some learner preferences are generational and all reflect the learner's previous knowledge and experience in addition to the diversity of demographics in gender, race and socioeconomic status. Educators who are aware of learner preferences have the ability to be flexible in the choices they make when creating IL objects. (Mestre, 2010).This flexibility answers the learning needs presented by various learner preferences.

Younger students who have recently graduated from high school are often referred to as digital natives, or depending upon their age, Generations X and Y and Millennials. The term digital natives refers those who have been born in the digital age, which began in the late 70's, and was

followed by the exponential growth of information with the advent of the internet in the 90's. They are for the most part immersed in digital activities in their daily lives socially, for communications, for music and for education (Ng, 2012). Such students have grown up with digital devices and use them more intuitively than previous generations. They are usually more comfortable with using the web of learning and most likely have already done so in educational settings.

Returning students and older students from generations before the digital natives have different experiences with technology than their younger classmates. While they have more life experiences and prior knowledge to draw upon, their confidence and experience with using the web of learning is usually less than that of digital natives. Adult learning, andragogy, is also different than the pedagogy of child learning. Adults learn better when previous experiences are relevant for new learning, when they can use internal motivation to learn and when instruction includes active learning (Stern, C. & Kaur, T., 2010). Even when these older students do consider themselves technologically savvy, they often lack the information literacy skills and experience with scholarly databases to access or critically analyze their search results (Kumar, Ochoa, & Edwards, 2012).

Understanding the diversity of student learning preferences is an advantage for academic librarians and will aid them when creating IL objects. Considering learner preferences helps librarians create pedagogically sound IL objects (Mestre, 2010). The advantage for academic librarians to understanding student learning preferences lies in their ability to help students find information and interact with and process that information. An awareness of learning preferences presents flexibility for librarians when creating IL objects (Mestre, 2010). The multitude of web of learning tools and instructional approaches when creating IL objects increases the opportunities to reach students with a variety of learner preferences (Nicholson & Eva, 2011). Luo (2010)

emphasized, after studying integration of Web 2.0 technology in information literacy instruction, that librarians who developed a keen sense of students' needs were better equipped to choose the best web of learning tools when creating IL objects.

Befus and Byrne's (2011) study Redesigned With Them in Mind: Evaluating an Online Library Information Literacy Tutorial IL further highlights the need for awareness of learner needs and preferences when designing IL objects. The results of the redesign of WSU's IL tutorial, known as Searchpath were disappointing based on assessment of student learning, satisfaction and confidence indicators. Explicitly, the study's conclusion is that there needs to be additional research into how IL objects can be refined so they have a more effective learning rate among the end users. Implicitly, the study supports the notion that even the most smartly and extensively designed IL object cannot be made suitable for all. The study highlights the diverse range of the learning preferences of the student population and makes clear the need for some customization. Indeed, the cumulative message from this study, if not of most of the literature on this subject is that, when it comes to IL objects, one size does not and cannot fit all. The results of the Befus and Byrne's study explicitly and implicitly support the need for further research on effective methods of creating IL objects, especially using methods which consider leaner preferences as R2D2 does.

Mestre's 2010 survey of academic librarians further supports the need for a greater awareness of learner types and preferences when creating IL objects, "Only 6% of the respondents indicated that they develop their learning objects to accommodate all modalities of learning" (p. 820). In the same survey respondents reported choosing tools to create IL objects based on personal learning style, ease of usage or availability. These practices and attitudes demonstrate a need for a framework to guide academic librarians when creating IL objects for online use which incorporate activities that appeal to and challenge the four type of learners identified by Bonk and

Zhang. Successfully creating IL objects tailored to various learner preferences promotes better information literacy skills (Rapchak & Behary, 2013).

Academic librarians' preparation for instruction and creation of IL objects for online learning

Academic librarians are increasingly called upon to create IL objects for online use for students in programs which are distance, blended or face-to-face. As such, librarians are often the only instructors for students in information literacy and thus it is significant that they have both the training and the tools for success (Mestre, 2010). However, few librarians have training in any type of instruction, let alone in online learning. In a recent study by the Online Learning Research Committee of the Educational and Social Sciences section of American College and Research Libraries only 28% of 92 librarians surveyed had previous coursework or a degree related to teaching. (Mestre et al., 2011). Mestre et al.(2005) also reported the librarians have minimal formal training or for creating IL objects. As a result of this dearth in preparation for instruction, academic librarians lack the skills and background in instructional design to effectively use the web of learning to successfully create online literacy objects which will both maximize student academic success and create lifelong learners. To best achieve integration of good IL skills in students incorporate sound principles instruction and educational theory, design and practice (Johnson, 2006).

Online teaching and learning is very different from a face-to-face instruction encounter. Online learning differs in many ways from face-to-face instruction because of the plethora of tools and activities which are available for use in the web of learning. Using principles of instructional design models greatly improve the effectiveness of IL objects for online use by students which will have the result of better overall student success and achievement. Design principles consist

of more than simply transferring face-to-face instruction to an online platform (Mestre et al., 2011). In an Education and Behavioral Sciences Section's Online Learning Research Committee survey, "respondents indicated a need to learn how to work with tools to effectively engage learners and promote learning" (Mestre et al., 2011, p. 237). This study has brought to the forefront the need for training of academic librarians in best practices and sound design principles for creating IL objects for online instruction. The authors of this study concluded that IL objects which are created using pedagogically sound design principles afford students a variety of ways to learn. This conclusion reinforces the need for both training of academic librarians in creating IL objects and the use of sound design principles in that creation.

Shank and Dewald (2012) found in their survey of academic library administrators' perceptions of four instructional skills that the responsibilities of librarians have grown markedly because of evolving instructional technologies and the expansion of information literacy. However, in that same study, academic library administrators ranked instructional design skills the lowest importance as a knowledge domain in Future Newly Created and/or Redefined Positions in their libraries. Starting at the administrative level, neither the instructional design skills nor the training to use the educational technologies required for creating IL objects for online instruction is valued or encouraged. This serves as further evidence that training of academic librarians to create IL objects is a pressing need.

Use of design principles by academic librarians in creation of IL objects for online learning

The use of instructional design models by academic librarians for the creation of IL objects is limited based on recent reviews of current literature. IL objects lack goals and ignore learner preferences when instructional design principles are not used. Using instructional design principles ensures IL objects have clear instructional goals and learner preferences are considered which

results in more active engagement by students (Davis, 2013). As Davis suggests above, there is growing awareness of the advantages of using instructional design principles when creating IL objects; however there exists scant literature or research that examines or supports this practice. ADDIE, which is considered only a framework, not a model, by the instructional design field, is most often referenced in literature pertaining to design and IL object creation (Koneru, 2010; Davis, 2013; Farmer, 2011).

Recent articles on information literacy in academic libraries examine Web 2.0 technologies and the web of learning but do not examine what, if any, instructional design principles were used by the academic librarians who used the Web 2.0 technologies and web of learning in the creation of IL objects. (Hew & Cheung, 2012; Magnuson, 2013; Su & Kuo, 2010; Luo, 2010). Both Su and Kuo (2010) and Luo (2010) studied Web 2.0 technology integration and found advantages to using the web of learning for information literacy instruction. Yet neither addresses the use of instructional design practices to effectively implement Web 2.0 tools which are part of the web of learning. These studies are evidence of a growing number of academic librarians who are using the web of learning to create IL objects, but they are doing so without an instructional design model or framework to guide them in their decision making and creation.

Magnuson's 2013 study titled "Web 2.0 and Information Literacy Instruction: Aligning Technology with ACRL Standards" serves as an example of the above mentioned deficiency in much of the creation of IL objects-a lack of instructional design principles when creating IL objects for instruction. Although the author examined potential use of Web 2.0 technologies for information literacy instruction, the term Web 2.0 technologies is somewhat misleading in its scope. The study was limited to four tools within a course management system and did not examine any elements of instructional design principles. The study concluded that choosing proper Web

2.0 tools is important when creating IL objects but provides no instructional design principles. The advantage of R2D2 is that it provides a framework for academic librarians when creating IL objects using these and other tools from the web of learning while providing options which are sensitive to learner preferences.

Recently, a model for embedded information literacy instruction was proposed which has some applications for academic librarians when creating IL objects. Mullins (2014) IDEA Model was designed for embedding information literacy instruction into academic courses and was specifically intended for use at the author's university. Although the author considers limitations of the model are that it was beyond the scope of individual IL objects and it did not focus on a particular delivery method, her conclusions support the need for the use of design principles by academic librarians when creating both embedded instruction in information literacy and IL objects (Mullins, 2014).

Many of the above mentioned design models have limited application and are effective for creating basic IL objects using only screen casting tools such as Camtasia. However, there are many other methods of instruction and tools which can be incorporated in IL objects. Bonk and Zhang's R2D2 is well-suited for the creation of IL objects because of the unique and useful way it provides a framework for instruction. Bonk and Zhang's R2D2 is a framework using design principles which by addressing learner needs and preferences students are better able to express themselves in different ways and for different types of learning.

In summary, academic librarians at institutions of higher learning are being called upon to create IL objects for distance learning. They often have received little or no training in instructional design principles or online learning so there is a great need for guidance to increase their awareness of and use of instructional design practices to produce high quality IL objects. The students using

these IL objects have diverse learning needs and preferences, which need to be addressed when academic librarians are creating the IL objects.

CHAPTER 3 METHODOLOGY

Introduction

The purpose of this design-based research study was to examine the use of instructional design principles by academic librarians using Merrill's First Principles and Bonk and Zhang's R2D2 (2008) as a framework to develop IL objects for online learning. The goal of this design-based research study was to promote greater awareness of instructional design principles and the benefits of using the framework of R2D2 which is cognizant of learner preferences. The use of an iterative approach to design, implementation and evaluation will result in increased awareness of academic librarians of instructional design principles, the usefulness of R2D2 and the importance of considering learner preferences to create better IL objects.

The following sections provide a description of the study's research methodology and details of: (a) rationale for designed-based research, (b) setting and participants, (c) research design and (d) data collection method. Before proceeding with this study, I obtained permission from Wayne State University's Internal Review Board and met any additional requirements needed to conduct my research.

Rationale for Design-Based Research

The research design for this study was design-based research. Design-based research was chosen because of its distinct characteristics, most notably collaboration between the researcher and practitioners in the field to achieve research goals that adequately address the complex nature of the problems presented. This collaboration between researcher and practitioner extends to not only the understanding of the problem but also to the design, development, implementation and evaluation of the results of the research. (Barab & Squire, 2004).

Bowler and Large (2008) recommend design-based research as a method of study for researchers and professionals in library and information science. There are three reasons for this recommendation. The first reason is a growing awareness among professionals of the role social and cultural contexts play to influence the information literacy behavior of users. The second reason is a shift in the field to designing information services and products which are user-centered. The third reason the authors recommend design-based research for use by professionals in library and information science is the increasing interest of librarians in practices which are evidence based and supported by scholarly research.

The clear lack of the use of design principles by academic librarians when creating IL objects and the dearth of applicable theoretical frameworks for practice was another indication that design-based research was appropriate for this study (Wang & Hannafin, 2005). The two fold need of academic librarians for both an increased awareness of instructional design principles (theory) and their application (practice) in creating IL objects created the perfect synergy for using design-based research in this study. With design-based research, simultaneous refinements of both theory and practice occurred through the iterations and subsequently refined applications so that new theory and educational practices emerged reciprocally (Bell et al, 2004). Introducing academic librarians to Merrill's First Principles and R2D2 through design-based research further demonstrated the advantages of using instructional design principles in tandem with the practical advantages provided by R2D2 to create IL objects. In design-based research the theory and practice are iterative, participative and situated thus, the design and research activities cannot be conducted separately (Wang & Hannafin, 2005).
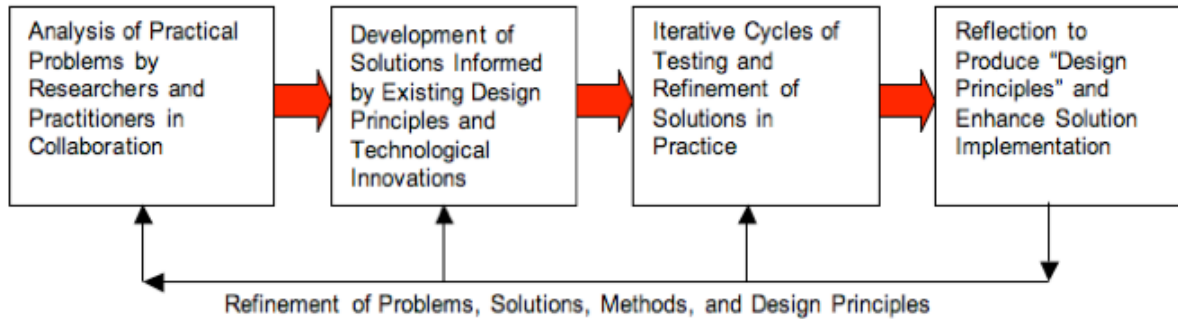
Figure 2. Design-Based Research Model

Note: Adapted from Design research from a technology perspective by Reeves, T. C. (2006). In J. V. d. Akker, K. Gravemeijer, S. McKenney & N. Nieveen (Eds.), *Educational design research* (pp. 52-66). UK: Routledge.

Setting and Participants

This design-based research study was conducted with librarians from two academic libraries of an urban university located in a large city in the Midwest. Wayne State University is the third largest university in the state of Michigan, with an enrollment of over 27,000. Located in the heart of the museum and cultural center in Midtown Detroit, WSU is Michigan's only research intensive urban university. At Wayne State, 89 percent of undergraduate students come from the Metropolitan Detroit area. However, WSU is the most diverse university in Michigan, with students representing 49 U.S. states and more than 60 countries. More than 46 percent of WSU's student population is minority. The university is divided into 13 distinct colleges and schools, offering more than 400 academic programs including the College of Education, School of Business Administration, College of Engineering, a Medical School and Law School. Degrees are awarded at the bachelor, master, and doctoral levels ("About WSU, Fact Book 2015", n.d.). There are eight libraries at WSU. These libraries are an undergraduate library, a graduate library, a law library, a medical library, a science and engineering library, a business library and two extension campus libraries. The libraries at WSU serve both undergraduate and graduate students. They have a digital

collection of resources and rich archives which can be accessed online. Participants in the study are librarians at the Purdy-Kresge and Undergraduate academic libraries located at Wayne State University. These librarians create IL objects for online learning for students which are accessed through the library's internet portal. My sample size of six librarians was determined by the number of academic librarians who agreed to participate in the research project.

Data Collection Methods

The research process consisted of four iterative cycles of an intervention in the form of an IL Object Design Guide designed collaboratively by the researcher and librarians. The interventions were guided by Merrill's First Principles of Instruction and incorporated learning activities suggested by R2D2 to create new IL objects. The IL objects which were created by the academic librarians reflected greater awareness of Merrill's First Principles of Instruction, the plethora of tools available on the web of learning and the learner preferences emphasized in R2D2's four phases. Data collection consisted of a literature review of previous literature on the subject, artifact analysis, semi-structured interviews, and reflective journal keeping.

Data Sources

This study collected qualitative data which provided insight to and rich descriptions of the design process of academic librarians when creating IL objects. The librarians used Merrill's First Principles of Instruction and Bonk and Zhang's R2D2 to guide their creation of IL objects which were reflective of their greater awareness of instructional design principles and learner preferences. There were four main sources of data used in this study. The first main data source was previous literature on the use of design models and principles by academic librarians when creating IL objects for online learning. The second main data source was an analysis of IL objects conducted collaboratively with the academic librarians. The third data source was semi-structured interviews

with the academic librarians who were creating IL objects at academic libraries. The fourth main data source was the researcher's reflective journal.

