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ADAPTING A WORKPLACE OPEN EDUCATIONAL RESOURCE DESIGN WITH AGILE DESIGN THINKING TECHNIQUES

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Dedication

This work is dedicated to three important people in my life: my mother who always believed in me and only wanted me to be a good citizen; my grandfather who insisted that I read and questioned everything; and my wife, Ella, who survives them both and who is my number one fan, who questions everything, and who encouraged me to take up the challenge of beginning this journey. I thank God for the role you have all played in shaping this journey.

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Abstract

This study contributes to the scholarly research and literature in open educational resources (OER) by responding to gaps identified in the open education cycle in the Global South (Hodgkinson-Williams et al., 2017). It also addresses the needs of specialist librarians in some of the government and institutional libraries in the Anglophone Caribbean for self-access educational resources to deliver information skills training to mid-level civil servants. Open educational resources, an affordable readymade solution, depend on traditional publishing models that favour expert and trainer-centred perceptions of quality (Irvine et al., 2021) but weak learner centric adaptation frameworks. Learning experience with agile development (LEAD), a proactive learner-centred evaluation framework, offers librarian trainers and their trainees a leadership role in selecting and adapting an online OER tutorial. A pragmatic worldview underpinned the study's multi-method strategy combining design ethnography (DE) and single evaluative case study (SECS) designs. The SECS replicated Fisher (2009) with modifications. Both methods use LEAD to leverage the combined strengths of two design thinking techniques, remote field visits (RFV) and remote moderated think aloud usability testing (RMTUT). Triangulation of data sources was used to collect and analyse data across two phases with a total of 20 participants. Field visits captured data through observation, interviews, and field notes, while usability tests used observation, participants comments, questionnaires, and interviews. Field visit data identified the emerging profiles of information mediator, programme specialist, and securities analyst as well as uncovered the need for a search plan among these profile groups. Usability tests uncovered issues of navigation and terminology, which made the learning

experience difficult, but useful. Overall, findings confirm that LEAD allows for choosing the *right* intervention and for adapting OER designs. Analysis of the data suggests linkages with emerging models: the uncertainty principle in the information search process (ISP) and extraneous cognitive load (ECL). The findings further suggest a role for information mediators both as trainers and as partners with trainees in OER quality assurance. The study recommends building awareness of the potential of OER (re)use for workplace training and government audiences while advocating the incorporation of agile OER design in open educational practices.

Keywords: Agile methods, Design ethnography, Design thinking, Open Educational Resources, Usability testing, User-centred design, Workplace

Preface

This project brings together the researcher's experience in programme and website usability evaluation, delivering instructional design workshops for language teachers and information professionals, participation in open educational resource (OER) tutorials, and service as an e-tutor.

The target audience for this dissertation project included knowledge and information managers and specialists, instructional and learning experience designers in workplace settings, and design researchers in the field of educational communications and technology.

The study contributes learning experience with agile design (LEAD), a proactive evaluation (design) research framework for localizing and improving OER for workplace training and development in the English-speaking Caribbean. The framework is also tested to determine its usefulness for selecting and (re)designing the OER intervention.

Trying out this framework involves understanding why an OER intervention is needed in the first place. It also means discovering who needs a training solution by watching and listening to what knowledge workers do, how they do it and what problems they encounter as they complete their daily work tasks. For example, an important work task among mid-level civil servants in Trinidad and Tobago is looking for sources of evidence to produce various types of reports.

More than understanding why the OER intervention is needed, it is important for learning experience researchers and designers not just to help choose (or design) one, but also to try out the intervention that best aligns with the needs of trainees in the workplace. Trying out the intervention *before* going live has several benefits. It explores

the learner's experience of the intervention, and whether the intervention is useful, usable, and learnable. Watching and listening to trainees' early encounters with the intervention also helps all partners in the training and development process decide what works and what needs to be adapted for it to work better.

While the framework itself might be considered sustainable for adapting and localizing OER designs, the data for this study uncovers two challenges linked to the technical sustainability of adapting OER designs. One challenge is the extent to which OER are truly open and adaptable. That is, whether OER design adaptability is limited to openly licensed content alone or whether users have access to the editing tools of the learning management system (LMS) site. The other related challenge concerns the extent to which instructional developers responsible for OER designs are willing to use the results of learner research and make the recommended changes.

The proposed framework, while not intended to replace other approaches to quality assurance for OER, extends the user-centered design framework for application in workplace training contexts. It incorporates a trainee-centric approach to the adoption and improvement of OER designs that might be combined with expert led approaches. Even though challenges to the technical sustainability of adapting OER designs are real, those challenges in no way compromise the usefulness of the framework in workplace contexts.

Table of Contents

List of Tables

List of Figures and Illustrations

List of Abbreviations

AD – Agile Development

CLT – Cognitive Load Theory

CMS – Course Management System

COL – Commonwealth of Learning

DE – Design Ethnography

DOAB – Directory of Open Access Books

DOAJ – Directory of Open Access Journals

DRID – Design Research in Instructional Design

ECL – Extraneous Cognitive Load

FUT – Formative Usability Testing

ICL – Intrinsic Cognitive Load

IDR – Interdisciplinary Design Research

IM – Instant Messaging

INASP – International Network for the Availability of Scientific Publications

ISP – Information Search Process

LEAD – Learning Experience with Agile Design/Development

LCD – Learner Centred Design

LDT – Learning Design and Technology

LMS – Learning Management System

LO – Learning Object

LOMA – Learning Object with Multicultural Affordances

LXD – Learning Experience Design

MOOC – Massive Open Online Course

NALIS – National Library and Information System

OEC – Open Educational Cycle

OEP – Open Educational Practice

OER – Open Educational Resources

PAT – Prepositional Approach Trinity

PEM – Print Educational Materials

RFV – Remote Field Visits

RITE – Rapid Iterative Testing and Evaluation

RMTUT – Remote Moderated Think Aloud Usability Testing

RQ – Research Question

SECS – Single Evaluative Case Study

SCI – Semi-Contextual Inquiry

SIDS – Small Island Developing States

SME – Subject Matter Expert

TE – Traditional Ethnography

TOC – Table of Contents

UCD – User Centred Design

UX – User Experience

UXD – User Experience Design

UNESCO – United Nations Educational, Scientific and Cultural Organization

Chapter 1. Introduction

Background of the Problem

While there has been widespread adoption of open educational resources (OER) in some regions of the Global North (Seaman & Seaman, 2018) their uptake in the Global South is still gaining momentum (Stewart, 2021). This is due, in part, to educational challenges including "unequal access to education, the variable quality of education, and the increasing cost and concerns about the sustainability of education" (Arinto et al., 2017, p. 6). In the anglophone Caribbean, uptake has been slow at the secondary school level, and almost non-existent at the postsecondary or tertiary levels and at the corporate training levels. Butcher et al. (2016) suggests that the challenge of variable quality at the school level ranges from a focus by many OER initiatives on the production of "openly licensed materials such as open textbooks that tend to support traditional educational models" (pp. 77–78). The authors recognize a need for a departure from top-down and teacher-centric models as additional reasons to realize incremental changes. They further acknowledge that the effective innovation of OER should be driven at the systemic, policy-directed level.