Literature Review

The literature review was used to prepare the researcher for the collaborative nature of the study. Because the researcher was also a participant in the study and was working with the librarians to create both an IL object and a guide for future use when doing so, it was imperative that the researcher was well-versed in the major facets of the study. The literature review acquainted the researcher with R2D2 and with Merrill's First Principles of Instruction. It explored how R2D2 had evolved and how it had been validated in other studies. The literature review explored Merrill's First Principles of Instruction and how it had been used to guide instructional design. That information was used to design the first iteration of the study with the academic librarians and to devise a guide which incorporated Merrill's First Principles of Instruction and R2D2 for future use by academic librarians when creating IL objects.

IL Object Analysis

IL object analysis was conducted by the researcher and the librarian participants using a series of questions. Those questions were used to determine to what extent the academic librarian used Merrill's First Principles of Instruction and the framework of R2D2 when creating an IL object. The IL object analysis also examined the extent to which learner preferences were considered in the creation process of the IL object by the academic librarian and which Web of Learning activities were chosen as well as the justifications for those choices. (Appendix B).

Semi-Structured Interviews

Semi-structured interviews were conducted by the researcher before and after the collaborative creative process between the academic librarian and researcher. The initial semi-structured interview provided insight in to the professional education of the librarians, their previous awareness of instructional design principles, their previous experience creating IL objects, their initial approaches to creating IL objects and their overall thoughts on IL objects. The concluding semi-structured interview provided insight to the librarians' experiences using "the Guide" to create IL objects including its usefulness, suggestions for its improvements, the use of Merrill's First Principles of Instruction and R2D2 during the creation of IL objects, and the librarians' increased awareness of instructional design principles and learners preferences when creating IL objects.

Researcher Journal

The researcher kept a journal to use as a reflective tool, as an organizer of information and as a record of the progression of the study. The researcher made ongoing entries into the journal after meeting with the librarians for each iterative cycle. The journal aided in identifying any barriers or challenges that occurred during the research process. Journaling also helped to recount in detail the process of the study and what did and what did not work. Throughout the study the entries helped the researcher reflect and analyze various situations to generate ideas or to make additional improvements throughout the design study. By maintaining these notes, the researcher was able to reflect on initial thoughts, allowing for comparisons and connections to be documented to generate further ideas and revisions throughout the research design.

Data Collection and Analysis

Data Collection Procedures

The iterative nature of DBR is one of its distinctive characteristics. As such, there were four phases in which data was collected. These phases and the specifics of the data collection will be detailed in the following paragraphs. The research study consisted of iterative cycles of an intervention designed collaboratively by the researcher and librarian. Initial field work and preparation was followed by three iterative design phases with recommendations for future strategies for successful creation of IL objects.

Phase 1

Phase 1 consisted of an initial orientation of the researcher to the problem. The initial orientation consisted of a literature review, a field investigation identifying possible academic libraries and librarians and the mailing of invitations to participate in the study to various librarians identified in the field investigation (Appendix A).

After determining a participating academic librarian, Phase 1 drew upon the collaborative nature of DBR with the researcher and principal collaborator meeting to discuss the research process. The researcher made notes in her researcher's journal. After the introductory meeting the researcher created the first iteration of the Guide and met again with the principal collaborator to discuss it. At this meeting the researcher introduced the librarian to the instructional design theories of Merrill's First Principles of Instruction and R2D2 using the Guide. The researcher conducted a semi-structured interview to gain a better understanding of the librarian's background and previous training which the academic librarian brought to the study. The purpose of this interview was to determine the education, experience and the comfort level with technology and

web of learning tools of the participant (Appendix C). Understanding of this information enhanced the prospects for effective collaboration between the researcher and the participants.

After the semi-structured interview the researcher and collaborating librarian examined the librarian's existing IL objects by using the IL Object Analysis (Appendix E) tool. The purpose of the analysis was to identify the topic of the IL object, utilization of Merrill's First Principles of Instruction, the phase of R2D2 the object addressed and the Web of Learning activity used. It served to introduce the librarians to Merrill's First Principles and R2D2 using the tangible examples found in the IL object. These meetings were approximately one hour long.

At the conclusion of that meeting, the researcher used the information gathered from the interview to prepare a guide for librarians to use when creating IL objects. The creation of the Guide was the centerpiece of Phase 1. The Guide was used to introduce academic librarians to instructional design principles using Merrill's First Principles of Instruction and R2D2 and served as a framework when using Web of Learning tools to create IL objects.

Following the creation of the Guide by the researcher, the researcher and librarian met a second time for approximately one hour to discuss the Guide which was to be used in future iterations by librarians to create IL objects. The researcher and the principal collaborating librarian worked collaboratively to determine potential recommendations for improvements to the Guide for the next iteration of the study. The researcher transcribed the interview and sent it to the principal collaborator for verification. After receiving verification of the transcript the researcher coded the transcript and the researcher's journal. The researcher modified the Guide using the feedback from the principal collaborating librarian and the researcher's reflective journal in preparation for the next iteration of the study.

Phase 2

The second iteration of the study commenced with introductory letters to a   group of academic librarians suggested by the principal collaborating librarian based on her knowledge of her colleagues and their previous openness to collaborate with others. The letter introduced the researcher and the study and requested their participation in the study. Eight letters requesting participation in the study were sent to librarians at two of the libraries in the Wayne State University system-Purdy Kresge Library and the Undergraduate Library. Two recipients of the letter declined to participate, one never responded and five responded positively indicating their willingness to participate in the study.

After the participants were identified, the researcher scheduled the first collaborative meeting with each of them. The purpose of the meeting was to introduce the researcher and the research topic to the librarians, conduct the pre-intervention semi-structured interview, introduce the librarians to instructional design principles using Merrill's First Principles and R2D2 by examining the Guide and finally to use the Guide to analyze an IL object which the librarian had already created. These meetings were about an hour in length with each of the five participating librarians and consisted of the same format each time. At the conclusion of each of these meetings the researcher made changes to the Guide based on recommendations and observations gleaned from careful analysis of the interview transcripts and her own researcher's journal before the following collaborative meeting.

At the beginning of her first meeting with each of the collaborating librarians, the researcher first conducted a semi-structured interview (Appendix D). The purpose of this interview was to determine the education, experience and the comfort level of the librarian with technology and web of learning tools as well as to gain a better understanding of the education,

background and previous training the academic librarians brought to the study. Awareness of this information was meant to enhance the prospects for effective collaboration between the researcher and the participants.

Following the semi-structured interview, the researcher used the Guide to introduce Merrill's First Principles of Instruction and R2D2 to the librarian. To introduce the Guide to the librarians the researcher read through it aloud stopping for discussions and questions from the librarian. Next, the researcher and librarian used the IL Object Analysis tool (Appendix C) to collaboratively examine a pre-existing IL object created by the librarian. At the conclusion of their first meeting the researcher tasked the librarian with creating an IL object using the Guide. Following the meeting, the researcher made entries in the researcher's reflective journal recording reflections of the meeting and transcribed the interview. The individual transcription was sent to each of the librarians for verification. After receiving verification from the librarians the researcher coded each interview and reflective journal entry. It was at this point that the researcher made modifications to the Guide based on careful analysis of the data collected during the most recent collaboration and in preparation for the next collaborative meeting This process was followed for each of the five meetings which were part of phase two.

Phase 3

Phase Three consisted of meeting again with each collaborating librarian to conduct a post-intervention interview and to examine the IL object the librarians created with the Guide using the IL Object Analysis tool. The purpose of this second meeting was to gather the librarians' reflections and experiences after using the Guide to create an IL object. The researcher hoped to ascertain to what extent they had incorporated Merrill's First Principles, R2D2, and learners preferences and to gather further observations on the Guide which would enhance its usability for

future librarians when creating IL objects. This process was followed for each of the five meetings which were part of Phase Three.

After a time interval during which the librarian created an IL object using the Guide for reference, the researcher and librarian met for a second time for approximately one hour. At this second meeting the librarian and researcher examined the new IL object using the Post-Intervention IL Object Analysis tool. After examining and discussing the IL object, the researcher conducted a semi-structured interview with the librarian especially focusing on the participant's reactions to the design process, Merrill's First Principles of Instruction, R2D2, and further recommendations for improvements to the Guide (Appendix E). The researcher made notes in her reflective journal after each meeting with the librarian. Following each of those meetings the researcher transcribed and coded the interviews and her research journal and sent the meeting transcription back to each of the librarians for verification. This process was followed for each of the five meetings which were part of Phase Three.

Phase 4

The central focus of Phase 4 was the refinement of the Guide. The researcher met once more with the principal collaborator to discuss the final version of the Guide. The Post-Intervention Semi-Structured Survey was used to guide the discussion. The researcher made reflective entries in the researcher's reflective journal. The interview was transcribed by the researcher and returned to the principal collaborator for verification. After the principal collaborator approved the transcript the researcher coded the transcription and her research journal. The researcher then reviewed all of the data collected in Phases One through Four which consisted of all previously compiled research including semi-structured interviews, IL object analyses, and the researcher's reflective journals. The researcher then conducted a summative analysis of the intervention

iterations and made further revisions necessary to create a final version of the Guide. This final Guide can be used for future research and by academic librarians in creating IL objects.

Data Analysis

Data analysis in qualitative research is an ongoing interrelated process (Creswell, 2014). The iterative, reflective nature of DBR also prompts continuing data analysis throughout the research process. In this study, qualitative analysis consisted of identifying patterns through coding of collected data. The collected data included semi-structured interviews, IL Object Analyses and the researcher's reflective journals. These sources were transcribed and coded by the researcher to identify themes or trends which could affect collaboration between the researcher and the librarians in future design processes.

Qualitative data was collected in this study through the use of semi-structured interviews, analysis of IL objects and the researcher's reflective journal. The constant comparative method was used to code, categorize, organize and analyze the qualitative data collected throughout the study (Smith, 2002). This method allowed the researcher to simultaneously code and analyze data and to make comparisons among categories to identify similarities and differences, and consistencies among participant responses (Smith, 2002). Microsoft Word was used to build tables to prepare and familiarize the researcher with the qualitative data, and to develop a simple coding system to categorize the data (Ruona, 2005). This information was used in the four design iterations that made up this study. The researcher coded the material herself.

There were four iterations in this design-based study. As the study progressed revisions were made to the Guide prior to the next meeting with a collaborating librarian. The table below displays the research questions and methods used which helped answer the research problem.

Table 1

Research Questions and Methods

Research Questions	Collection Method	Data sources	Data Analysis Procedure
Q 1. Does the use of Merrill's First Principles facilitate the design of information literacy objects for online instruction? If so, how?	Semi-structured interviews Reflective journal Literature review IL object analysis	Academic librarians & Researcher	Qualitative analysis
Q 2. Does the use of R2D2 facilitate the design of information literacy objects for online instruction? If so, how?	Semi-structured interviews Reflective journal Literature review IL object analysis	Academic librarians & Researcher	Qualitative analysis
Q 3. Does the consideration of learner preferences facilitate the creation of information literacy objects for online instruction? If so, how?	Semi-structured interviews Reflective journal IL object analysis	Academic librarians & Researcher	Qualitative analysis
Q 4. How does use of the IL Object Design Guide facilitate the creation of information literacy objects?	Semi-structured interviews Reflective journal IL object analysis	Academic Librarians & Researcher	Qualitative analysis

Validation of Findings

Triangulation of data was used to validate the findings. A multiple methods approach increased the internal validity of the research through the collection and comparison of previous literature on the topic, semi-structured interviews, IL object analysis and the researcher's reflective journal. Common themes emerged through the triangulation of the collected data which helped to establish credibility and reliability. A thick, rich description served to describe the setting and creative process thereby endeavoring to include the reader in the collaborative creation experience and increase the generalizability of the study by providing inspiration and suggestions for creation of future IL objects.

Summary

This design-based research study collected qualitative information from academic librarians at an urban university in a large city in the Midwest. The collaborative effort between

the researcher and librarians examined the creation of IL objects for online use utilizing Merrill's First Principles of Instruction and Bonk and Zhang's R2D2 as a framework. Research and collaboration occurred within the design environment of the academic libraries. Four iterative design phases formed the foundation of the study, resulting in documented recommendations and a guide for librarians to use for future creation of IL objects. The well-developed data collection and analysis plan helped to realize the over-arching goals of the study: to increase the awareness of academic librarians of instructional design principles, R2D2 and learner preferences when creating IL objects.

CHAPTER 4 RESULTS

This chapter presents the data analyses of this study. It starts with a description of the participants. It proceeds to describe the iterative nature of design-based research that resulted in four separate phases of data collection which are then described. This rich and thick description of the four phases of data collection is followed by an analysis of the findings for each research question. The chapter then concludes with a summary.

Participants Profile

Six participants completed this study. The participants in this study were academic librarians at a large urban research university located in the American Midwest. They worked at different academic libraries of this university and had varying levels of experience as librarians, with instructional design principles and with the creation of information literacy objects. Table 2 summarizes their profiles.

Table 2
Participant's Profile

Librarian	Years of Experience as Librarians	MLIS	Created IL Objects?	Familiar with ID?	Coursework in ID?	Customize IL Objects for Learner Preferences?
1	14	Yes	Yes	Yes	Yes	No
2	1	Yes	Yes	No	No	No
3	30	Yes	Yes	No	No	No
4	15	Yes	Yes	No	No	No
5	6	Yes	Yes	No	No	No
6	17	Yes	Yes	Yes	No	No

The librarians who participated in the study were all academic librarians with Masters in Library and Information Science from accredited graduate programs. They had extensive post-graduate academic experience. Five of the six had other master's degrees, often in fields which they were supporting as academic librarians. All of the librarians had continued further academic enrichment by taking graduate level classes or attaining specialty certificates. It is to be noted that only one of the librarians had any coursework or training in instructional design. Two of the librarians had mathematical and engineering backgrounds and had worked in those fields before becoming librarians. The other librarians had backgrounds in the humanities, social work and fine arts. There was a vast range of library work experience among the librarians ranging from one year to thirty years.

Phases of Data Collection

Design-based research was chosen for this study because its iterative nature allowed the researcher to modify the Guide on an ongoing basis thus maximizing the benefits of the collaborative process and the individual experiences and expertise of the participants. There were four iterative phases, each of which is described below. Data was collected in each of the four phases. See Table 3.

Table 3

Research Phases and Data Collection

Phase of Research	Data Collection Method	Data Analysis Procedure
Phase 1 (6 months)	Literature Review Semi-structured interviews Research Journal	Qualitative Analysis
Phase 2 (2 months)	Semi-structured interviews IL Object Analysis Research Journal	Qualitative Analysis
Phase 3 (2 months)	Semi-structured interviews IL Object Analysis Research Journal	Qualitative Analysis
Phase 4 (2 months)	Semi-structured interviews Research Journal	Qualitative Analysis

Phase One

Phase One commenced with a thorough literature review exploring the need for preparation of librarians in instructional design principles. It was found that academic librarians are woefully underprepared to create IL objects because of a lack of training in both education as a whole and especially in instructional design principles for online learning. The researcher perceived a need to introduce librarians to instructional design principles which would aid them when creating IL Objects, particularly because academic librarians are increasingly being called upon to do so. The researcher also introduced the academic librarians to R2D2 which would act as a framework to increase both their awareness of learner preferences and the plethora of tools available on the Web of Learning to help them when creating IL objects.

The first meeting with the principal collaborating librarian (PCL) was informal and served to introduce the research topic and to plan future meetings during which the researcher and PCL would collaborate to develop the Guide. The Guide was to be used in future collaborative iterations with the other academic librarians. The researcher also conducted the Librarian Pre-Intervention

Semi-Structured Interview during this meeting, (Appendix C). Data collected at this meeting consisted of notes and reflective entries made in the researcher's journal and the responses to the interview. Following the initial introductory meeting with the PCL the researcher analyzed the notes and developed the initial draft of the Guide.

The second meeting between the researcher and the PCL was another collaboration and discussion during which the researcher showed the PCL a preliminary draft of the Guide and they discussed limitations to it and advantages of it. Data collected at this meeting consisted of notes and reflective entries made in the researcher's journal. Following this meeting further modifications were made to the Guide to limit narrative, create prompts and to make it more visually appealing.