Notwithstanding, reports on the adoption and use of OER for corporate (workplace) training in the Global North are nascent (Geith et al., 2010; Merkel & Cohen, 2015). However, in the Global South there is little evidence in the literature to suggest that OER have significant adoption rates in corporate (workplace) training contexts. Further, Weiland (2015) acknowledges that evaluation of the experiences of learners has not kept pace with the expansion of access to online resources. Judging the

value of OER is but one dimension of the problem of the OER cycle discussed in the problem statement below.

Definition of Terms

Several key concepts and terms have been used throughout the dissertation. These concepts are described below.

Agile development (AD) principles value "individuals and interactions over processes and tools; working software over comprehensive documentation; customer collaboration over contract negotiation; and responding to change over following a plan" (Beck et al., 2023, para. 1).

Design ethnography describes a method of field research that involves "going out of the office to meet people where they are most comfortable – that is at their habitual places and activities" (Goodman et al., 2012, p. 213). "Design ethnographers are visitors who observe and interview" (Travis & Hodgson, 2019, p. 77). Design ethnography aims to understand "how and why people do what they do" (Goodman et al., 2012, p. 213) and to gain "design insights [understandings to inform design]" (Travis & Hodgson, 2019, p. 97) within a time frame of days or weeks.

Design thinking describes "an analytic and creative process that engages a person in opportunities to experiment, create and prototype models, gather feedback and redesign." (Razzouk & Shute, 2012, p. 330)

Information behaviour refers to "ways in which human beings interact with information - how people seek and utilize information, but also includes other activities such as avoiding/stopping, distorting, encountering by chance, organizing, storing,

creating, sharing, diffusing, and deciding to stop using information." (Agarwal, 2023, para.1)

Information (literacy) skills refer to "the ability to make efficient and effective use of information sources" (Julien, 2001, as cited in Case & Given, 2016, p. 371).

Information seeking refers to "behaviour that occurs when an individual senses a problematic situation or information gap, in which his or her internal knowledge and beliefs, and model of the environment, fail to suggest a path toward satisfaction of his or her goals." (Case & Given, 2016, p. 372)

Learner-Centred Design (LCD) describes a process that focuses on "upfront data collection and analysis about the learner's requirements using human factors methodologies, the development of e-learning prototypes using actual learners, [and] redesigning prototypes based on ongoing testing with learners." (Fleet et al., 2008, pp. 172–173)

Learning experience is "any interaction with a user/customer/individual in which the person is going to learn something" (Interaction Design Foundation, 2020, para. 1). It has also been defined as "learners' perceptions, responses, and performances through interaction with a learning environment, educational products, resources, and so on." (Huang et al., 2019, p. 94)

Open Educational Resources (OER) describe "[t]eaching, learning, and research materials in any medium that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation, and redistribution by others" (Creative Commons, 2020, p. 106)

Usability is the "result of actions taken after observing, listening and learning from real users who are actively engaged in pursuit of a real learning goal…it is a process, rarely an outcome. The goal should be improvement, not perfection" (Barnum, 2008b, para. 5). In addition, the International Standards Organization describes usability as "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction" (ISO, 2018, para. 23).

Usability testing describes "the process of learning from users about a product's usability by observing them using the product" (Barnum, 2002, p. 9). In addition, it "focuses on learning about the experiences of the user engaged in an e-learning course… observing the user performing typical tasks in pursuit of his or her [learning] goal." (Barnum, 2008a, para. 3)

User centred design (UCD) refers to a design philosophy that prioritises users and their tasks, empirical measurement, and iterative and integrative design (Gould & Lewis, 1985). The Interaction Design Foundation (IxDF) describes it as:

> an iterative design process in which designers focus on the users and their needs in each phase of the design process. In UCD, design teams involve users throughout the design process via a variety of research and design techniques, to create highly usable and accessible products for them. (2016, para. 1)

The process resembles the one proposed by Fleet et al. (2008) for LCD above.

Statement of Problem

General Problem. While OER have the potential for an extended lifecycle (Orr et al., 2015), Hodgkinson-Willians et al. (2017), in a recent meta-synthesis of research on open educational resources for development in the Global South, suggests that the OER

cycle is incomplete. The authors found that OER adoption is not fully optimised due to five points of disjuncture. These include:

> (1) the dependence on copying of existing OER and the corollary failure to localise; (2) the adaptation of OER, but with inconsistent curation and rehosting of derivative works on publicly available platforms or in repositories, limiting access to the derivative OER; (3) limited circulation of derivative OER due, in part, to the absence of a communication strategy; (4) inconsistent quality assurance processes; and (5) a weak feedback loop for continuous improvement of the original or derivative work. (Hodgkinson-Williams et al., 2017, p. 28)

The concern about weak adaptation (a combination of dependence on copying without localising and limited curation of original and derivative OER and weak feedback loops of OER in the Global South resonates with Weiland's (2015) claim about the slow pace of evaluation cited above. The question may not be as simple as whether judging the worth of open educational resources is executed but how and why. The second and third dimensions of the problem of evaluation of the OER artefact are treated next.

Methodological Concerns. Another dimension of the problem of evaluation of OER is the legacy of approaches to judging the worth of distance educational programmes and courses which Clark (2000) describes as "reaction evaluation" (p. 305). Although Clark (2000) limits his comments to distance education programmes and courses, the issue has implications for learning objects. A review of the OER research literature (Law, 2019; Wright, 2018) suggests a near absence of proactive evaluation techniques in the development of derivative and original OER. The OER research have favoured expert- and teacher- (trainer-) centred quality evaluation frameworks (Irvine et

al., 2021; Zawacki-Richter et al., 2022), but weak learner centric adaptation frameworks in the Global South. The research literature on fee-based educational resource adaptation points to partial adoption and use of design thinking techniques mainly in university contexts (Davids et al., 2014; Doubleday et al., 2011). However, much of that literature shows how partial adoption of design thinking was implemented through formative usability testing (FUT) of learning resource prototypes. One of the assumptions the formative usability testing of prototypes makes is that the educational resource solution was the right one for learners. Another assumption is that FUT was the right technique to judge learner requirements. The first of these assumptions is understandable in structured postsecondary academic environments where learners have little control over the content to be learned (Laurillard, 2012). However, that assumption can be challenged in workplace environments which support formal, non-formal and informal learning, environments in which new workers may contribute to the content to be learned (Lane, 2013; Monge & Frisicaro-Pawlowski, 2014; Olcott, 2013). Workplace contexts may require more robust needs assessment techniques that involve learners (trainees) in the selection and redesign of learning objects that best match their needs.

In addition, while partial adoption of design thinking has led, in a few instances, to incremental change and improvements in the (re)design of the educational resource (Grudniewicz, 2015; Kealey, 2015) in several others, it has led to recommendations only (English & Reigeluth, 1995; Fisher & Wright, 2010; Myers, 2015). Part of the problem with design thinking approaches is over dependence on report documentation of the users' needs and goals leading to delays in product development (Beck et al., 2023). To reduce time delays agile approaches have focused on product building and postponing

real end user involvement (Takeuchi & Nonaka, 1985). The different yet complementary nature of design thinking and agile methods has led to proposals for frameworks integrating both approaches (Chamberlain et al., 2006; Gurusamy et al., 2016). While a few studies have integrated design thinking with agile methods (Sy, 2007), few have applied agile design thinking to educational resource adaptation and even fewer have done so in reference to workplace OER adaptation.

Practical Issues. On the practical side, both the grey and research literature show limited reports of instances of the development of workplace OER. In particular, reports of adoption and adaptation of workplace OER for information skills training for mid-level civil servants are still emerging. It should be noted that even though the skillset of information literacy in school and academic environments is transferable to workplace contexts, fundamental differences exist in the information needs, information seeking behaviours and information use patterns of students when compared with employees and knowledge workers (Jinadu & Kaur, 2014; Kirton & Barham, 2005; Monge & Frisicaro-Pawlowski, 2014).

To confirm if specialist librarians responsible for delivering information skills training needed OER and based on the researcher's position as a librarian, the researcher submitted a proposal to the Executive Director of the National Library and Information System (NALIS) authority requesting approval to inquire into the information behaviours (i.e., the information needs, the information search patterns and information use) of mid-level civil servants to discover if there was a need for an information skills module for special libraries. Following approval of the proposal, preliminary interviews with four special librarians not only confirmed that no training resources existed for these

environments but also that no self-access resources existed to guide workplace information skills training of their specialist user groups including mid-level civil servants in their respective parent organisations. Special librarians also confirmed that in-house resources were mainly paper-based and forced busy mid-level civil servants to visit their information centres when a digital self-access resource on a web platform could be accessed from the desktops of these mid-level public officers. Librarians would welcome the option of OER designed to meet the needs of their clients.

Studies Incorporating a Partial Design Thinking Approach to the Problem

Indeed, a growing list of studies has taken a participatory design approach, one that includes users in the designs they will use, and have explored the potential of usability testing to improve the design of learning environments and course satisfaction (Adebesin et al., 2009; Adnan & Ritzhaupt, 2018; Ardito et al., 2006; Arimoto, 2016; Buzhardt et al., 2005; Crowther et al., 2004; Davids et al., 2013; Fisher & Wright, 2010; Jurado-Navas & Munoz-Luna, 2017; Krehbiel et al., 2017; Magana et al., 2018; Mahalakshmi & Sundararajan, 2015; Miller-Cochran & Rodrigo, 2006; Monaco, 2012; Royle & Nikolic, 2016; Salza et al., 2019; Scott et al., 2014; Vogelzang et al., 2019, 2020a, 2020b). In several of these studies, a key area of concern was ensuring the learner could find content on the system. This shows a focus on navigation (Lynch & Roecker, 2007) because findability precedes usability. In other words, "users must be able to *find* [emphasis added] content before they can use it" (Morville & Rosenfeld, 2006, p. 219). Other technical usability principles included learnability, accessibility, consistency, and visual design. Instructional design principles and the user as learner received less attention in these studies. Further, little attention was given to ensuring learners

understood what they found (Redish, 2012), or contextual processing, what the learner does, whether intended or not, while participating in learning activities (Phillips et al., 2012).

Within the small island developing states of the Anglophone Caribbean there is some familiarity with website usability. However, studies have had different foci. One study focused on documenting the technical usability of government ministry websites in Trinidad and Tobago based on six usability dimensions that enhance users' abilities to benefit from electronic government (Roach, 2007). More recently, Gosine-Boodoo et al. (2013) have focused on the usability evaluation of the website of the Trinidad and Tobago Virtual Health Library employing questionnaires to gauge user satisfaction. However, only a few studies have focussed on learning spaces (such as those of academic library websites) to get student users to "identify the strengths and weaknesses of the site and incorporate the results and participant feedback into site redesign" (Rogers & Preston, 2009, p. 200). A more recent study by Duncan and Durant (2015) also focussed on an academic library website to assess the usability of the site with a similar purpose. At the time of writing, even fewer studies in the region have explored the efficacy and usefulness of usability testing of course e-learning environments to improve online course design and student engagement, let alone the design of educational resources.

Limited Scope of the Above Studies

Educational Resources for Postsecondary Contexts. As noted in the previous section several of the studies identified have been conducted in higher education environments in Europe (Ardito et al., 2006), North America (Crowther et al., 2004;

Miller-Cochran & Rodrigo, 2006; Monaco, 2012), and South Africa (Adebesin et al., 2009; Davids et al., 2014). Only three have employed usability evaluations in the Caribbean. As mentioned above, only two studies from the Caribbean were conducted in learning spaces within a postsecondary institution (Duncan & Durant, 2015; Rogers & Preston, 2009). To date, there is a dearth of usability studies in the English–speaking Caribbean using formative research to improve course and educational resource design. Indeed, whether within or beyond the Caribbean, few of the usability studies cited above have been used to adapt or improve workplace OER.

Generic Learning Tools. Another challenge with previous studies is that they have focused on the technical dimension of the e-learning artefacts such as learning management systems (LMS), course managements systems, or virtual learning environments. In other words, their focus was on the technology acceptance and accessibility of the interface. Indeed, this is the case even with more recent studies focusing on OER usability (Baldiris et al., 2017; Padhi, 2018). Such a focus may leave open learnability of content and relevant theories that have informed the instructional design knowledge base. The theories include communications theory and others under the wider framework of conditions-based theory, motivation theory, and cognitive load theory (Richey et al., 2011). These last two theories within the instructional design knowledge base provide a theoretical basis for learning resource design of OER and Massive Open Online Courses (Xiao et al., 2014).