The third meeting between the researcher and PCL was also a collaborative brainstorming session during which the Guide was again discussed and examined. The previous experience of the PCL in creating IL Objects was called upon to provide perspective on the usefulness of the Guide. Data collected at this meeting consisted of notes and reflective entries made in the researcher's journal. The PCL also provided the researcher with the names of eight librarians who were potential future collaborators and participants. The researcher wrote the suggested librarians, explained the study and asked them to participate and collaborate. Of the eight academic librarians who were contacted two did not reply, one declined to participate and five agreed to participate.

The fourth meeting between the researcher and the PCL was the final meeting of Phase One. It was during this meeting that the idea was formulated by the researcher to create tables with pre and post-design questions to use as prompts for Merrill's First Principles and to include the table and figure from R2D2. Data collected at this meeting consisted of notes and reflective entries

made in the researcher's journal. Following this meeting the researcher made final modifications to the Guide based on careful analysis of the research journal notes. This concluded Phase One.

Phase Two

Phase Two began with setting up appointments with the collaborating librarians. It was at the first meeting with a collaborative librarian in this phase that the researcher decided to introduce the Guide, take notes on suggestions during the introductory process and to modify the Guide following the initial meeting with each of the collaborating librarians. The decision to include modifications to the Guide as an ongoing process in Phase Two was made for two reasons: the suggestions and feedback being given on the Guide in the initial meeting were so helpful that it made sense to immediately incorporate them and the timeline for the use of the Guide between each librarian was so long as to not be useful or conducive to the research process. Too much time would have elapsed between when the researcher introduced the Guide and when the librarian would actually use it to develop an IL Object and then meet again with the researcher. By incorporating initial suggestions on an ongoing basis the researcher was able to maximize the effect of the iterations of the Guide when introducing it to the next librarian and thus keeping the momentum of the research progressing. The focus of the study became whether introducing the librarians to the Guide, Merrill, and R2D2 helped them create a better IL object by raising their awareness of instructional design principles, learner preferences and web of learning tools.

At each individual meeting with the five collaborating librarians, the researcher conducted the pre-intervention semi-structured interview. The researcher then introduced the Guide to the librarian, reading it over aloud and discussing any questions as they were raised in the course of the conversation. Following the introduction of the Guide, the researcher and the librarian used the IL Object Analysis (Appendix C) to examine an IL object created by the librarian, referring to the

Guide to help answer questions. Data collected at these meetings consisted of the interview which was recorded, transcribed and analyzed by the researcher and the notes in the researcher's journal. This process was repeated for each of the five librarians. Before meeting with the next librarian, the Guide was modified using the librarians' suggestions, researcher's journal and decisions made by researcher after careful analysis of each set of coded data after each meeting. At the end of each meeting the librarians were asked to use the Guide to create a new IL Object following which the researcher and librarian would meet to discuss their experiences using the Guide to do so. Phase Two ended after the researcher had met with each of the five librarians as described above and analyzed the data.

Phase Three

Phase Three commenced when the librarians completed the new IL Object. The researcher scheduled meetings to discuss the librarians' experiences using the Guide to create a new IL Object. At this final collaborative meeting with each librarian the researcher again conducted an interview using the Post-Intervention Semi-Structured Interview followed by an IL Object Analysis. Final suggestions and recommendations from the librarians were recorded. Data collected in Phase Three consisted of the Post-Intervention Semi-Structured Interview, IL Object Analysis and the researcher's journal. Phase Three was concluded at this point.

Phase Four

The researcher had a final meeting with PCL to share the recommendations of her colleagues, reveal the final iteration of the Guide and to discuss suggestions based on the final model of the Guide. Data collected at this meeting consisted of researcher's journal notes and a semi-structured interview. The researcher reviewed the notes from the researcher's journal and semi-structured interview and made final changes to the guide.

Data Analysis

Data analysis was conducted in a continual process throughout the data collection and various iterations using the constant comparison process. This section describes the data analysis procedures and is organized by data source. The data sources consisted of the Pre- and Post-Intervention IL Object Analysis, Pre- and Post-Intervention Semi-Structured Interviews with the collaborating librarians which included the evolving Guide, and the researcher's reflective journal.

Data was analyzed by constant comparative method using qualitative coding for data analysis. The constant comparative method was used to code, categorize, organize and analyze the qualitative data collected throughout the study (Smith, 2002). This method allowed the researcher to simultaneously code and analyze data and to make comparisons among categories to identify similarities and differences, and consistencies among participant responses (Smith, 2002). Microsoft Word was used to build tables to prepare and familiarize the researcher with the qualitative data, and to help develop a simple coding system to categorize the data (Ruona, 2005). The Microsoft Word tables provided the organizational structure for the coding of the interviews and In Vivo coding (Miles, Huberman & Saldana, 2013) guided the researcher when developing the codes. The In Vivo coding was chosen to code the data for two reasons. The first reason In Vivo coding was chosen was because it allowed the researcher to code the data using the recurring phrases and themes which were present in the semi-structured interviews. The second reason In Vivo coding was chosen was because it is particularly well-suited for studies which "prioritize and honor the participant's voice" (Miles, Huberman & Saldana, 2013, p. 74).

After transcribing the data and member checking the transcripts for accuracy, the researcher manually coded the data by identifying recurring phrases and themes. The themes were

developed around the research questions. The researcher looked for statements and phrases which were divided into the following ideas listed in Table 4.

Table 4

General Description of Coding Themes

Research Question	Coding Theme
Usefulness of Merrill's First Principles	Positive (+) comment on usefulness of Negative (-) comment on usefulness of
Usefulness of R2D2	Positive (+) comment on usefulness of Negative (-) comment on usefulness of
Usefulness of Learner Preferences	Positive (+) comment on usefulness of Negative (-) comment on usefulness of
Usefulness of the Guide	Positive (+) comment on usefulness of Negative (-) comment on usefulness of

First Data Source: IL Object Analysis

The IL Object Analysis was an instrument developed by the researcher with a number of purposes in mind. Its initial use as part of the Pre-Intervention Semi-Structured interview had two distinct purposes. The first purpose was to raise awareness of the collaborating librarians of the principles of instructional design represented by Merrill's First Principles, R2D2's emphasis on learner preferences and the suggested tools available on the web of learning, all of which are presented in the Guide. The second purpose of the IL Object Analysis was to focus attention to areas of the librarians' own IL Objects where the above mentioned principles were or were not present. In the Post-Intervention Semi-Structured Interview the purpose of the IL Object Analysis was to highlight if in fact the librarian had adopted any of the suggestions from the Guide and if so which ones.

Pre- and Post-Intervention IL Object Analysis

The Pre-Intervention IL Object Analysis took place following the researcher and the librarian's semi-structured interview and after the researcher introduced the Guide to the collaborating librarian. The researcher and each of the participating librarians examined an IL object, created by the librarian, using the IL Object Analysis. The goal was to identify if and where the librarians had incorporated Merrill's First Principles and R2D2's learner preferences and web of learning activities. It was hoped that by raising the librarians' awareness of the instructional design principles espoused in the Guide the librarians would consider and include them in the creation of new IL objects.

The Post-Intervention IL Object Analysis was conducted during the second meeting with the collaborating librarians. The purpose of this meeting was to determine to what extent the librarians had incorporated Merrill's First Principles and R2D2 into their newly created IL objects for online learning.

The tables below show the results of the Pre- and Post-intervention IL Object Analysis. They are followed by a discussion of the data.

Pre-Intervention IL Object Analysis for Merrill's First Principles of Instruction

Table 5 shows the number of times Merrill's First Principles were incorporated followed by a discussion of the findings.

Table 5

IL Object Analysis Pre-Intervention Merrill's First Principles

Merrill's First Principles	Identified in IL Object Analysis
Principle 1: Learning is promoted when learners are engaged in solving real world problems	3 times
Principle 2: Learning is promoted when existing knowledge is activated as a foundation for new knowledge	1 time
Principle 3: Learning is promoted when new knowledge is demonstrated to the learner	5 times
Principle 4: Learning is promoted when new knowledge is applied by the learner	3 times
Principle 5: Learning is promoted when new knowledge is integrated into the learner's world	2 times

Principle 1: Learning is promoted when learners are engaged in solving real world problems was identified by librarians in three IL Objects. The collaborating librarians had differing opinions on the definition of real world problems. Some interpreted the term to mean it was something relevant to the student's current life such as a research tool or device for a current academic assignment. An example of this was librarian 3's observation: "…it is helping them find the resources they need to complete the assignment.." Other librarians interpreted the term as a tangible "world" problem such as hunger or poverty. The librarians with that view of real world problems did not identify this principle as being present in their IL Objects. Librarian 6 expressed: "I'm not solving real world problems, its's not for that type of course" They also expressed that they thought it would be difficult to incorporate that principle in a future IL object.

Principle 2: Learning is promoted when existing knowledge is activated as a foundation for new knowledge. Only one librarian identified this principle in the IL Object Analysis. Librarian 3 did so because the terms used in this IL Object were ones the students should recognize

and have interest in because of previous course work: "…it is trying to use phrases that are things from the past and the audience very likely has interest in".

Principle 3: Learning is promoted when new knowledge is demonstrated to the learner. Five librarians identified this principle in the IL Object Analysis.The overwhelming reason they gave in support of this identification was because the purpose of the IL Object was instruction of some type and these IL Objects were all intended to be instructional. . Librarian 4: "That's why we change the screen the way it does so you can point out the steps to how you get to something."

Principle 4: Learning is promoted when new knowledge is applied by the learner. Three librarians identified this principle in the IL Object Analysis. Reasons for their identification of this principle were that it had been designed with the intention of it being used by the students in their future studies. Librarian 3 supports this: "I know that the 4th one happens because they tell me they use it in other classes." Librarian 6 identified Principle 4 in the IL object because: "…they're supposed to apply their new learning from this IL object to write their research paper". Librarian 4 did not identify it in the IL object because: "…they don't really get to apply any of the knowledge".

Principle 5: Learning is promoted when new knowledge is integrated into the learner's world. Two librarians identified this principle in their IL Object. . Librarian 3: "I can't see online that they have integrated it, but when they are able to find an article later for the class then I guess that means they've applied it." In further discussion they both observed that it is difficult to know if the information imparted in the IL Object had in fact been integrated in the learner's world other than hoping that the new knowledge would be used in other course work: This was the same observation the other three librarians made about Principle Five and the reason they gave for not

identifying it in their IL Objects. Librarian 5: "I'm not sure I know that students are being engaged by learning objects."

Post-Intervention IL Object Analysis Merrill's First Principles

Table 6 shows the number of times Merrill's First Principles were incorporated followed by a discussion of the findings.

Table 6

Post-Intervention IL Object Analysis Merrill's First Principles

Merrill's First Principles	Identified in IL Objects
Principle 1: Learning is promoted when learners are engaged in solving real world problems	3 times
Principle 2: Learning is promoted when existing knowledge is activated as a foundation for new knowledge	2 times
Principle 3: Learning is promoted when new knowledge is demonstrated to the learner	3 times
Principle 4: Learning is promoted when new knowledge is applied by the learner	2 times
Principle 5: Learning is promoted when new knowledge is integrated into the learner's world	2 times

Principle 1: Learning is promoted when learners are engaged in solving real world problems. This principle was identified by librarians three times in their post-intervention IL Object. They used the need for the knowledge included in the IL Object as a real world problem of the students. Librarian 3: "The real world problem is the assignment and they have to use the resources in the IL object to successfully complete it."

Principle 2: Learning is promoted when existing knowledge is activated as a foundation for new knowledge. This principle was identified by librarians two times in their post-intervention IL Object. They designed the IL Object with the intention of activating prior knowledge from

courses in which students had already been enrolled. Librarian 3: "…from second part of course and I focused on activating what should have been the students prior knowledge from previous course material."

Principle 3: Learning is promoted when new knowledge is demonstrated to the learner. This principle was identified by librarians three times in their post-intervention IL Object. Demonstrations to the learner included presentations created with PowerPoint and Camtasia to guide the students through a particular task. Librarian 3: "I was able to do a fair amount using PowerPoint." Librarian 4: "I used a voiceover with PowerPoint."

Principle 4: Learning is promoted when new knowledge is applied by the learner. This principle was identified two times by librarians in their post-intervention IL Objects because opportunity for practice of the new knowledge was included in the IL Object. Librarian 5: "Part of the game based activity requires the students to solve engineering problems."

Principle 5: Learning is promoted when new knowledge is integrated into the learner's world. This principle was identified two times by librarians in their post-intervention IL Objects. Both of the librarians expressed being pleasantly surprised that they had been able to incorporate this principle having previously expressed the difficulty of doing so in the pre-intervention discussions. Librarian 5: "In this game based activity the learners are applying the knowledge and integrating it into their world which is solving engineering problems."

Figure 3 below summarizes a comparative analysis of the frequency of identification of Merrill's First Principles in the Pre- and Post-Intervention IL Object Analysis.
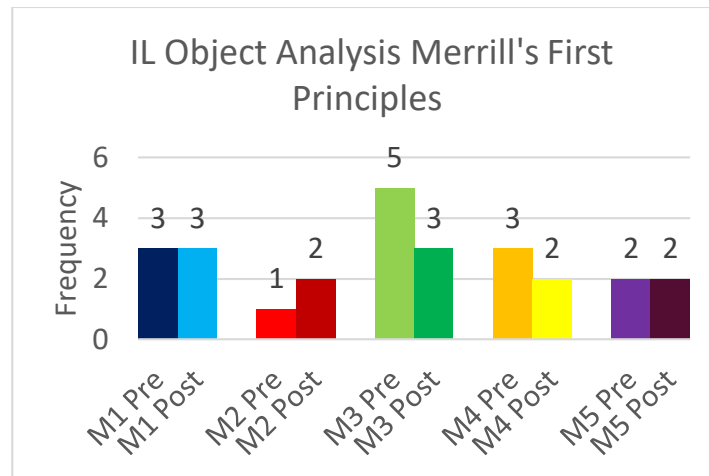
Figure 3 *IL Object Analysis Merrill's First Principles Pre and Post Interventi*

In summary, the identification and use of Merrill's Third Principle of Instruction decreased between the Pre-Intervention and Post-Intervention IL Object Analysis as did Merrill's Fourth Principle of Instruction. The identification of Merrill's Second Principle of Instruction increased from the Pre-Intervention IL Object Analysis to the Post-Intervention IL Object Analysis. The identification of Merrill's First and Fifth Principles of Instruction remained the same from the Pre-Intervention IL Object Analysis to the Post-Intervention IL Object Analysis.

Pre and Post-Intervention IL Object Analysis for R2D2

In both the Pre- and Post-Intervention IL Object Analysis the librarians were asked to identify for which phase and type of learner the IL object was designed and which Web of Learning activity was used. The tables below show the responses of the librarians to the questions of which R2D2 phases were present in their IL objects and which Web of Learning activities were used in those same IL objects. The tables are followed by a discussion of the findings and a summary.

Pre-Intervention IL Object Analysis R2D2

Table 7

Pre-Intervention IL Object Analysis R2D2

R2D2: Read, Reflect, Display, Do	Identified in IL Objects	Web of Learning Activity in IL Object
Read: Auditory and verbal learners	4 times	PowerPoint presentations, e-books, online journals
Reflect: Reflective and observational learners	1 times	online exam
Display: Visual learners	4 times	online charts, graphs, timeline and video
Do: Tactile and kinesthetic learners	1 times	Online practice exercises

Read was identified as a phase four times by the librarians. Librarian 2: "The content involves a lot of reading." Some of the activities from this phase which were included in the IL Objects were PowerPoint presentations, e-books, and online journals. Librarian 5: "…the object is textual in nature and a combination of online pdf documents". Librarian 6: "online journals and providing databases help with number 1 Read….".