A further concern is the timing of the studies and responsiveness to recommendations. This refers to the time elapsed between feedback and implementation and testing of suggested revisions. Even though a few of the studies of e-learning spaces

have used formative evaluation research to improve course design (Fisher & Wright, 2010), none of the ones cited has done so in time for or before the course launch date. Feedback from the evaluation research approaches is useful only to participants in the next iteration of the course rather than for intended course participants and learner stakeholders. While this may have been customary for traditional face-to-face delivery modes, educational course products in online learning environments demand more agile and proactive, people-oriented approaches (Douglas, 2006). One explanation, according to Gordon and Zemke (2000) is the slow and clumsy instructional systems design process model in which evaluation of the design instance or the course instructional product occurs at the end of the course. In their view, this is not only an administrative weakness of the process model, but also a weakness whose inflexibility limits creativity in teaching and learning. Open and other educational resources risk a similar challenge if more flexible, proactive evaluation research approaches remain underutilised. These, together with other challenges elaborated upon under the problem statement, provide a basis for the current project whose purpose is discussed below.

Purpose of the Study

In response to the general, methodological, and practical challenges identified in the previous section, the study used a multi-methods strategy to select and adapt an OER for workplace training in the English-speaking Caribbean. Design ethnography was proposed to establish the need for an instructional intervention. The single evaluative case study responded to Fisher's (2009) call for replication of her study in a different context in addition to adapting and improving the OER. The definition adopted for OER is the Creative Commons (2020) adaptation of the UNESCO definition, "[t]eaching,

learning, and research materials in any medium that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation, and redistribution by others" (p. 106). The version of OER considered was one licensed under Creative Commons Attribution Share-Alike Licence (CC-BY-SA 4.0). According to Perryman et al. (2014) "A CC-BY-SA licence for all resources allow for adaptation by end-users as long as the original author is attributed, and the derivative resource is shared under the same licence as the original version" (p. 1). The OER used in this research study was an online tutorial on search strategies (INASP Moodle, n.d.). An anticipated outcome of the evaluation was both to reuse and to repurpose the resource for use in a self-access online course. To achieve that outcome a proactive evaluation framework called learning experience with agile development (LEAD) principles was also proposed to support the multi-method approach. LEAD leveraged the strengths of a design thinking process with agile principles to ensure the selected open educational resource matched learner requirements from the start and to ensure responsiveness to recommended changes before the resource went live. The study also aimed to confirm whether the proposed LEAD framework, which used the core user-centred design (UCD) framework, was necessary and sufficient to select the right intervention for the right problem and to adapt and improve the OER intervention.

Assumptions

The assumptions this study made include the following:

1. It was assumed that learners would allow observation of their workspace and collection of artefacts online or onsite.

2. It was assumed that learners would want to choose both linear and non-linear pathways to complete the Search Strategies Tutorial.
3. It was assumed that learners would openly report all usability problems encountered during usability testing.
4. It was assumed that learners who were not selected for the study would have identified the same usability problems as those who were selected.
5. It was assumed that instructional developers would record their sincere opinions concerning issues learners experienced and their reasons for recommended changes to the OER.
6. It was assumed that learners would respond honestly to the Pre-test and Post-task Questionnaires and Exit Interviews during the usability testing sessions (Fisher, 2009).
7. It was assumed that developers at INASP would make the changes to the OER based on the observations made from the journal entries and notes of observers.

Limitations and Delimitations

Three initial limitations identified below were:

1. Participants were limited to civil servants within the public service in Trinidad and Tobago. Consequently, the results were not generalizable beyond the study's scope.
2. The study conducted usability testing on an online tutorial on search strategies (INASP Moodle, n.d.). Generalization from findings to other learner populations and OER are likely to be inexact.

3. The small number of users in the study's sample might not reflect all the learners authorised to use the resource.

Research Questions

In line with the study's purpose the central questions below guided the data collection effort:

1. Why do special librarians, and member users of government and institutional libraries, require an open educational resource solution to implement information skills training? (Phase one)
2. How does the design of the open educational resource solution help or hinder workplace trainees as they complete their learning activities and tasks? (Phase two)
3. How should the design of the open educational resource solution be improved to enable workplace trainees to complete their learning activities and tasks? (Phase two)

Significance of the Study

This study adds to the scholarly research and literature in the field since it is first, a response to the gaps identified in the open education cycle in the Global South (Hodgkinson-Williams et al., 2017). It also adds to the evaluation research literature on OER because its focus is on the adaptation of an OER for use in a corporate (workplace) training context. It fills the need for evaluation research reports of an adaptation of an original OER in the small island developing states of the Anglophone Caribbean since reports are only available for Latin America. In addition, it begins the feedback loop for continuous iterative improvement of an OER in a workplace training context. Further, it

uses LEAD, a proactive evaluation research framework that is yet to be trialled with OER.

The results of this study may have relevance for more than a few practitioner groups. One of these is the instructional design and learning experience design practitioners in workplace training contexts including those of the English-speaking Caribbean. This study reinforces the case for practitioners to focus both on ensuring instructional delivery systems are designed right *and* on designing or selecting the right intervention for their clients. This means incorporating agile and design thinking methods as part of their design process. One of the design thinking methods is contextual research. An important take away for practitioners is that the study shows how one type of contextual research, design ethnography, has the potential not only to uncover work practices but also to reveal the performance gaps to allow for assessment of the training needs of knowledge workers. This type of contextual research highlights the role of needs assessment to validate those contextual work practices (Stefaniak & Sentsz, 2020).

Another important practitioner group for which this study has some relevance is the group of librarians and information specialists attached to government, institutional, and specialist libraries. In the context of declining budgets set aside for these libraries, librarians and information specialists may need to extend their traditional role from information resource provision to that of trainer in the use of information resources to increase their visibility in their respective parent institutions and ensure sustainability of budget allocations and minimize budget cuts. In addition, to enhance their role as trainer they may need to build capacity by expanding their skill set into the domain of instructional development. Rothwell (2018) suggests that “the expanding role of

librarians requires instructional design skills. However, many librarians have limited formal exposure and training in instructional design" (p. 24). Strengthening the capacity of librarians in this area can help ensure learner needs are better defined and addressed (Turner, 2016).

A third practitioner group for whom this study may be relevant is trainers and training managers. The study not only showcases the existence of OER alternatives to home grown training assets but also provides a conceptual model for adapting those resources to meet the needs of trainees within their organizations.

Finally, it should be noted that while OER quality continues to be a concern in some quarters of higher education, approaches to the quality improvement of educational resources have been reactive. That is, feedback from learners is only requested after expert and peer review processes are completed and after the resource is published. Even then, these learning assets may still be found to be lacking in quality. Irvine et al. (2021) are among the few authors asking for learner involvement in the evaluation of OER. Expert reviewers cannot be the only arbiters of fitness for purpose. The agile design thinking processes and techniques implemented and proposed in this study demonstrate a more proactive approach to OER evaluation and prioritize early learner involvement to inform and confirm decisions about the fitness for purpose of these resources (Tannian, 2020).

Summary

This chapter presented an outline of the dissertation research study. It included a background of the study, a statement of the problem, the purpose of the study, the research questions of interest, the significance of the study, operational definitions,

assumptions, and limitations. The second chapter reviews key concepts of the literature on the extent to which design thinking methods have been incorporated into workplace OER adaptation efforts, the promise and the challenges associated with design thinking techniques.

Chapter 2. Review of the Literature

Introduction

Design thinking, usability, learnability and (user) experience design share a common focus: the end-users and their interactions with design artefacts. For design artefacts such as OER, the learner is acknowledged as the most important user (McAndrew, 2011). However, it is still unclear whether current investigations into OER prioritize the learner as central to workplace OER adaptation efforts. Formative usability evaluation research into the improvement of educational resources have consistently placed student users at the centre of resource development efforts. This chapter makes the case for learning experience with agile development (LEAD), a proactive evaluation framework that places learners at the centre of adapting workplace OER artefacts. The proposed framework integrates core user-centred design (UCD) principles (Gould & Lewis, 1985) with core agile development principles used in software development and taken from the *Agile Manifesto* (Beck et al., 2023). User-centred design and design thinking can be traced to Simon (1996) in *The Science of the Artificial*. Ideas about agility (speed and flexibility in product design) can be traced to Takeuchi and Nonaka (1986). Both approaches have been used in product design and development. However, tensions between the amount of time it takes to understand a problem and the time it takes to build the product have led to calls for integration of the two methodologies (Deuff & Cosquer, 2013; Gurusamy et al., 2016). Before proposing the framework, this review: summarises the search strategy used to identify relevant research and their limitations; considers key elements of design thinking and experience design; and examines various conceptions of OER and related research (including OER adaptation

research and studies of workplace OER). The strengths and weakness of formative usability evaluation research of educational resources are then assessed before the framework is proposed.

A Search Strategy to Explore the Literature

The ProQuest Dissertations and Theses Global database was used to locate recent dissertations and theses that have implemented usability testing to adapt open educational resources in workplace settings. Search terms used in that resource were "usability testing," "open educational resources," and "workplace training." Other sources consulted to explore the literature were Google Scholar, the Directory of Open Access Journals (DOAJ) and the Directory of Open Access Books (DOAB). The researcher interrogated these sources using the same search terms described above.

Usability testing or formative evaluation research is one development technique used to try out educational resources with student end-users. It has also been used within a user-centred design framework in systems development. However, search results revealed it is yet to be implemented with OER used in corporate or workplace environments. While the results of the search identified studies implementing usability testing of print and digital resources, none of these was an open educational resource. In addition, studies of open education resources focused mainly on the higher educational settings. In the DOAJ the search phrase used was "adapting OER". This returned nine results, three of which were studies of adaptation practices conducted in the Global South. Few reports of research on OER and models seem to acknowledge and involve the most important user in OER, the learner. A search for "OER usability" in Google Scholar returned a few results. The only result returned was a study by Padhi (2018). Usability

evaluations of the design of educational resources have come closest to placing learner users at the forefront of design improvements. Design thinking and experience design are discussed below.

Design Thinking and Experience Design

Defining design thinking is made difficult due to the divisions in the design discourse between academics and practitioners discussed in Johansson-Sköldberg et al. (2013). Despite these divisions, definitions of design thinking share the ideal of a human centred approach to problem solving. Boller and Fletcher (2018) in their design thinking toolkit for learning professionals focus on how or why it is used. They focus on its use to "resolve massive human challenges as well as to design software solutions and consumer products." (p. 8). A more designer centric definition is presented in Dunne and Martin (2006) which distinguishes between design products (objects, services, or systems) and the way designers think, that is, their mental processes. Brown (2009) suggests a more disciplinary focus. For him, it is a discipline that "uses a designer's sensibility and methods to match peoples' needs with what is technologically feasible and what a viable business [civil servant training] strategy can convert into customer [learner] value and market opportunity" (p. 86).

Empathy, the ability to match peoples' needs with what is technologically feasible, defines the human-centred approach and is what distinguishes academic thinking from design thinking. The mission of academic thinking is "to generate new knowledge, test a theory or produce a scientific hypothesis... The mission of design thinking is to translate observations into insights and insights into products and services" (Brown, 2009, p. 49). Perhaps the prepositional approach trinity for interdisciplinary

design research offers a useful starting point for appreciating the tension between academic and design thinking as shown in Table 1 below. In addition, a summary of the use of design research techniques implemented in educational resource adaptation, discussed later in this chapter, shows that testing educational theory may or may not be of interest to some (educational) design researchers.

The tension between design thinking and academic thinking is not new. Just as scholars have been divided about the nature of design, so too they have been divided over the nature of design research. Interdisciplinary design research describes three defining approaches in response to the problem of defining design research (Christensen & West, 2018). The most promising of these, the prepositional approach trinity or the trinities of design research (Jonas, 2007), identifies a preposition between research and design to focus on the purposes and primary functions of design research. Nelson (2014) reinterprets the PAT approach to distinguish three categories of design research in instructional design. These include research *during* design, research *about* design and research *through* design. Research *through* design is concerned with creating theoretical knowledge and corresponds to design science. According to Nelson (2014) research *about* design aims "to understand, inform and improve design practices" (p. 128). Nelson further states that research *during* design takes place "as part of a design process where research activities are utilized in support of design practices in a particular context" (p. 128). While this study prioritizes research *during* design, which focusses on the product and the process, it is open to the potential for attending to learning theory and instructional models as a few studies have shown in Table 4. Even though design thinking and scientific thinking are different, Nelson agrees that "both kinds of thinking

can be creative" (p. 126). Since Nelson's categorization of design research makes no claim for mutual exclusivity between each type, combining "science thinking and design thinking may be better than either alone as a source of advice" (Owen, 2007, p. 22). As indicated in both IDR and DRID (see Table 1) research through design, even though it neither tests nor generates hypotheses in the academic or scientific thinking way, it aims to create design theories or principles.