Reflect was identified one time as a phase by the librarians. . The activity from this phase which was included in the IL object was an online exam. Librarian 4: "After the listen to it there is a very short ten question quiz which they take." The librarians expressed Reflect was difficult to incorporate in an online Il object

Display was also identified a phase four times by the librarians. Librarian 2: "…this is heavy on the visual because it relies on imbedded videos." Librarian 3: " I always think of things in terms of visually. I always think of video" Some of the activities from this phase which were used in the IL objects are online charts and graphs, a timeline and video. Librarian 5: "…for

students who prefer visual learning there will be some video tutorials…". Librarian 6: "The timeline would satisfy for visual learners."

Do was identified as a phase one time in the Pre-Intervention IL Object Analysis. Librarian 3: "The session itself accommodates the tactile because they actually do touch the keys and actually do the search, not just watch examples of it'" All of the librarians expressed that it would be very difficult to incorporate activities for the Do phase of learning. This was attributed to several technology constraints which exist within the library's electronic system and the nature of online delivery of the IL objects. Librarian 5: "I have nothing like that online, nothing such as hands-on learning or simulations."

Post-Intervention IL Object Analysis R2D2

The post-intervention interview and IL Object Analysis occurred after the collaborative librarians used the IL Object Design Guide to create a new IL object. The results of the Post-Intervention IL Object Analysis are found in Table 8 below.

Table 8

Post-Intervention IL Object Analysis R2D2

R2D2: Read, Reflect, Display, Do	Identified in IL Objects	Web of Learning Activity in IL Object
Read: Auditory and verbal learners	3	PowerPoint presentations, e-books, online journals
Reflect: Reflective and observational learners	1	Expert videos,
Display: Visual learners	3	Photos, online charts, graphs and visualization tools
Do: Tactile and kinesthetic learners	2	Simulations, online games, online resource links

Read was identified as a phase three times by the librarians in the Post-Intervention IL Object Analysis. Librarian 2: "I have a lot of reading that you can do.". Some of the activities from

this phase were PowerPoint presentations, e-books, and online journals. Librarian 5: "This is really text intensive."

Reflect was identified as a phase two times by the librarians in the Post-Intervention IL Object Analysis. In this instance a video, normally considered Display was used for Reflect because the video was of a discussion panel. Librarian 2: "I thought the videos of a panel discussion about a biographical documentary represented the reflective side of things." This is the same phase which librarians expressed difficulty incorporating in online IL objects. Librarian 3: "I got hung up on the reflecting part which I think is difficult to build in to what I'm doing in an online object."

Display was identified as a phase three times by the librarians in the Post-Intervention IL Object Analysis. Librarian 3:" My focus is usually on Display because that's what I prefer as well." Some of the activities from this phase which were used in the IL objects were virtual fieldtrips and tours, online charts and graphs, and a timeline. Librarian 2: "I wasn't sure what thing I could get into this category, it was kind of difficult, and then I found an online tool which makes a timeline.". Librarian 5: "…the charts here seem to be putting the information in to a visual format and I would think the video also…".

Do was identified two times by the librarians in the Post-Intervention IL Object Analysis. Librarian 2: "The link to the Smithsonian Collection was hands-on because you could go in and explore a little bit. And Zotero as well because you actually do something with it." Some of the activities from this phase which were used in the IL bjects were simulations and online games. Librarian 5: …Engineering Village is a game-based simulation that's really suitable for this."

Figure 4 below summarizes a comparative analysis of the frequency of identification of R2D2 phases in the Pre- and Post-Intervention IL Object Analysis.
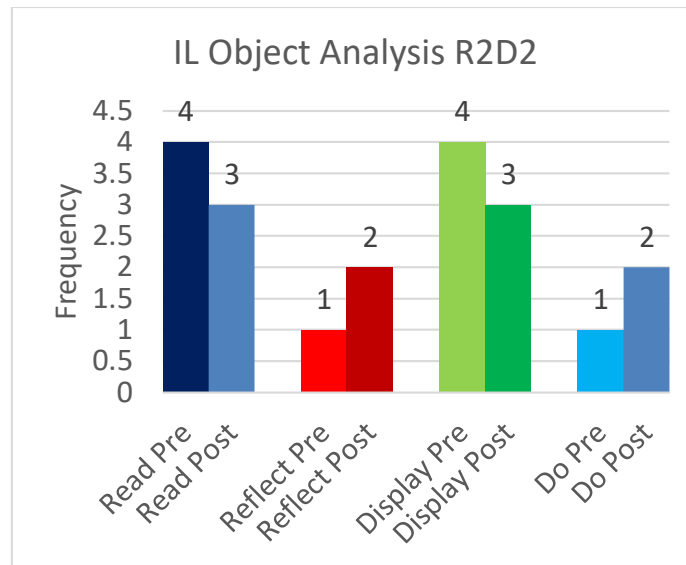
Figure 4 *Pre- and Post-Intervention IL Object Analysis R2D2*

In summary the collaborating librarians reported using a greater variety of resources from the Web of Learning in the Post-Intervention IL Object Analysis. They also increased the use of two phases of R2D2 in the Post-Intervention IL Object Analysis.

Second Data Source: Semi-Structured Interviews with Collaborating Librarians

Both the pre-intervention and post-intervention semi-structured interviews were transcribed by the researcher, member-checked for accuracy and then manually coded by the researcher. It became apparent early in the research process that all of the participants were in overwhelming agreement on the helpfulness of the Guide and the information it was intended to impart. Because of the consistency of these views the researcher then looked for differences between the collaborating librarians which served to illuminate how individuals used and perceived the Guide and its contents. Part of the semi-structured interviews included discussion of the Guide and suggestions for revision. Therefore, the second part of this section contains a

presentation of the data collected during the different phases of the research concerning the contents, iterations of and revisions to the Guide.

Semi-Structured Interviews

The data from Pre- and Post-intervention semi-structured interviews is presented together because they are largely consistent with no meaningful contradictory or other significant difference. Presenting the results together also helps to highlight the pre-intervention and post-intervention findings of the same themes resulting in better understanding and comparisons. The same reasoning applies to the description of the limitations that the academic librarians offered on each theme. Those limitations were also so similar and overlapping between the Pre- and Post-intervention semi-structured interviews that they too are also presented in one section.

Table 9

General Description of Overarching Themes

Overarching Themes	Description
Merrill's First Principles	Collaborating librarians were unfamiliar with Merrill's First Principles and all but one had no training in instructional design principles. The overarching application of instructional design principles was well-received by the collaborating librarians who as a whole said it was very helpful knowledge.
R2D2	Most academic librarians have little or no training in teaching. R2D2 was included in the Guide to provide a framework for the collaborating librarians to aid in their creation of IL objects and provide suggestions for sample technology resources and tools available on the web of learning. The collaborating librarians found R2D2 to be helpful.
Learning Preferences	Learner preferences and types of learner are a significant aspect of R2D2 and one of its unique attributes.
IL Object Design Guide	The Guide, in all its iterations, was well-received and deemed helpful by the collaborating librarians.

The matrix and graph displaying the responses of the collaborating librarians to the overarching theme of Merrill's First Principles are shown in Table 10 and Figure 6.

Table 10

Merrill's First Principles Collaborative Librarian Responses

Theme	Examples from Collaborative Librarian Responses (Key:L2.5=Librarian 2.turn number 5 in coded responses)	Number of Occurrence
Merrill's First Principles (pre-intervention)	"It sounds very practical to me I appreciate the idea of it." L5.27 "the principles certainly resonate based on what I have heard in my time in the library about reaching students" L5.31 "I like the way they're phrased. They are all 'is promoted', you're not out of luck if you don't get all 5." L5.33 "It's more like a goal and the more you get hopefully the more effective it will be." L5.33 "I could make it through probably the first three of Merrill's Principles" L4.34 "having them apply things in real world situations" L5.31 "Merrill's second principle might actually be the most applicable" L4.54 "some attempt is made to integrate this knowledge into their world" L5.57	8
(post-intervention)	"knowledge that already exists- that was stuff that I would not have thought about if I hadn't been introduced to his First Principles" L2.20 "when we talked initially Merrill was not something I had seen necessarily before at all" L2.20 "I used the chart in the guide to see if I was using some of Merrill's principles such as activating prior knowledge and finding real world examples." L3.1 "definitely draw upon prior knowledge." L3.9 "definitely very helpful. I do I like Merrill very much." L3.13 "I think the guide and the knowledge of Merrill's principles that I extracted from it will be very helpful in broadening the type of content that I will include." L5.6 "Learners are applying the knowledge and integrating it into their world" L5.10 "Some of the activities I am planning and integrating use Merrill's Principles" L5.10 "I found Merrill's Principles more useful to me in the beginning" L5.32 "It's a principle. It's a why and kind of an ideal thing which we should aim for" L5.40 "it was still good for me to keep these principles in mind" L5.42 "Merrill was good" L6.2 "it helped me come up with some answers" L6.2	13

Figure 5 summarizes a comparative analysis of the occurrences of Merrill's First Principles in Pre- and Post-Intervention Semi-Structured Interviews.
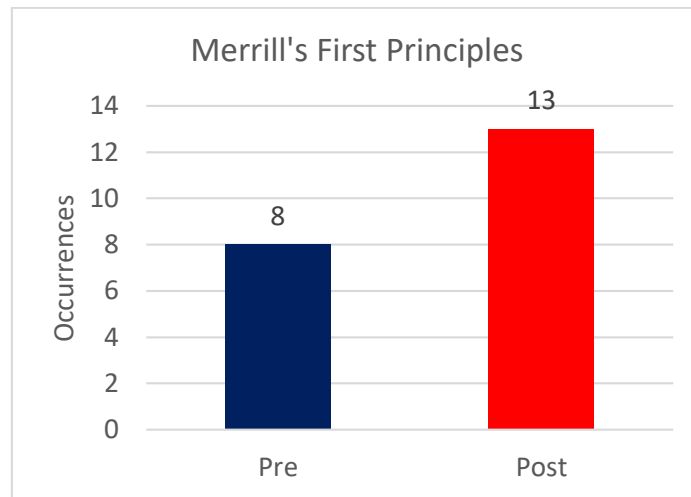
Figure 5 *Merrill's First Principles Occurrences*

As noted in the literature review and supported in Table 2 most academic librarians have little or no training in either instructional design principles. Merrill's First Principles, with its overarching application of instructional design principles, was well-received by the collaborative librarians who as a whole said it was very helpful knowledge. There was a growing level of recognition of Merrill's First Principles and how they can be used in the creation of an IL object. Merrill's Principles became guideposts for the librarians in assessing how they could better convey knowledge to their learners which would lead the learners to integrate that knowledge into their world.

R2D2

The matrix and graph displaying the responses of the collaborating librarians to the overarching theme of R2D2 are shown in Table 11 and Figure 7.

Table 11

R2D2 Collaborative Librarian Responses

Theme	Examples from Participant Librarian Responses (Key:L2.5=Librarian2.turn number 5 in coded responses)	Number of Occurrence
R2D2 (pre-intervention)	"Definitely in the creation of this I think it would have been helpful." L3.92 "the middle of your table is a chart of activities and I use that as a thought starter" L5.64 "I will try to apply some of these and expand those sorts of activities" L5.13 "in the table probably 80% of these are activities that would not occur to me and might be applicable" L5.76 "I can see how they're helpful but even if they're not relevant to me, a lot of them might be." L5.76 "it's probably introduced me to some other things some different ways to get points across" L4.36 "weighing each of the four in my mind as to how much work each one is for me" L4.36	7
(post-intervention)	"R2D2 more or less helps me point out where I'm lacking, things I should give more attention to." L3.17 "I like the sample technology and tools. They were helpful." L3.19 "The guide spoke to me more through R2D2." L4.3 "I would like to actually be able to follow those 4 phases" L4.5 "R2D2 increased my awareness of learning preferences." L5.7 "the table of different types of learners and different types of delivery methods are more helpful" L5.32 "R2D2 definitely raised my awareness of learning preferences" L5.14 "the R2D2 table that introduced sample resources and tools for each learning preference became something that was actionable for me" L5.33	8

Figure 6 summarizes a comparative analysis of the occurrences of R2D2 in Pre- and Post-Intervention Semi-Structured Interviews.
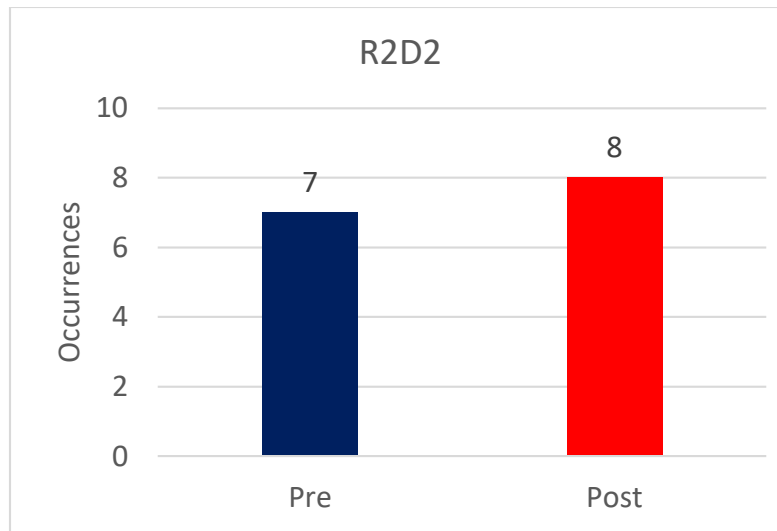
Figure 6 *R2D2 Occurrences*

As was also noted in the literature review most academic librarians have little or no training in teaching. R2D2 was included in the Guide to provide a framework for the collaborating librarians to aid in their creation of IL objects and provide suggestions for sample technology resources and tools available on the web of learning. The collaborative librarians found R2D2 to be helpful. There is an increase, albeit slight, in the number of occurrences between the pre-intervention and post-intervention. However, what is unmistakably present is the appearance of more detailed and thoughtful understanding of R2D2 during post-intervention. It demonstrates a clear growth of awareness as well as depth of understanding of the R2D2's focus on learning preferences. What is equally apparent in both pre-intervention and post-intervention comments is that the librarian participants were not only receptive to but were actually welcoming to these concepts.

Learner Preferences

The matrix and graph displaying the responses of the collaborative librarians to the overarching theme of Learner Preferences are shown in Table 12 and Figure 8.

Table 12

Learner Preferences Collaborative Librarian Responses

Theme	Examples from Collaborative Librarian Responses (Key:L2.5=Librarian2.turn number 5 in coded responses)	Number of Occurrence
Learner Preferences (pre-intervention)	"having an understanding of different learning styles and assessing prevalent ones in audiences when putting the IL object together can make it more effective if you take those things into consideration." L2.10 "It always seems to help depending on what the need is" L "it's a good reminder of different aspects to consider no matter what type of instructional tool or experience you are developing." L3.59 "clearly different learning styles exist and we need to provide some range of options to those type of students" L5.11 "I realize that different students have different preferred ways of learning" L5.19 "I shouldn't probably refer to 1 single mode of learning" L5.19 "I might consider more than one mode of learning or an alternate learning." L5.19 "I think the more tailored it can be the better." L4.22 "it's by looking at the phase and type of learner" L4.36	9
(post-intervention)	"things you might not otherwise think of, that might not be the first things you think of when you put this together" L2.12 "It certainly did. Learner preferences are something that I'm already aware of a little bit but it definitely kept it on my radar more strongly" L5.14 "was helpful to keep that in my awareness and help me to consider a wider range of tools and maybe some that are more Interactive than I would have otherwise" L2.14 "I don't think I necessarily did a great job with that part" L3.11 "it's something I will try to keep in mind" L3.11 "It's something that I will definitely use at some time." L4.5 "considered some of the differences in learning styles from your Guide" L5.2 "What other learning styles could be accommodated" L "accommodate some other learning styles" L5.2 "find alternative materials which would appeal to different learning styles" L5.2 "I reviewed both Merrill and R2D2. It jogged my memory and provoked me to start looking for and integrating for other preferences." L5.4 "librarians don't always think about different learning preferences" L5.30	12

Figure 7 summarizes a comparative analysis of the occurrences of Learner Preferences in Pre- and Post-Intervention Semi-Structured Interviews.
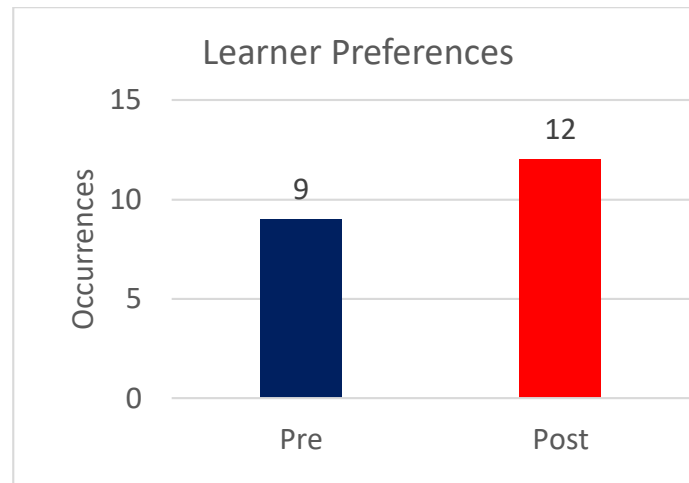
Figure 7 *Learner Preferences Occurrences*

Learner preferences and types of learner are a major aspect of R2D2 and one of its unique attributes. There is a pattern of an increasing level of understanding of learner preferences in the pre-intervention phase and increasing depth of comprehension of learner preferences in the post-intervention phase. The post-intervention responses revealed a greater level of awareness and appreciation for the significance of learner preferences when designing IL objects.

IL Object Design Guide

The matrix and graph displaying the responses of the collaborating librarians to the overarching theme of Usefulness of the IL Object Design Guide are shown in Table13 and Figure 8.

Table 13

IL Object Design Guide Collaborative Librarian Responses

Theme	Examples from Collaborative Librarian Responses (Key:L2.5=Librarian2.turn number 5 in coded responses)	Number of Occurrence
IL Object Design Guide (pre-intervention)	"Yes I think would be very helpful" L2.10 "perfectly packages the framework of resources" L6.14 "I feel like I'm missing some sort of framework, maybe something could help me from a theoretical foundation in teaching and learning." L6.29 "What I thought was most helpful there was the sample technology" L6.71 "I'm finding this helpful already in the sense of being reminded about these things." L3.37 "I think this is a very interesting topic. And I think you are right on when you say we don't have any design training. Anything you can do that can help fill in that gap without people having to take a whole course to just give some guidelines and principles like this" L3.111 "this will help me think about this in a different way" L5.71 "I understand what you and the prior authors are trying to get at and I can see the potential benefit." L5.71 "it strikes me as a tremendous resource" "It's interesting" L4.79	10
(post-intervention)	"it led me to explore some ideas that I probably would not have if I hadn't had this in front of me" L2.2 "that is something I would not have done otherwise if I hadn't looked at the guide" L2.2 "I feel it was very helpful." L2.10 "It helped me get to ideas that I would probably not have gotten to on my own or thought to include." L2.10 "it is easy to incorporate, easy to ingest and it's in an easy readable form" L2.12 "it really helped to guide me towards aspects and integrating tools that reflect other learning styles" L2.12 "it helped me stop and reflect and focus" L2.14 "I did find some interesting stuff that I wouldn't have pursued had it not been for the Guide." L2.18 "Definitely it would help other librarians create IL objects." L2. "I found it very useful." L2.26 "I think I ended up with a much more robust IL object than I would have if I had not used it." L2.26 "I found it very helpful" L2.26	37

| | "absolutely the Guide raised my awareness of ID principles" L2.15 "Definitely I'm going to hang on to it and use it again." L2.28 "I like the Guide mostly for the reminders or for a checklist"L3.21 "it certainly gives you the structure" L3.27 "I think it's helpful to review what we've done."L3.27 "I think as a tool to use this is nice and succinct." L3.31 "It would be very useful." L3.31 "Definitely this is helpful for librarians doing a variety of different kinds of IL objects" L4.11 "covers a wide variety of things and I think this would be very helpful" L4.11 "The guide was very useful." L4.11 "the guide helps me to accommodate other learning styles" L5.6 "The Guide increased my awareness of learner preferences provided by both methods R2D2 and Merrill's Principles"L5.14 "the fact that you explain in the boxes how R2D2 applies and where it may or may not apply to a particular situation was very helpful to me"L5.22 "I thought the presentation of the guide was very helpful" L "I appreciate the variety in the guide rather than it being very prescriptive." L5.24 "Its variety of different theories gives me an ability to pick and choose what makes the best sense in my context and use"L5.24 "The chronology is also helpful." L5.26 "I really appreciated the background and the theory where it came from." L5.26 "I find it very effective" L5.28 "the interjected things in the boxes you wrote after the presentation tables are the actionable things that brought me back to the reality of what I could use in a practical way"L5.28 "I was constantly drawn back to the boxes and thinking what do I do next and those are very helpful in that regard."L5.28 "I think the Guide would be useful to other librarians here and elsewhere." L5.30 "it reminds them there are benefits to be had by incorporating materials into their IL objects that will9 cater to other learning preferences" L5.30 "I find the Guide which you created very useful" L5.33 "It's a very concise document." L5.32 | |

Figure 8 summarizes a comparative analysis of the occurrences of the IL Object Design Guide, the Guide, in Pre- and Post-Intervention Semi-Structured Interviews.
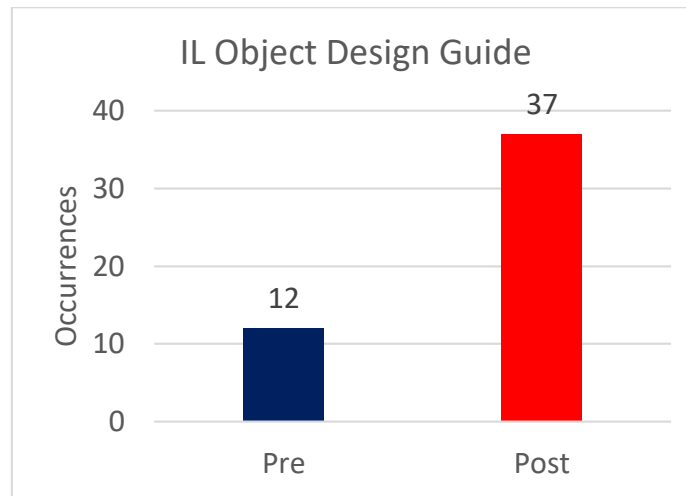
Figure 8 *IL Object Design Guide Occurrences*

One of the two overarching goals of this study was to create an IL Object Design Guide which could be used by academic librarians when creating IL Objects. The Guide, in all its iterations was extremely well-received and deemed helpful by the collaborating librarians. The number of occurrences in the pre-intervention phase to the post-intervention phase showed a dramatic increase in the number from 10 to 37. There were numerous and very positive references to the helpful aspects of the Guide. In addition to the increased number of the occurrences, there was unanimity among the librarians about the robust and beneficial qualities of the IL Object Design Guide.

Critical Responses

The matrix and graph displaying the critical observations of the collaborating librarians to the overarching themes of Merrill's First Principles, R2D2, learner preferences and the IL Object Design Guide are shown in Table 14 and Figure 10.

Table 14

Critical Responses Collaborative Librarian Responses

Critical Responses	Examples from Collaborative Librarian Responses (Key:L2.5=Librarian2.turn number 5 in coded responses)	Number of Occurrence
Merrill's First Principles (pre-intervention)	"This all seems so abstract. I try to think about these things and I always end up with the question about if learning is promoted. I'm trying to be the learner and it's like I need a context for all of this." L6.29 "How can I activate the Learners prior knowledge?" L6.29 " maybe you can't if it's something that's completely brand new." L6.29 "activating prior knowledge could be tricky because a lot of these students have no prior knowledge of the subject matter at all" L6.33 "providing context or examples for instance for each one of the principles that would be so helpful for me" L6.65 "I get stuck on learning is promoted. I'm not wild about the word promoted. What do you mean promoted?" L6.76 "One of the difficult ones I think is to ensure the second one because so often you don't know what the existing knowledge is right?" L3.37 "I don't know how you find the last one it's very vague other than afterwards them telling you that they used it." L3.100 "I'm not sure I know that students are being engaged by learning objects." L5.7 "I find points four and five a little harder to engage." L4.34	9
(post-intervention)	"I think I got all of them except knowledge is applied by the learner" L2.6 "I thought it (5) would be difficult and I wanted to get the other principles included because it would be easier to deal with them." L2.6 "apply knowledge and integrated knowledge are just hard things to get at" L2.22 "it's not realistic to expect to be able to interact on that level with the people using the IL object" L2.22 "think about incorporating some practice but I don't know how to do that in an online environment" L3.11 "I like Merrill but they seem too general to me." L4.3 "they weren't very actionable" L5.3 "a little difficult to verify" L5.4 "I find it difficult to activate prior knowledge" L6.2	9

R2D2 (pre-intervention)	"I see these more as assignments as opposed to being used in learning objects." L6.45 "I would think it would be difficult to get all these into a single object"L3.57 "I would not associate web of learning with the internet." L3.61 "To me reflect would be the most difficult part that and the doing. Yes, I know you can do interactive things and have responses to questions or something or ask them to do something I just don't have the technical skills to design those kinds of activities." L3.94 "they don't like reflecting on what they've learned." L5.45 "There might be other ways to communicate the phases to librarians who are out there reading this as a training guide and trying to apply it." L5.78 "the table doesn't develop the contrast between the learning styles and phases" L5.78 "weighing each of the four in my mind as to how much work each one is for me" L4.36	8
(post-intervention)	"I wasn't sure of what things I could get into that category it was kind of difficult" L2.2 "some of the aspects of R2D2 I found difficult with these type of literacy objects creating them" L2.16 "I found the activities were helpful but it was a lot and not necessarily many can apply to something like an IL object"L2.16 "I get hung up on the reflecting part which I think is difficult to build into what I'm doing." L3.5 "Using the method that I did I didn't see a way to do something reflective." LL3.5 " doesn't really lend itself to incorporating their responses" "I feel a little bit hampered with the Doing-gaming and things like that I don't have any experience with it." L3.17 "As time goes on some of these examples in R2D2 could fall off' L4.13 "the cyclic phases of the diagram are not as helpful to me"L5.12 "I find the term phase in a diagram like this confusing." L5.16 "no opportunity for reflection in my IL object" L6.4 "difficult to incorporate display" L6.4 "The sample tools didn't fit with the boxes associated with the learning preferences." L6.4 "The most confusing part about R2D2 with the tools it went in too many directions and content areas and were things that I don't have the opportunity to use in an IL object." L6.4	14

Learner Preferences (pre-intervention)	"I suppose if I knew what type of student I was trying to reach I could select the appropriate strategy? But often I wouldn't know" L5.43	1
(post-intervention)	"I think it would be too long if I try to reach out to all four learner preferences in one IL object." L4.7 "I might not know what the learning preferences are of my audience." L4.9 "Type of Learners is confusing." L6.4 "Learner preferences are difficult." L6.6 "I don't know who my students are so I can't learn their strengths" L6.6	5
IL Object Design Guide (pre-intervention)	"How prompts are used to activate prior knowledge-that can be tricky" L6.37 "providing context or examples for instance for each one of the principles that would be so helpful for me" L6.65	2
(post-intervention)	"the presentation tables were a lot of words" L6.2 "prompts were a bit confusing to me" L6.2	2

Figure 9 summarizes a comparative analysis of the occurrences of critical responses to Merrill's First Principles, R2D2, learner preferences and the Guide in Pre- and Post-Intervention Semi-Structured Interviews.
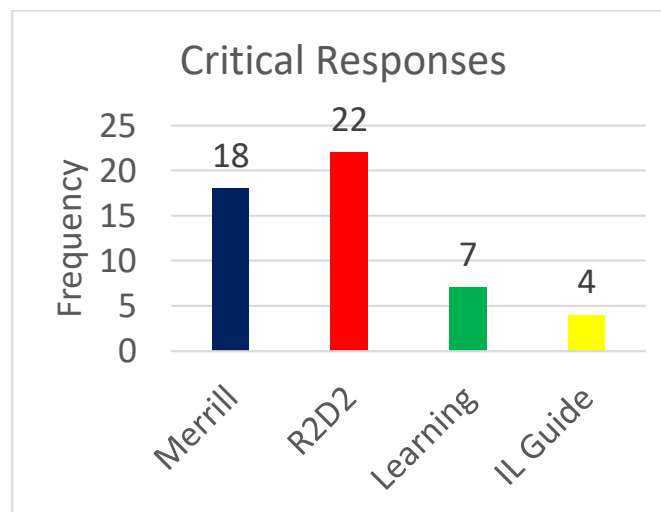
Figure 9 *Critical Responses by Theme*

Critical Response to Merrill's First Principles

Critical responses to Merrill's First Principles were consistently expressed over the difficulty to create IL objects which incorporate Merrill's Fourth and Fifth Principles and the inability to determine if a learner is applying or integrating new knowledge.

Critical Response to R2D2

Critical responses to R2D2 centered on the librarians' perceived difficulty to create IL objects which incorporated activities in the phases of Reflect and Do. Also, frustration was expressed because many of the activities suggested in the Sample Technology Resources and Tools were not conducive to adaptation for use in IL objects.

Critical Response to Learner Preferences

Critical responses concerning learner preferences were consistent. The common criticism of learner preferences was that while it was useful to learn about the phases and types of learners it was difficult to tailor the IL Objects to different types of learners. The librarians found it difficult to do so mainly because they often did not know the specifics of the audience for whom the IL Object was being created.

Critical Response to IL Object Design Guide

Critical responses concerning the Guide were limited which reflects the overall satisfaction the librarians expressed both pre-intervention and post-intervention. The main criticism was that it contained a lot of text and lacked examples.

Iterations of the Guide

A critical element of this design based research was the incorporation of improvements to the Guide in each step of the process. More specifically, at the conclusion of each of the collaborative research sessions with the collaborative librarian the researcher made improvements

to the Guide after careful analysis of suggested revisions from that librarian. The revised guide was then presented to the next librarian as an introduction to instructional design principles through Merrill's First Principles and an introduction to types of learners and Web of Learning activities through R2D2. At no stage of the iterative process, when suggestions for improvement were elicited from the collaborative librarian, was there any prohibition or direction of any kind from the researcher as to what permissible changes were allowed. In other words, there was no built-in bias in the study towards the preservation of earlier made changes. In that way, everything was in play for further revision.

In the table set forth below is a summary of the revisions to the Guide which were incorporated following each of the research episodes. This table is followed by a detailed description of the revisions to the Guide and exhibits.

Table 15

Summary of Revisions to the Guide

Iteration	Revisions
One	Initial brainstorming and rough draft
Two	Added narrative
Three	Created Merrill table with pre and post design prompts, added figures, two-sided
Four	Added definitions
Five	Corrected typos, added to table
Six	Changed format to pictochart
Seven	Added to explanations
Eight	Changed some graphics to color
Nine	Further colorization of graphics

Iteration One

Iterative Cycle One consisted of a number of revisions to the Guide during its development by the researcher in collaboration with the principal collaborating librarian. The Guide started out as a word document which consisted of a paragraph which introduced R2D2 and Table 1.1 from

Empowering Online Learning (Bonk & Zhang, 2008). At that point, although Merrill's First Principles were being used to introduce the academic librarians to instructional design principles, no decision by the researcher had been made to include them in the Guide.

Figure 10. IL Object Design Guide 1

Iteration Two

Following a collaborative meeting with the principal collaborating librarian the Guide was revised and consisted of three paragraphs-an introductory paragraph, and paragraphs describing both Merrill's First Principles and R2D2. Table 1.1 was not included. See Figure 12.