Table 1

Prepositional Approach Trinity for Design Research

Types of design research	Author	Purpose and functions	Prepositional approach trinity (PAT)
Interdisciplinary design research (IDR)	Jonas (2007)	Build and improve design product	Research FOR design
		Study and improve design practices	Research INTO design
		Develop authentic theories of design	Research THROUGH design
Design & research in instructional design (DRID)	Nelson (2014)	Find a solution for a problem	Research DURING design
		Study and improve design practices	Research ABOUT design
		Create emergent theory, design principles and heuristics	Research THROUGH design

In the field of education Razzouk and Shute (2012) define design thinking as "an analytic and creative process that engages a person in opportunities to experiment, create and prototype models, gather feedback and redesign" (p. 330). A creative process for problem solving according to Clarke (2020), includes some type of:

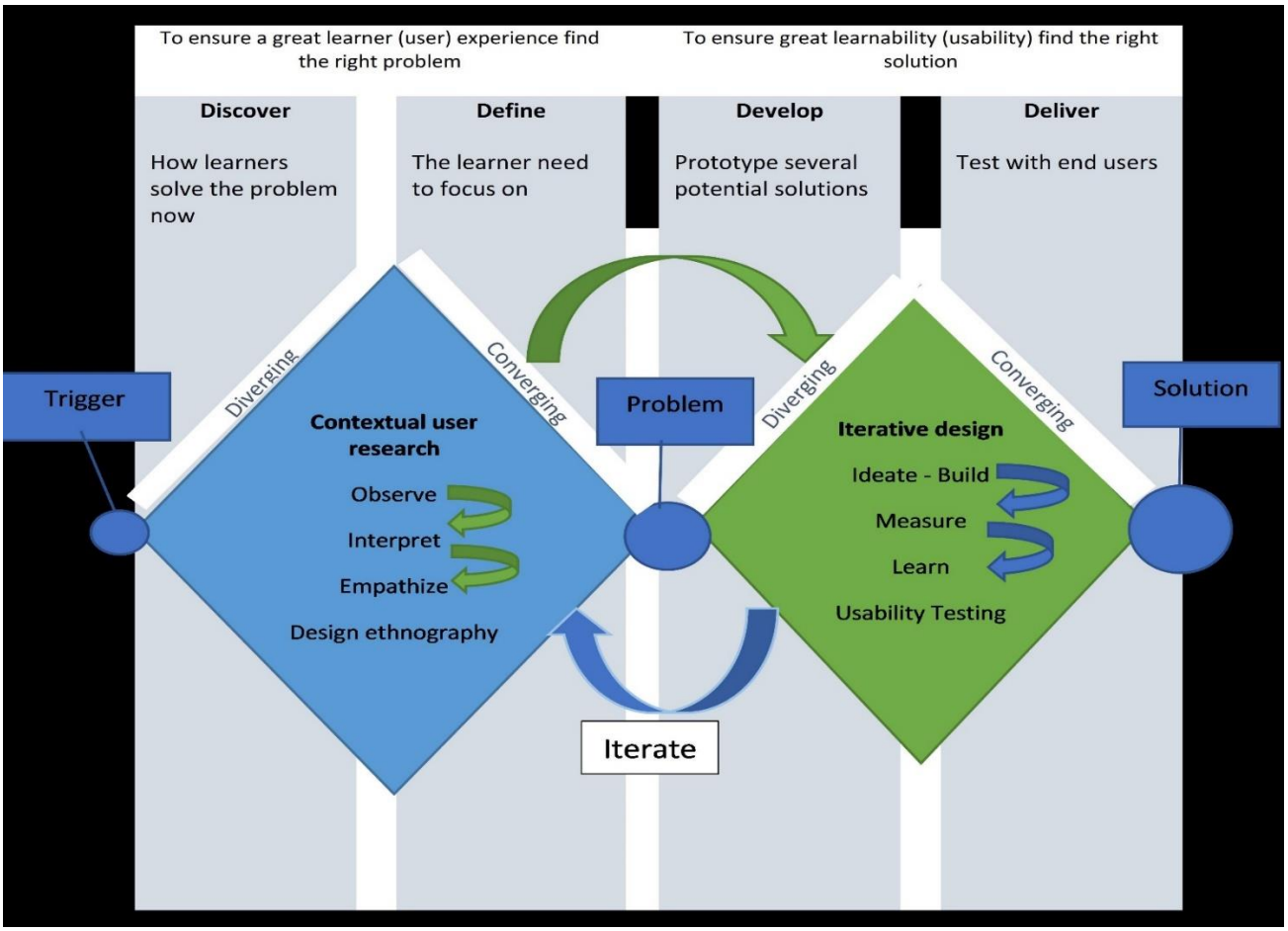
- Empathy or discovery – understanding the needs of those for whom a design is intended;

- Definition - framing problems as opportunities for creative solutions;
- Ideation or concept formation – generating design solutions to a problem;
- Prototyping (Development) – communicating the core elements of solutions to others;
- Testing (Delivery) – learning what works and what does not work to improve solutions. (p. 20)

Clarke (2020) cites several versions of the design thinking process. One version that captures the design thinking mindset, process and techniques is the Design Council's model in Figure 1, adapted with permission for this study.

Figure 1

The Design Council's Double Diamond Design Thinking Model



Note. Adapted with permission from Travis & Hodgson, 2019.

According to Travis and Hodgson (2019), the design thinking process model has the potential to produce innovative products or incremental improvements on existing products. The discovery and definition stages are best suited to innovative product design while the development and delivery phases are most appropriate for incremental iterative improvements on existing products (Travis & Hodgson, 2019). Travis and Hodgson also note that each phase of product design and development requires a different type of user research. For example, the discovery and definition phases require field visits whereas

the prototyping (development) and testing (delivery) phases require usability testing (see Figure 1). It should be noted that the design thinking process model aligns with the core, modified and proposed frameworks described in Table 4. Usability and user experience are key concepts of design thinking and are discussed next.

From Usability to User Experience

While design thinking refers to a process used by software and instruction systems designers, it should be noted that at the centre of the process the focus is usually on some product. The products of design thinking processes need an attribute or standard that focuses the designers' attention. For print and online documents (including software) that attribute or standard is usability which includes comprehension and readability. There have been several different conceptions of what it means for a product or service to be usable. For example, in one frequently cited definition usability is defined by the International Organization for Standardization as "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction" (ISO, 2018, para. 23). In another definition "the people who use the product can do so quickly and easily to accomplish their own tasks" (Dumas & Redish, 1999, p. 4). In yet another definition a product or service is truly usable when "the user can do what he or she wants to do the way he or she expects to be able to do it, without hindrance, hesitations, or questions" (Rubin & Chisnel, 2008, p. 4). Most agree that usability is an attribute of every product (Dumas & Redish, 1999), and it is invisible when it becomes inherent in the products we use (Barnum, 2021; Rubin & Chisnel, 2008). In addition, the above definitions all focus on users and their perception of the quality of the product, their goals and tasks, and the context in which the product will be

used. The attribute of usability is important for all categories of educational technology including learning resources.