Figure 11. IL Object Design Guide 2

Iteration Three

The third revision of the Guide incorporated major changes to both the content and the

appearance of the Guide. These changes included making it two-sided so Merrill's First Principles

were on one side and R2D2 was on the other; creating a table incorporating Merrill's First

Principles and pre- and post-design questions to serve as either pre-design prompts when

creating the IL object or as post-design checks to ensure the Principles were considered by the librarian when creating an IL object; Table 1.1 was included on the R2D2 side as well as Figure 1.1 which shows the phases of R2D2 and types of learners. See Figure 12.

Figure 12. IL Object Design Guide 3 (Front and Back)

This concluded Phase One. The researcher used the final revision of the Guide developed in Phase One to launch the meetings and collaborative design process of Phase Two.

Phase Two

Phase Two of the design–based research process consisted of collaborative meetings with each of the academic librarians during which the researcher introduced the librarian to the study, conducted the semi-structured interview, introduced the IL Object Design Guide and then examined the participating librarian's IL object using the IL Object Analysis Instrument. As part of the discussion, the participating librarian was asked for thoughts and suggestions for improvements to the Guide. These observations were considered by the researcher and revisions were made to the Guide before meeting with the next collaborative librarian. This model was followed with each of the five collaborative librarians in this phase. Below is a summary of changes made to the Guide after each meeting.

Iteration Four

Following the researcher's meeting with the first collaborative librarian which followed the model above the researcher added a definition of instructional design. See Figure 13.

5

Information Literacy Object Design Guide Using Merrill's First Principles and Bonk and Zhang's R2D2

When designing IL Objects it is helpful to have a guide which incorporates sound instructional design principles with practical suggestions. This guide will introduce you to both! As you proceed in your craft it is hoped that you will find this useful!

INSTRUCTIONAL DESIGN: "a systematic process that is employed to develop education and training programs in a consistent and reliable fashion" (Reiser, Dempsey, 2007). Instructional design is a process for creating effective and efficient learning processes.

Merrill's First Principles
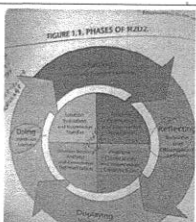
M. David Merrill identifies five prescriptive design principles which transcend the proliferation of instructional design theories and models. Pondering the prompts provided will help guide you to create IL objects which incorporate good ID practices. This will result in more effective IL Objects and better student mastery of the requisite skills.

As you create an IL object keep in mind Merrill's First Principles and these prompts to guide you:

Merrill's Principles	Pre-Design Questions	Post-Design Questions
Learning is promoted when learners are engaged in solving real world problems	What real world problem will be solved for the learner with this IL object?	Is this practical knowledge for the learner of this topic?
Learning is promoted when existing knowledge is activated as a foundation for new knowledge	How can I activate the learner's prior knowledge?	Are prompts used to activate the learner's prior knowledge?
Learning is promoted when new knowledge is demonstrated to the learner	What examples will demonstrate the new knowledge to the learner?	Are sufficient examples provided?
Learning is promoted when new knowledge is applied by the learner	How can practice of the new knowledge be incorporated?	Is there enough opportunity for the learner to practice?
Learning is promoted when new knowledge is integrated into the learner's world	How will the learner use this new knowledge?	Can the learner easily use this new knowledge?

R2D2: Read, Reflect, Display, Do

R2D2 by Bonk and Zhang provides a framework to use when creating IL Objects. It addresses the diverse types of learners found in academic settings. R2D2 introduces multiple teaching and learning methods to enhance the learning process and add variety to the learning experience. Its four phases- Read, Reflect, Display, Do enables learners with different learning preferences, comfort with technology and varying access to technology. R2D2 is effective across any CMS or web-based learning platform. Incorporating the activities suggested in R2D2 will help you create IL objects which appeal to a variety of learner preferences using the plethora of tools found in the web of learning.

| Phase and Type of Learner	Learning Preferences and Activities	Sample Technology Resources and Tools
1. Read: Auditory and verbal learners	Auditory and verbal learners prefer words, sounds, and spoken or written	Podcasts, online PDF documents, sound or audio files, PowerPoint presentations, online portals, course announcements, helpsystems, FAQs, Webquests, online newsletters, e-books, and online journals
2. Reflect: Reflective and observational learners	Reflective and observational learners prefer to reflect, observe, view, and watch learning; they make careful judgments and view things from different perspectives, including reflection, self-testing, review, and reflective summary writing	Blogs, synchronous chats, online exams, writing aids, electronic portfolios, asynchronous discussion, reflective writing tools, online review and self-testing aids, expert videos or performances
3. Display: Visual learners	Visual learners prefer diagrams, concept maps, flowcharts, timelines, pictures, films, and demonstrations.	Concept mapping and timeline tools, interactive news, videostreamed content, online videos, virtual field trips and tours, animations, whiteboards, videoconferencing, online charts and graphs and visualization tools, video blogs (that is vblogs), vodcasts
4. Do: Tactile and kinesthetic learners	Tactile and kinesthetic learners prefer role play, dramatization, cooperative games, simulations, scenarios, creative movement and dance, multisensory activities, manipulatives, and hands-on projects	Simulations, online games, wikis, digital storytelling and movie making. Real-time cases, video scenarios, survey research, continuous stories, groupware and collaborative tools, role play and debate tools

Figure 13. IL Object Design Guide 4. (Front and Back)

Iteration Five

Following the researcher's meeting with the second collaborative librarian which followed

the same meeting model the researcher made grammatical corrections, added a prompt to explain

how to use the Merrill table and improved the quality of the graphics for figure 1.1. See Figure 14.

Figure 14. IL Object Design Guide 5. (Front and Back)

Iteration Six

Following the researcher's meeting with the third collaborative librarian which followed

the same meeting model the researcher modified Table 1.1 from Bonk and Zhang's Empowering

Online Learning (2008) and included a description for each type of learner. See Figure 15.
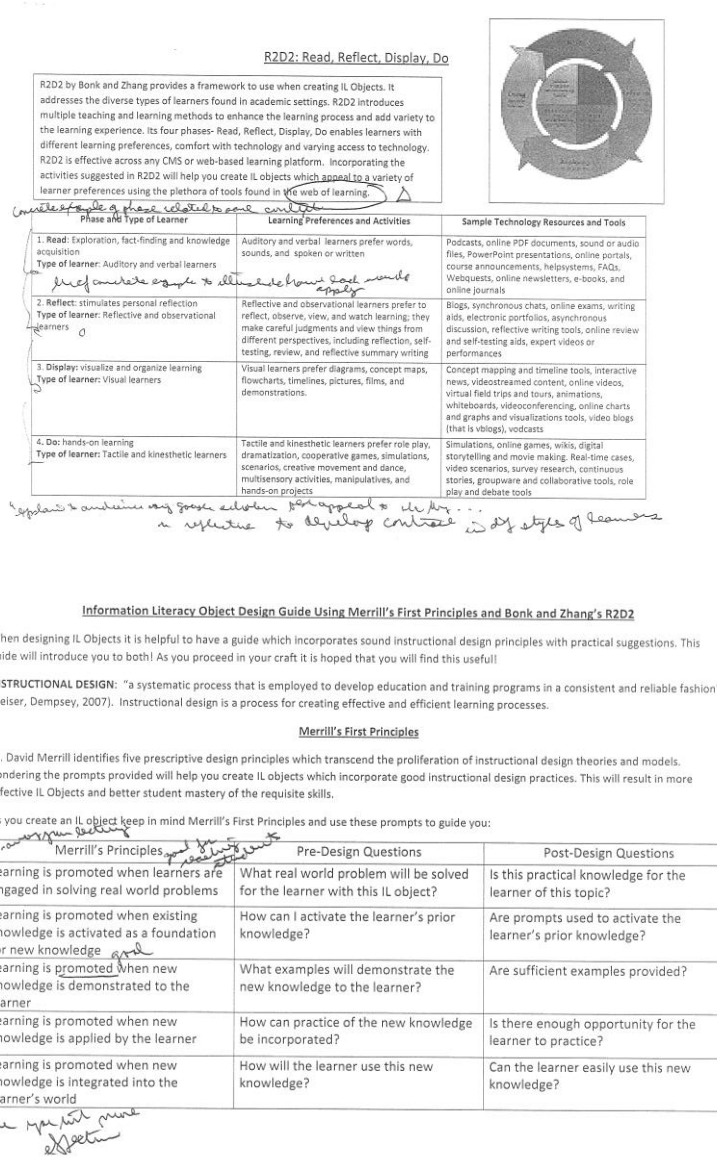
Figure 15. IL Object Design Guide 6. (Front and Back)

Iteration Seven

Following the researcher's meeting with the fourth collaborative librarian, which followed the same meeting model, the researcher made a major format change and created a pictogram which was in color and included graphics. Content that changed was the inclusion of a prompt at the top of figure 1.1 to guide use of R2D2 and a change from the term "Web of Learning" to "the web". See Figure 16.

Figure 16. IL Object Design Guide 7 (Front and Back)

Iteration Eight

Further refinements to the pictogram were made and it was printed in color. See Figure 17.

Figure 17. IL Object Design Guide 8 (Front and Back)

Phase Three

Phase Three consisted of meetings with the collaborative librarians to discuss their experiences using the Guide to create a new IL object. As occurred in Phase Two, the researcher met individually with the collaborative librarians for the Post-Intervention Semi-Structured interview and the Post-Intervention IL Object Analysis to examine the new IL object created using the Guide. Suggestions for revisions to the Guide from the collaborative librarians were recorded but no modifications were made to the Guide in Phase Three.

Phase Four

Phase Four consisted of a final meeting with the principal collaborating librarian to discuss the revisions to the Guide made by the researcher in Phase Two. Following this meeting the researcher made a final change by colorizing the R2D2 cycle and the Guide was finalized. The final version of the Guide is below. See Figure 18. Appendix E is the full-sized version of the Guide.

Figure 18. IL Objects Design Guide 9 (Front and Back)

Aspects of the iterative process of developing the Guide which should be noted are the following: 1. There were no subsequent changes in the later revisions to the guide which negated previously made revisions. In other words, the revisions were a continuing process and consistent with prior revisions. 2. There was no backward movement in the revisions to the first version. The absence of any movement backward or of any subsequent contrary revisions in effect demonstrated

that all of the subsequent commentators were satisfied with the previous revisions. Therefore, the editorial process further endorsed the effectiveness of the Guide as it grew stronger.

Third Data Source: Researcher's Reflective Journal

The researcher's reflective journal was a Google document in which the researcher kept notes, memos and reflections throughout the research process. Entries were made after each meeting with the participating librarians and other times in the research process when the researcher analyzed the data, prepared for meetings with the collaborative librarians and worked on iterations of the Guide. The reflective journal served as a gathering place of ideas which became a record of the timeline and development of the research process and the Guide.

<div align="center">

Analysis of Data with Respect to Research Questions

</div>

Research Question 1: Does the use of Merrill's First Principles facilitate the design of IL objects? If so, how?

Although the librarians used it in different ways, Merrill's First Principles, with its overarching approach to instructional design, was a helpful introduction to instructional design principles, of which five of the six collaborating librarians had no formal training. The practicality of it was part of the success of its introduction to the librarians and its use in the Guide. "It sounds very practical; I appreciate the idea of it." Other expressions of the usefulness of Merrill's First Principles by the librarians included: "It's more like a goal and the more you get hopefully the more effective it will be." Another librarian expressed a similar sentiment, "It's a principle, kind of an ideal thing which we should aim for." Numerous times librarians observed that Merrill is "good", "useful", or "helpful." The six librarians in the study commented positively on the usefulness of Merrill's First Principles 21 times.

Critical observations from the collaborative librarians focused primarily on the difficulty of applying Merrill's Fourth and Fifth Principles when creating IL objects for online instruction. The librarians expressed this because of their inability to determine when new knowledge is applied or integrated by the learner in an asynchronous, online environment. A librarian reflected in the post-intervention survey: "It's not realistic to expect to be able to interact on that level with people using the IL object." It was not necessarily a criticism of Merrill's First Principles, but an acknowledgement of some of the constraints of online instruction.

Research Question 2: Does the use of R2D2 facilitate the design of IL objects? If so, how?

There were 15 occurrences of R2D2 being mentioned positively in the pre and post-intervention Semi-Structured Interviews. As with Merrill, there were some librarians who preferred one over the other, but all of the collaborative librarians overwhelmingly found R2D2 helpful in many ways when creating IL objects. As one collaborative librarian noted: "The Guide spoke to me more through R2D2." Read and Do were the phases which were most used by the librarians: "I liked the sample technology and tools, they were really helpful." Another librarian stated: "It introduced me to some different ways to get my point across."

Critical responses to R2D2 expressed the difficulty of addressing some learner phases and types in an IL Object for online learning: "Some of the aspects of R2D2 I found difficult with these types of literacy objects." "I get hung up on the reflect part which I think is difficult to build in to what I'm doing." This difficulty does not rest entirely in R2D2; instead it rests in part on the constraints imposed by technology available to the librarians at that specific school and in the nature of online instruction as a whole.

Research Question 3: Does the consideration of learner preferences facilitate the design of IL objects? If so, how?

They overwhelmingly professed a need to be conscious of learning preferences, as is expressed in this comment: "I realize that different students have different preferred ways of learning". Awareness of learning preferences helped one librarian "find alternative materials which would appeal to different types of learners". It was mentioned 21 times in the Pre- and Post-Intervention Semi-Structured Interviews. Interestingly enough, despite the emphasis on learner types and preferences emphasized in R2D2 and the Guide, some of the librarians still referred to learning "styles" when discussing this term.

The consistent critical response from the librarians concerning learner preferences was the impediment created by not knowing either the learners using the IL Object or their learner preferences. Many of the collaborating librarians expressed similar observations: "I don't know who my students are." And "I might not know what the learning preferences are of my audience." Again this can be viewed not as a shortcoming of learner preferences or R2D2 but a constraint resulting from the nature of online education and the intended audience of the IL objects.

Research Question 4: How does the use of the IL Object Design Guide facilitate the design of IL objects?

There were 47 occurrences of the Guide being mentioned positively in the Pre- and Post-Intervention Semi-Structured Interviews. As one librarian noted, the Guide "perfectly packages the framework of resources." All of the collaborative librarians indicated they would use it again and that it would be helpful to other librarians when creating IL objects: "It strikes me as a tremendous resource;" "The Guide helps me accommodate other learning styles;" and "I appreciate the variety in the Guide rather than it being very prescriptive."

There were only four critical responses offered by the collaborative librarians concerning the Guide. Two of the responses addressed the presentation which was "too wordy in some of the text boxes" and two requested examples, especially for the design prompts. These responses were addressed as part of the iterative improvements to the Guide.

Summary

The goal of this study was to explore the usefulness of introducing academic librarians to instructional design principles to help them create better IL objects for online learning. This was accomplished by working collaboratively with them using desig- based research methods to develop the IL Object Design Guide. The conclusions, implications and recommendations for future research are discussed in the next chapter.

CHAPTER 5 DISCUSSION AND CONCLUSION

This chapter discusses the research and practical implications of the study. Final conclusions about this research are drawn in this chapter and recommendations are shared to benefit future researchers and practitioners in the development of IL objects.

This study was conducted to explore the role of instructional design principles using Merrill's First Principles and Bonk and Zhang's R2D2 to increase academic librarians' awareness of instructional design principles and learner preferences when creating IL objects. Major findings are summarized below by research question:

1. Does the use of Merrill's First Principles facilitate the design of IL objects for online instruction? If so, how?

2. Does the use of R2D2 facilitate the design of IL Objects for online instruction? If so, how?

3. Does the increased awareness of learner preferences facilitate the design of IL objects for online instruction? If so, how?

4. How does the use of the IL Object Design Guide (the Guide), facilitate the design of IL objects for online instruction?

Research Question 1: Does the use of Merrill's First Principles facilitate the design of IL objects for online instruction? If so, how?

Yes, Merrill's First Principles facilitated the design of IL objects for online instruction. Qualitative data analyses of the data sources which included the pre- and post-intervention IL Object Analyses, the researcher's journal and pre- and post-intervention Semi-Structured Interviews revealed that the collaborative librarians found Merrill's First Principles helpful when

designing IL objects. This positive concurrence was evident in the number and variety of responses collected during the research.

Using Merrill's First Principles in the Guide facilitated the creation of IL objects for online instruction in a number of ways, but most importantly by introducing the academic librarians to instructional design principles of which they were previously unaware. 83% of the academic librarians who participated in this study had no previous training in instructional design. As supported in Davis (2013), using instructional design principles ensures IL objects have clear instructional goals and learner preferences are considered which results in more active engagement by students.

Mullins (2014) IDEA Model, which was designed for embedding IL instruction into academic courses at the author's university, was considered limited in its application because it was beyond the scope of individual IL objects and it did not focus on a particular delivery method. Merrill's overarching principles which are in themselves guidelines, but not prescriptive, were an excellent vehicle for an introduction to ID principles without the added complications of implementing a traditional design model. Providing succinct, guiding principles for instructional design was a further way Merrill's First Principles facilitated the creation of IL objects for online instruction.

Critical observations from the collaborative librarians focused primarily on the difficulty of applying Merrill's Fourth and Fifth Principles when creating IL objects for online instruction. The librarians expressed this because of their inability to determine when new knowledge is applied or integrated by the learner in an asynchronous, online environment. A librarian reflected in the post-intervention survey: "It's not realistic to expect to be able to interact on that level with

people using the IL object." It was not necessarily a criticism of Merrill's First Principles, but an acknowledgement of some of the constraints of using IL objects for online instruction.

Research Question 2: Does the use of R2D2 facilitate the design of IL objects? If so, how?

Yes, the use of R2D2 facilitated the design of IL objects. Qualitative data analyses of the data sources which included the pre- and post- intervention IL Object Analyses, the researcher's journal and pre- and post-intervention Semi-Structured Interviews revealed that the collaborative librarians found R2D2 helpful when designing IL objects.

Bonk and Zhang's R2D2 is not a design model, rather it is a framework intended to guide educators, in this case the academic librarians, to create learning opportunities using activities readily available in the Web of Learning (Bonk and Zhang, 2008). The use of R2D2 facilitated the design of IL objects in a number of ways which are reflective of the variety of experience and educational backgrounds of the participating librarians. After being introduced to R2D2 in the Guide, some of the librarians were encouraged to seek out new tools and ways to incorporate those tools in their Post-Intervention IL objects. Magnuson's (2013) study examined the potential use of Web 2.0 technologies for IL instruction. It concluded that choosing proper Web 2.0 tools was important when creating IL objects but was limited to four tools within a course management system. R2D2's potential is profound with respect to creativity and choice when creating IL objects because of the plethora of tools available on the Web of Learning. The only limitation of R2D2 was that all of the activities were not necessarily conducive to adoption in IL objects. That however is not due to a deficiency in R2D2 rather it is due to the nature of IL objects and technological constraints.

Critical responses to R2D2 expressed the difficulty of addressing some learner phases and types in an IL Object for online learning: "Some of the aspects of R2D2 I found difficult with these

types of literacy objects." "I get hung up on the reflect part which I think is difficult to build in to what I'm doing." This difficulty does not rest entirely in R2D2; instead it rests in part on the constraints imposed by technology available to the librarians at that specific school and in the nature of online instruction as a whole.

Research Question 3: Does the consideration of learner preferences facilitate the design of IL objects? If so, how?

Yes, the consideration of learner preferences facilitates the design of IL objects. Qualitative data analyses of the data sources which included the pre- and post-intervention IL Object Analyses, the researcher's journal and pre- and post-intervention Semi-Structured Interviews revealed that the collaborative librarians found learner preferences helpful when creating IL objects.

The consideration of learner preferences facilitated the design of IL objects in many ways. . The multitude of Web of Learning tools and instructional approaches when creating IL objects increases the opportunities to reach students with a variety of learning preferences (Nicholson & Eva, 2011). The collaborating librarians expressed how their greater awareness of learner preferences, which came from R2D2 and the Guide, led them to seek out different tools and activities from the Web of Learning. These were tools which they would not have otherwise used in IL objects. An awareness of learning preferences presents flexibility for librarians when creating IL objects (Mestre, 2010). R2D2, present in the Guide, helped create a greater awareness of learner preferences which resulted in broader adoption of Web of Learning tools in the IL objects created by the collaborating librarians.

The consistent critical response from the librarians concerning learner preferences was the impediment created by not knowing either the learners using the IL Object or their learner

preferences. Many of the collaborating librarians expressed similar observations: "I don't know who my students are." And "I might not know what the learning preferences are of my audience." Again, this can be viewed not as a shortcoming of learner preferences or R2D2 but a constraint resulting from the nature of online education and the intended audience of the IL objects.

Research Question 4: How does the use of the IL Object Design Guide (the Guide), facilitate the design of IL objects for online instruction?

Qualitative data analyses of the data sources which included the pre- and post-intervention IL Object Analyses, the researcher's journal and pre- and post-intervention Semi-Structured Interviews revealed that the collaborative librarians unanimously found the Guide extremely helpful and that it facilitated the creation of IL objects in a number of ways.

The Guide was created in response to an acknowledged lack of preparation of academic librarians for instruction, especially in online learning. This dearth of preparation is supported in numerous studies. Mestre et al, (2005) reported librarians have minimal formal training in instruction or for creating IL Objects. In a recent study by the Online Learning Research Committee of ACRl only 28% of 92 librarians surveyed had previous coursework or a degree related to teaching (Mestre et al., 2011). None of the participants in this study had any formal preparation for teaching and only 17% (1 of 6) had any training in instructional design.

Increasingly, academic librarians are being called upon to create IL objects for online learning. Online teaching and learning is very different from face-to-face instruction; therefore the preparation of academic for creating IL objects for online instruction needs to take into consideration those differences. Johnson (2006) suggests the way to best achieve integration of good IL skills in students is to incorporate sound principles of instruction and educational theory, design and practice. The Guide introduced the collaborating librarians to instructional design

through Merrill's First Principles of Instruction and to the tools available on the Web of Learning through Bonk and Zhang's R2D2 to create IL objects for online learning which incorporate learner preferences. Davis (2013) also reinforces the importance and usefulness of the Guide because using instructional design principles ensures IL objects have clear instructional goals and learner preferences are considered which results in more active engagement by students. Using Davis' assumptions above, the Guide, through Merrill's First Principles and R2D2 facilitates the creation of better IL objects which more actively engage students.

There were only four critical responses offered by the collaborative librarians concerning the Guide. Two of the responses addressed the presentation which was "too wordy in some of the text boxes" and two requested examples, especially for the design prompts. These responses were addressed as part of the iterative improvements to the Guide.

The iterative nature of design-based research was useful in developing the Guide which increased academic librarians' awareness of instructional design principles using Merrill's First Principles and Bonk and Zhang's R2D2. Moreover, the use of R2D2 introduced the collaborating librarians to the plethora of tools available to them in the Web of Learning to create IL objects with an increased awareness of the importance of learner preferences.

Discussions

The Pre- and Post-Intervention Semi-Structured Interviews with the collaborative librarians revealed that the iterative process for the development and refinement of the Guide and its constituent members, R2D2 and Merrill, was extremely helpful. The process aided the academic librarians in the preparation of IL objects with which they expressed satisfaction. Whether those IL objects will ultimately be effective and to what extent is unknown at the present time. The data that supported those results consisted in part of detailed information provided by each of the

librarians in the interviews. As is evident from the chart of coded responses, the librarians consistently expressed the idea that R2D2 and Merrill were largely new concepts to them and that they would be welcome improvements to the Guide which would steer their preparation of IL objects. The academic librarians overwhelmingly expressed satisfaction with the Guide and the usefulness of its contents-Merrill's First Principles and R2D2. The Guide was helpful because it introduced them to instructional design principles and a framework which increased their awareness of learner preferences and the tools available on the Web of Learning. This resulted in a greater variety of activities being incorporated in IL objects which were innovative and appealed to students with a variety of learner preferences. Indeed, the principal collaborating librarian asserted that she wants to use the Guide as a training tool when preparing other librarians at the university to create IL objects which better incorporate instructional design principles, resources from the Web of Learning and learner preferences.

This research study was conducted at a large urban university located in the American Midwest. The participants were librarians from two of the libraries in the university's library system- the undergraduate library and the graduate library. The librarians were all certified librarians with master's degrees in library and information science. All of the librarians had different library specialties and levels of experience both as librarians and with instructional design principles. All had previous experience creating IL objects.

Limitations

The limitations to this research study were attributable to a variety of influences. These limitations are described below.

Libguides was the only framework in which IL objects were embedded. The academic librarians at this institution used Libguides as the framework to create research guides for academic

support for either individual courses or by subject matter. The IL objects which they created were limited by the technical requirements of the Libguides and the university's technological standards. An example of this was MP4 was the only type of file which could be uploaded to the server.

Only academic librarians from one institution of higher learning were used as collaborators. The research was conducted at only one university and the collaborative librarians were all employed by that university. Albeit, they were stationed at two different libraries within that system, it was still one university library system. Thus, presumably, they had all received similar training in the use of Libguides and other technology tools and were operating under similar technological restraints.

Due to time constraints of a dissertation research, the study was limited to six librarians and was conducted during the Spring/Summer semester when their availability was the greatest. Fewer students and limited distractions during the summer allowed the librarians more time to devote to planning and preparation providing them the latitude to devote the necessary time to participate in the study.

Implications

The findings of this study demonstrate the usefulness of the Guide—and its components of R2D2 and Merrill's First Principles- for use by academic librarians when creating IL objects. There are many implications for both practice and research that flow from these findings.

There are several implications regarding practice. First, it appears that for the first time a tool is available for use by librarians when creating IL objects. The Guide incorporates established instructional design principles with a framework which emphasizes learner preferences and the sample tools and resources available on the Web of Learning. Secondly, availability of the Guide to academic librarians will help improve the quality of IL objects as the librarians become more

aware of instructional design principles, R2D2 and learner preferences. One can also reasonably expect that the academic librarians who will be using the Guide going forward to create other IL objects may also serve as examples to other librarians resulting in potential significant long range effects on student education. Thirdly, the Guide can be transformed for use in other disciplines. Although its original audience was academic librarians, the principles advanced by it are not confined to either librarianship or creating IL objects. Indeed, the Guide may well be applied to many other instructional subject matters or environments whether blended learning, online or face-to-face.

Finally, on the research front, these findings corroborate prior research about established deficiencies in instructional design education among librarians and that IL objects created with pedagogically designed principles and with an eye toward learner preferences afford students a variety of ways to learn Mestre et al.,(2011), Johnson (2006) and Luo (2010).

Recommendations for Future Research

This research focused on development of the Guide, enriched by Merrill's Principles and R2D2, to be used by academic librarians to create IL objects for online learning. Future research should include developing an online version of the Guide with links to examples of IL objects demonstrating successful incorporation of Merrill's First Principles and R2D2. Indeed, requests for such examples were made by collaborating librarians when the researcher introduced the Guide. Links to examples were also suggested improvements to the Guide during post-intervention interviews. Research should also be pursued into the usefulness of a blog or discussion board as part of an online version of the Guide. Other future research should study the efficacy of IL objects which are created using the Guide. In addition to the obvious benefits of such research, it could also have the effect of encouraging collaboration and discussion amongst librarians. This

discussion would ultimately help librarians incorporate instructional design principles and also improve their awareness of both learner preferences and the tools available on the Web of Learning when creating IL objects.

Conclusion

This research study was conducted with two overarching goals-to increase the awareness of academic librarians of instructional design principles and to increase their awareness of the two primary facets of R2D2, namely phases and types of learners and the plethora of tools available on the Web of Learning which can help librarians as they create IL Objects. The tool created for this purpose was called the Guide. The Guide incorporated Merrill's First Principle's and Bonk and Zhang's R2D2 in a format which was revised through numerous collaborative meetings with academic librarians. The librarians who participated in the research and collaborated with the librarian during the creation of the Guide all reported that greater awareness through the Guide of Merrill's First Principles, R2D2, and learner's preferences were all helpful to them when tasked with creating an IL Object. They also all reported that the Guide was extremely helpful to them and they would use it again when creating other IL objects in the future. It is hoped that the Guide, which was the result of this research study, will be helpful to not only these librarians but also to other librarians and perhaps to other professionals when creating IL objects.

APPENDIX A

Letter Describing Study and Invitation to Participate

June 10, 2015

Organization X

Address

Dear Academic Librarian,

My name is Kristin Orlich Lavoie. I am currently a Ph.D. candidate at Wayne State University. I am conducting a research study to increase our understanding of the formulation of information literacy (IL) objects used by academic librarians for online instruction at your university. This study will use design-based research in which the researcher will work collaboratively with you to examine the processes and activities you use when creating IL objects for online learners. The study will identify best practices for doing so. It will also focus on integrating various learning activities with different technologies for effective online learning for a diverse array of learners.

As an academic librarian, you are in an ideal position to give us valuable firsthand information from your own perspective.

The study will involve the following four stages of activity with you:

1. The researcher will conduct a semi-structured interview with you. At the conclusion of the semi-structured interview you and the researcher will collaboratively review an IL object presently in use.

2. The researcher will then present and discuss a "Guide" which includes information on instructional design principles and learning preferences for your use to design an improved IL object based on increased consideration of those elements. Before the next meeting you will be asked to create a new IL object using the "Guide". It is expected that this collaborative effort would occur over the period of one meeting and last approximately one to two hours.

3. The revised IL object will be implemented as you would normally do.

4. Once implemented, another meeting will be scheduled during which you and the researcher will collaboratively review the new IL object. After an analysis and discussion of the IL object, the researcher will conduct another semi-structured interview with you. This interview should is very informal. We are simply trying to capture your thoughts and perspectives on how well the IL object and the "Guide" performed.

Your collaboration and responses to the interview will be kept confidential.

There is no compensation for participating in this study. However, your participation will be a valuable addition to our research and findings could lead to improvement of IL objects within the field of academic librarians. The information that you provide will be used to help explain the results of the study more fully, and to give other practitioners the information to help them improve their IL objects. It will also ultimately improve information literacy of students. Finally it could result in greater public understanding of the important responsibilities of academic librarians.

This study has been reviewed and received ethics clearance through Wayne State University Institutional Review Board.

If you are willing to participate please suggest a day and time that suits you and I'll do my best to be available. If you have any questions please do not hesitate to ask me.

Here is my contact information:

Thank you for your help. I look forward to hearing from you soon to set a meeting time.

Sincerely,

Kristin Orlich Lavoie

APPENDIX B

IL Object Analysis

1. What is the topic or purpose of the IL object?

2. Which of Merrill's First Principles of Instruction are represented or utilized in this IL object?

3. Why do you think that? What is the supporting evidence?

4. Which R2D2 phase is addressed in this IL object?

5. Why do you think that? What is the supporting evidence?

6. Why was that particular phase chosen?

7. Which Web of Learning activities were used in this IL object?

8. Why do you think that particular Web of Learning activity chosen?

9. How useful was R2D2 to you in creation of the IL object?

10. How useful were Merrill's First Principles of Instruction to you when creating the IL object?

APPENDIX C

Librarian Pre-Intervention Semi-Structured Interview

1. How long have you been an academic librarian?

2. How long have you been in your current position?

3. What is your educational background?

4. Have you created IL objects in the past?

5. What do you believe are the major objectives of a good IL object?

6. What do you believe is the best way to achieve those goals?

7. Is there anything else in addition to the IL object that you believe can be used to achieve those goals?

8. Do you believe that IL objects need to be customized to the preferences of the different types of learners? Why or why not?

9. Are you familiar with any design principles or models? If so, which ones?

10. How would you go about creating an IL object for the following topic: teaching a first year undergraduate student how to access Google scholar from the library's homepage? Please take a moment or two to reflect upon your answer and then briefly share your thought processes and considerations as you solved this problem.