A study by Draper (2015) found that many e-learning designers were "not familiar with the formal practices of UX design [and] many were also not familiar with several of the seminal works of the UX design field" (p. ii). This unfamiliarity was present even though the themes from the data indicate shared areas of interest between UX design and e-learning design such as the educational interface and the presentation of learning materials.

What, then, is the meaning of user experience? How is it different from usability defined above? Norman (2004) distinguished three types of design: visceral, behavioural, and reflective. Visceral design refers to the look and feel of the product or its emotional appeal. Behavioural design focuses on function, understandability, usability, and physical feel. Reflective design is "all about message, about culture, and about the meaning of a product or its use" (Norman, 2004, p. 93). While usability focuses on the users' ability to accomplish their goals, the behaviour, user experience includes the users' behaviour and their emotional response to the product.

Designing for experience is one of five design principles proposed by Kahle (2008) for designing open educational resources and technology. Rather than focusing solely on the usability of a product and its behavioural design, user experience designers are more interested in the affective qualities of their applications and must also consider how their product appeals to its users. When applied to this dissertation research study, questions such as the following were used: "Does this [OER] tool attract attention? Is the

experience of using the resource enjoyable and satisfying?" (Kahle, 2008, p. 42). A similar distinction is made below between learnability and the learner experience.

Learnability and the Learner Experience

Learnability is one of the attributes of usability identified by Nielsen and Loranger (2006). It can refer to how easy it is for visitors to an online university website to learn how to orient themselves and get a good overview of the university's course and programme offerings. It can also refer to how easy it is for current students to interact with the course materials while engaged in learning. Duchastel (2003) suggests that these are the traditional issues of usability described above, important but hardly the most interesting. The basic question to be considered is what makes the content of a site learnable. In fact, Donald Norman is twice quoted in the E-learn Magazine as saying that in the context of e-learning, "usability is not the major issue; learnability is" (as cited in Feldstein, 2002, para. 2; Quigley, 2002, para. 4). Further, Quintana et al. (2000) includes (domain) learnability as part of their underlying theoretical approach to a structured definition of learner-centred design (LCD).

What, then, is learnability? According to Duchastel (2003) the locus of learnability is the same as the locus of usability, not the intelligence, motivation, or persistence of the learner or user, but the product or the embodiment of the learning event. Learnability takes a product view of the teaching and learning event. This is because the product is the artefact, an important touchpoint in the learning situation and the target for adaptation and improvement by instructional designers. The product is the course material. The learnability of course materials and resources starts with an attitude that assigns value to the design of resources. Learnability is maximized through the

design of learning materials. Duchastel (2003), reflecting on the features or deep issues underlying learnability, raises three questions: “What is learning [learning]?... How do you design for learning [design]?...What to teach, the content” (p. 301). However, to focus on the product alone is to overlook the learner experience and the tools to help improve the learner’s experience.

The learner experience includes concerns like the affective factors of the user’s experience described above. In educational terms, enjoyment of and success in learning (Duchastel, 2003) are as much a part of learnability as they are a desirable part of the learner’s experience. The question of whether a learning resource is appealing, engaging, or satisfying is one which aligns with the affective dimension of user experience. The behavioural dimension of the user experience complements the affective since, as indicated above, the user experience includes both the user’s behaviour and their emotional response to the product. However, to achieve both the affective and the behavioural dimensions of the learner’s experience it is necessary to study the interaction between the learner and the learning resource. The product focus of usability/learnability is but one dimension of the learner’s experience. A learning experience refers to “learners’ perceptions, responses, and performances through interaction with a learning environment, educational products, resources, and so on.” (Huang et al., 2019, p. 94). It is the learner’s interaction with the artefact that contributes to the learning experience. The one tool that can uncover the learner’s experience of educational resources is an integrated feedback system (Nathenson & Henderson, 1980, 2018) known as formative evaluation research or usability testing. This is discussed in the section below.

Tools to Improve the Learner's Experience

Before improving the generic user's experience of any product came into focus, Gould and Lewis (1985) outlined a principled framework for the design of systems. The initial user centred design (UCD) framework entailed "early focus on users and tasks; empirical measurement and iterative design" (Gould & Lewis, 1985, p. 300). Early focus on users and tasks is about understanding the users, the tasks that they perform and the context in which they perform these tasks (field visits). The principle of empirical measurement focuses on observing, recording, and analysing the performance and reactions of users as they engage in real tasks through simulations and prototypes (usability testing). The principle of iterative design describes "a cycle of design, test and measure, and redesign, repeated as often as necessary" (Gould & Lewis, 1985, p. 300). Integrated design, a fourth principle, was later added to suggest "all aspects of usability evolve in parallel" (Gould, 1988, p.110). Norman (2002) would later apply the same framework to the development of all products. Indeed, he defined the UCD as a "philosophy based on the needs and interests of the user, with an emphasis on making products usable and understandable" (p. 188).

The UCD framework captures both the phases of the design process and the design research techniques appropriate to the phases of the process. One of the techniques, the field visit, while not stated explicitly, seems appropriate to the first element of the framework. It is a design tool useful for understanding users' contexts, tasks, and goals. Gould and Lewis (1985) "recommend interviews and discussions with potential users, and actual observations, by the design team, of users on the present version of a system" (p. 301). The other technique, usability testing, is also implied.

According to the authors it is about "building a prototype to find out how easily people can learn and use that prototype...an empirical question" (p. 302). Usability testing can focus on student users or learners, their tasks and the (OER) product (Sullivan, 1989). However, since usability research is a theory of audience (Sullivan, 1989), there is no substitute for testing the system with the actual user audience.

In terms of the intentional design of learning resources to achieve learning outcomes, usability testing or formative evaluation prioritises the behavioural dimension of the experience of learners as they interact with learning materials. Nathenson and Henderson (1980, 2018) show why formative evaluation with student users is necessary. They argue that when developers are interested in improving the learnability of resources student users make better informants than content experts. The strategy of think *aloud* usability testing, which includes watching and listening to learners as they interact with learning materials, is most suited to gathering data about learnability and the learning experience (Barnum, 2008a). Think-aloud usability testing data are valued for their rich and continuous account of underlying thinking (Conrad et al., 1999) and the immediacy of the insights they provide (Cohen, 1996). Most important, think-aloud data examine the question of how learners use or interact with educational resources. Think-aloud data are believed to inform programme review and development because of the additional information they provide about the nature of the learning experience of individual learners and the difficulties they encounter while using the resources (Cotton & Gresty, 2006).