APPENDIX D

Librarian Post-Intervention Semi-Structured Interview

1. What do you see as strengths in the "Guide" provided by the researcher?

2. What do you see as weaknesses in the "Guide" provided by the researcher? If so, how could it be improved?

3. Do you believe the "Guide" provided by the researcher could help other librarians create more effective IL objects? If so, how?

4. What do you believe are the major objectives of a good IL object?

5. What do you believe is the best way to achieve those goals?

6. Do you believe that IL objects need to be customized to the preferences of the different types of learners? Why or why not?

7. Do you believe that, having gone through the process of creating this IL object that it would or would not influence you in the preparation of your next IL object?

8. Do you believe that the incorporation of Merrill's First Principles into IL objects will make them more or less effective?

9. Do you believe that the incorporation of R2D2 into IL Objects will make them more or less effective?

10. Do you have any other suggestions for how the "Guide" or the process for creating the IL object could be strengthened?

APPENDIX E

Final IL Object Design Guide

The Guide

Information Literacy Object Design Guide

When designing Information Literacy (IL) Objects it is helpful to have a guide which incorporates sound instructional design principles with practical suggestions. This guide will introduce you to both!

Instructional Design, Merrill's First Principles and R2D2

Instructional Design — Instructional Design is a process for creating effective and efficient learning processes

Merrill's First Principles — M. David Merrrill identified five prescriptive design principles which transcend ID theories and models serving as overarching recommendations for design

R2D2 — R2D2: Read, Reflect, Display, Do, by Bonk and Zhang, provides a framework to use when creating IL objects for diverse learners using the plethora of digital tools found on the web

Instructional Design for IL Objects: Use Merrill's First Principles and R2D2 to create effective, well-designed IL objects keeping in mind the variety of learner preferences and activities available to match them

Merrill's First Principles

As you create an IL object use these pre and post design questions as prompts to guide you

Merrill's Principles	Pre-Design Questions	Post-Design Questions
Learning is promoted when learners are engaged in solving real world problems	What real world problem will be solved for the learner with this IL object?	Is this practical knowledge for the learner of this topic?
Learning is promoted when existing knowledge is activated as a foundation for new knowledge	How can I activate the learner's prior knowledge?	Are prompts used to activate the learner's prior knowledge?
Learning is promoted when new knowledge is demonstrated to the learner	What examples will demonstrate the new knowledge to the learner?	Are sufficient examples provided?
Learning is promoted when new knowledge is applied by the learner	How can practice of the new knowledge be incorporated?	Is there enough opportunity for the learner to practice?
Learning is promoted when new knowledge is integrated into the learner's world	How will the learner use this new knowledge?	Can the learner easily use this new knowledge?

Merril, M. D. (2002). First Principles of Instruction. Educational Technology Research and Development, 50(3), 43-59.   The content of this guide was conceptualized by Kristin O. Lavoie, PhD 2016 MJL Information Literacy Object Design Guide © 2016

R2D2: Read, Reflect, Display, Do

R2D2 by Bonk and Zhang introduces a dynamic approach to online learning. It recognizes the diversity of learner needs and preferences with easy to apply learning activities. R2D2 introduces multiple teaching and learning methods to enhance the learning process and add variety to the learning experience using the plethora of tools available on the web.

R2D2 The four phases of R2D2: Read, Reflect, Display, Do enable learners with different learning preferences and comfort with technology to acquire knowledge using a variety of online resources.

Use the chart to identify a desired phase or type of learner, corresponding learning preferences and activities, and sample technology resources and tools to create an IL object

Phase and Type of Learner	Learning Preferences and Activities	Sample Technology Resources and Tools
1. **Read**: Exploration, fact-finding and knowledge acquisition **Type of learner**: Auditory and verbal learners	Auditory and verbal learners prefer words, sounds, and spoken or written	Podcasts, online PDF documents, sound or audio files, PowerPoint presentations, online portals, course announcements, helpsystems, FAQs, Webquests, online newsletters, e-books, and online journals
2. **Reflect**: stimulates personal reflection **Type of learner**: Reflective and observational learners	Reflective and observational learners prefer to reflect, observe, view, and watch learning; they make careful judgments and view things from different perspectives, including reflection, self-testing, review, and reflective summary writing	Blogs, synchronous chats, online exams, writing aids, electronic portfolios, asynchronous discussion, reflective writing tools, online review and self-testing aids, expert videos or performances
3. **Display**: visualize and organize learning **Type of learner:** Visual learners	Visual learners prefer diagrams, concept maps, flowcharts, timelines, pictures, films, and demonstrations.	Concept mapping and timeline tools, interactive news, videostreamed content, online videos, virtual field trips and tours, animations, whiteboards, videoconferencing, online charts and graphs and visualizations tools, video blogs (that is vblogs), vodcasts
4. **Do**: hands-on learning **Type of learner:** Tactile and kinesthetic learners	Tactile and kinesthetic learners prefer role play, dramatization, cooperative games, simulations, scenarios, creative movement and dance, multisensory activities, manipulatives, and hands-on projects	Simulations, online games, wikis, digital storytelling and movie making. Real-time cases, video scenarios, survey research, continuous stories, groupware and collaborative tools, role play and debate tools

Incorporating the activities suggested in R2D2 will help you create IL Objects which appeal to a variety of learner preferences. R2D2 is effective across any CMS or web-based learning platform and provides diversity, variety, flexibility and options to stimulate creativity for both the practitioner and student.

Bonk, C. J. & Zhang, K. (2008). Empowering online learning: 100+ activities for reading, reflecting, displaying, doing. San Francisco, CA: Jossey-Bass.
This guide was designed by Elliott X. Fernandes

APPENDIX F

Qualitative Data Coding Sample

Code	ID	Q#	T#	L 2	
				post intervention interview.	
guide + R2D2 DISPLAY				After that brainstorming making myself a little chart of the different I did Marilyn cells first and then I didn't R2D2 and just tried to put different I guess pieces of what I was trying to put together in an organized sections according to what I thought I could do green 2 what the information you gave me especially some of the activities you mentioned as well. So it led me to explore some ideas that I probably would not have if I hadn't had this in front of me so I have the basic stuff I have videos over here this is a document that we have the catalog a list of books organized by tab then some the stuff I would have had to put together time line which is one of the ones that's an R2D2 display which I guess was the one I wasn't sure of what things I could get into that category it was kind of difficult and then I found this online tool that you enter your dates and can make a timeline is called time lines is it wasn't too hard to use so you just use the template and entering the date headline and text Sarah and it spits out a timeline that was hopefully people will like it. it brings a lot of the things that different things the author wrote like the off videos in Kentucky License in to a timeline and I thought that is something I would have done otherwise if I hadn't looked at the guide. The other two things the Smithsonian has a lot of things in their online collection related to him inside the link to the search and I also think that's under display and I would have used that otherwise using online resources was one of the suggestions. and then it's back up one thing in particular a lot of magazine articles that are available online the timeline isn't the most convenient way to get an article help scroll through so this was a suggestion from Veronica to use zotero Library and I put all the books and the magazine articles with a direct link.	
				How long did it take you to do this?	
				I worked on it off and on for quite a while the timeline was the Big Thing Once I had that once I had all the links in the description from the timeline is Otero don't take that long was a matter of cutting and	

			pasting it the time line was the most time-consuming thing that I did I didn't if it's really anticipate it but it seemed valuable not there was worthwhile to spend the time. I was excited about the topic and I put a lot of work into it I guess it's the subject of the month it's just for the pretty Kresge library and there's a physical display as well quit I did we didn't have a lot of books for it and it's not the craziest things but most of my time on the online thing then in conjunction with that we do the online guide wish I spent more time on this graphic here was done by the graphic designer for the library and insert them these are the things I made	
			Which of Merrill's first principles are represented here?	
NOT 4 TOO HARD FOR THIS			I think I got all of them except now supplied by Lerner that one something like this especially for something like a static information literacy object there is a lot of information for back and forth I don't know how I would get it in there. I guess at the beginning I decided to focus on some of the other stuff because I thought it would be difficult I wanted to get the other principals included because they would be easier to deal with them	esp for abstract CL about when there isn't a lot of opportunity for back & forth.
			For R2D2 what phases did you use?	
R2D2 : ALL			I think I got all of them. Obviously I have a lot of reading that you can do and then reflecting I thought the videos or maybe representative of that aspect especially the one that's a panel discussion that's about a documentary that was made about him so I thought that represented the reflective side of things reading x / videos is one of the examples see other people discussed with hopefully do for light obviously the timeline and do it kind of hard but I also thought delete this election hopefully got to that aspect of it because it was more Hands-On you could go in and explore a little bit and maybe 30 row as well because it's something something could actually do something with and I guess the display aspect of his physical appearance if we're just looking at the information literacy object all I have is a photo of it but it's hopefully that would help them become Interactive that was I thought help you as well.	biographical link to the Smithsonian Collection

GUIDE +			from all over the web and so I did find some interesting stuff that I wouldn't have pursued had it not been the guide.	
			What about Meryl and trying to incorporate some of his first principles? Did an increased awareness of it help you create the IL object?	
		✓	I thought the first principles Or more I'm trying to think more about the activities to include or the Merrill stuff with more conceptual so he was a civil rights author and I was trying to tie him in with Martin Luther King and also there's a lot of parallels between him and Coates who is a contemporary author who also wrote a lot about race relations and also move to France and so this is the way I can Knowledge that already exists that was stuff that I would not have thought about if I hadn't been introduced to his first principles and when we talked initially that Merrills was not something I had seen necessarily before at all	need guide
			What were limitations you found in Merrills first principles?	
4 & 5 HARD TO DO NOT REALISTIC IN THIS IL OBJECT ONLINE		2	Like I said the last two aspects I think the apply knowledge and integrated knowledge are just hard things to get at so I don't think they're necessary weaknesses overall just maybe for something like this it's not realistic to expect to be able to interact with for the users the people using the Guide on that level	
			Do you have any suggestions for how the guide can be strengthened?	
EXAMPLES & BETTER ACTIVITIES MORE RELEVANT TO IL OBJECT		2	Perhaps picking out some specific activities that seem the most applicable to this type of situation. If it were any way possible to look at the last 2 of Merrill's principles and the last 2 R2D2 aspects and maybe deal with them in a way that might be more realistic for an IL objects. If there could be some way about presenting them with suggestions for how they could be more easily incorporated into an IL object if that's even possible	suggestions for +
			Do you believe the Guide could help other Librarians create IL objects?	
GUIDE +		2	Oh yes definitely I found it very useful I think I ended up with a much more robust the object then I would have if I had not used it. I found it	

GUIDE +			very helpful maybe because of what I've been doing or for this particular object it was very good	
			Do you think you would use it again?	
Guide +		✓	Definitely I'm going to use hang on to it and if I could have a further refined 1 as you're going through the iterations if you could send me a copy that would be great	use again

			What do you think our strength of the guide discuss	
GUIDE +		12	Strengths are that it is easy to incorporate easy to ingest and it's in an easy readable form and it really helped to guide you towards aspects and integrating tools that reflect other learning styles are that are things you might not otherwise think of that might not be the first things you think of when you put this together	
			Do you think it increase your awareness of learning preferences? And how did that influence your creation of the IL object?	
LEARNING PREFERENCE		16	It certainly did it was something that I'm already aware of a little bit but it definitely kept it on my radar more strongly and I also tend to get a little excited so it help me stop and reflect and focus and was helpful to keep that in my awareness and help me to consider a wider range of tools and maybe some that are more Interactive than I would have otherwise	
			What are some of the weaknesses of the guide?	
R2D2 - alot of activities couldn't be used in IL object		16	I don't know if it's necessarily the guide itself but some of the aspects of R2D2 I found difficult with these type of static literacy objects creating them. Sorry I guess that's all part of 3 of it though and. so I found the hundred activities were helpful but it was a lot and not necessarily that can apply to something like a static object.	
			That's what I'm finding that the hundred activities from R2D2 are not very applicable to Il object	
		14	Maybe it's not easy to see but it's not hard to suss out some that are difficult to do I don't think I'm line museums or libraries with something that I would be able to use and then I'm looking I was able to find something this is this Digital Library of America it's a lesson plan in dealing with some of his books and they have stuff they pulled	

APPENDIX G

IRB Concurrence of Exemption

WAYNE STATE UNIVERSITY

IRB Administration Office
87 East Canfield, Second Floor
Detroit, Michigan 48201
Phone: (313) 577-1628
FAX: (313) 993-7122
http://irb.wayne.edu

CONCURRENCE OF EXEMPTION

To: Kristin Lavoie
Administration & Organization Stud

From: Dr. Deborah Ellis _C. Zolondek / 2-2_
Chairperson, Behavioral Institutional Review Board (B3)

Date: August 03, 2015

RE: IRB #: 074215B3X

Protocol Title: Design-Based Research Using R2D2 to Create Information Literacy Objects in Academic Libraries

Sponsor:

Protocol #: 1507014176

The above-referenced protocol has been reviewed and found to qualify for **Exemption** according to paragraph #2 of the Department of Health and Human Services Code of Federal Regulations [45 CFR 46.101(b)].

- Revised Social/Behavioral/Education Exempt Protocol Summary Form (revision received in the IRB office 07/20/15)
- Revised Research Protocol (dated June 10, 2015 revision received in the IRB office 07/08/15)
- Research Information Sheet (revision dated 06/10/15)
- Letter Describing Study and Invitation to Participate
- Data Collection Tools (3): i) Object Analysis, (ii) Librarian Pre-Intervention Semi-Structured Interview, and iii) Librarian Post-Intervention Semi-Structured interview

This proposal has not been evaluated for scientific merit, except to weigh the risk to the human subjects in relation to the potential benefits.

- Exempt protocols do not require annual review by the IRB.
- All changes or amendments to the above-referenced protocol require review and approval by the IRB **BEFORE** implementation.
- Adverse Reactions/Unexpected Events (AR/UE) must be submitted on the appropriate form within the timeframe specified in the IRB Administration Office Policy (http://irb.wayne.edu/policies-human-research.php).

NOTE: Forms should be downloaded from the IRB Administration Office website http://irb.wayne.edu at each use.

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ABSTRACT

USING R2D2 TO CREATE INFORMATION LITERACY OBJECTS IN ACADEMIC LIBRARIES: DESIGN-BASED RESEARCH

by

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December 2016

Advisor: Dr. Ke Zhang

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Degree: Doctor of Philosophy

Academic librarians at the university level are increasingly called upon to create information literacy objects which are available to students online. These librarians, however, frequently have little or no training in any type of instruction, either face to face or online. Because of the unique attributes of online learning, librarians should be aware of instructional design models and learner preferences in order to maximize online student learning. Academic librarians' utilization of the activities which promote efficacious online learning can be increased through awareness of an instructional design model best suited to this purpose. Research was needed to develop a guide and its components as a vehicle which best delivers that awareness to librarians. This study examined the process of creating an IL Object Design Guide, using design based research, in collaboration with academic librarians. Use of the Guide should aid their creation of information literacy objects for online learners and identify best practices for doing so within the framework of Bonk and Zhang's R2D2 (Read, Reflect, Display, Do) Model and utilizing Merrill's First Principles of Instruction. A series of four phases of data collection began with consultations

with a principal collaborating librarian, continued with meetings with individual academic librarians and concluded with a final meeting with the principal collaborating librarian. Each phase of the study included data analysis of information gathered from the IL object analysis, semi-structured interviews and progressive iterations of the IL Object Design Guide. Qualitative data analysis was conducted using the In Vivo coding method. The significance of the study was the creation of the Guide which can now be used by academic librarians when creating IL Objects. The Guide is enriched with Merrill's First Principles of Instruction and Bonk and Zhang's R2D2. The inclusion of these elements in the Guide was found to be very helpful by the participants. This study can serve as a baseline for future development of training methods which prepare academic librarians to create IL objects that incorporate good instructional design principles and practices ultimately increasing their efficacy in education.

AUTOBIOGRAPHICAL STATEMENT

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