Despite the value of the above-mentioned design thinking techniques to the design and development phases of (educational) products, these techniques have led to

delays in product completion when designers are part of development teams. One major challenge associated with these techniques is the inherently sequential nature of product development. Design thinking techniques prioritise design documentation and understanding of users before product building begins (Chamberlain et al., 2006).

In response, Takeuchi and Nonaka (1986) proposed a new holistic approach to product building that focused on product completion by attending to speed and flexibility. These ideas of speed and flexibility would gain further support in the software development industry almost 40 years later through the publication of the *Agile Manifesto* (Beck et al., 2023). The problems of product development have not changed. Speed and flexibility still inform product completion. However, before discussing any further the limits of design thinking techniques and the possible role agile methods might play through integration with the UCD principles, it is important to explore the nature of OER and the extent to which design and design thinking are part of their nature.

Open Educational Resources

Definitions of Open Educational Resources have at once attended to the meaning of open and to the meaning of educational resources. Supplementary notions of OER include adaptation and lifecycle. When lifecycle is used, it can refer to an OER lifecycle or an open education cycle.

In terms of the meaning of open in OER, definitions lean toward the non-financial and the legal. The following definition from the United Nations Educational, Scientific and Cultural Organisation (UNESCO) and the Commonwealth of Learning (COL) (2011, 2015) references the non-financial and the legal aspects: “Open Educational Resources are teaching, learning, and research materials in any medium that reside in the public

domain or have been released under an open license that permits no-cost access, use, adaptation, and redistribution by others" (p. v). This definition is also endorsed by the Creative Commons Organization. The licensing tool of Creative Commons (CC) allows for the free use and repurposing of resources by others (Bliss & Smith, 2017). Another dimension of the meaning of open emerges from Wiley's (2019) elaboration on the permissions granted to an educational resource by an open licence. These permissions according to Wiley (2019) include:

> Retain – the right to make, own, and control copies of the content
>
> Reuse – the right to use the content in a wide range of ways (e.g., in a class, in a study group, on a website, in a video)
>
> Revise – the right to adapt, adjust, modify, or alter the content itself (e.g., translate the content into another language)
>
> Remix – the right to combine the original or revised content with other open content to create something new (e.g., incorporate the content into a mashup)
>
> Redistribute – the right to share copies of the original content, your revisions, or your remixes with others (e.g., give a copy of the content to a friend)
>
> (p. 102)

With respect to the educational resource aspect of OER definitions there is some agreement that educational resources can refer to a broad range of items. UNESCO and the COL (2011, 2015) list these to include:

> full courses/programmes, course materials, modules, student guides, teaching notes, textbooks, research articles, videos, assessment tools and instruments,

> interactive materials such as simulations and role plays, databases, software, apps (including mobile apps) and any other educationally useful materials. (p. v)

An inclusive description of educational resources considers those types of resources that can belong to more than one type. Open educational resources possess three general characteristics: coverage of a broad range of learning resources; availability in any medium; allowances for reuse and modifications. As Orr et al. (2015) explain further, OER are:

> any type of learning resource used in an educational setting...are often, though not exclusively, offered in a digital format...the digital format allows the reuse, sharing, adaptation and repurposing of the resource for a different, new educational setting than the original one. (p. 18)

However, these are not the only defining features of OER.

Other ways of defining OER include distinguishing them from other innovations and specifying what they are not. Open educational resources are more than digital content available on the web such as Wikipedia and Open Data. While a Wikipedia page may be considered an open resource, it only becomes an OER if it is "used within a specific learning arrangement as an educational resource" (Falconer et al., 2013, p. 62) or "has a specified pedagogical purpose/context" (McGreal, 2014, as cited in Orr et al., 2015, p. 18). Similarly, with open data it is a source of information whose purpose is not directly educational. In addition, OER differ from learning objects and digital learning materials as they prioritise openness and lack of restrictive copyright. The same criteria of openness and flexible intellectual property rights such as creative commons licences separate OER from digital learning materials. Further, OER are seldom massive open

online courses (MOOC) since openness in a MOOC is limited to free access and use. In terms of form of resource, MOOCs tend to be designed as full courses targeted towards learners while OER, as discussed above, can refer to a range of designed objects including a full course. In terms of audience, OER are targeted towards teachers and learners. Finally, OER are part of open education (Cronin, 2017; Iiyoshi & Kumar, 2008) and sometimes open pedagogy (DeRosa & Robison, 2017; Werth &Williams, 2023; Wiley & Hilton, 2018).

Few definitions surveyed above conceive of OER as design artefacts (Kahle, 2008; Phillips et al., 2012). It is unclear whether this may have implications for the approaches to research undertaken about OER. A more immediate concern is whether the omission of design in the definitions above influenced the lifecycle approach to OER.

A Lifecycle Approach to Open Educational Resources

A lifecycle approach to OER is both a conceptual tool and a process map for the development of these resources. Open educational resources may also be conceptualized as products of open educational practices. These practices, in turn, are part of an open educational cycle (Hodgkinson-Williams et al., 2017), an OER lifecycle (Orr et al., 2017), or models of engagement with OER (Gurell, 2008). Hodgkinson-Williams et al. (2017) define the open education cycle (OEC) as practices comprising several activities starting with conceptualization (planning, proposing, and imagining), followed by creation (curation, circulation, certifying, and critiquing), then use (location and copying) and adaptation (customizing and combining) of these resources.

Orr et al. (2015) describe the OER lifecycle as an iterative process of production and reproduction divided in three stages. The first stage in the process is creation of a

resource by a producer. The second is ascription of a resource to a particular use or implicitly to a user group. Ascription refers to the description of the resource using metadata. Metadata are records that describe the most important features of the resources (Cechinel & da Silva Camargo, 2011). These records can include data about the creator(s), title, publisher, format, subject, unique resource identifier, etc. (Zeng & Qin, 2008). In the OEC, metadata ascription is a major part of the curation of OER. The third element of the OER lifecycle is adaptation of a resource. Adaptation (revision) of a resource can occur in two ways. One way is through changing the ascription of the resource. This can refer to the repurposing the resource for a different use or a different group of users, which can lead to a return to the second stage. Another way is by changing the content of the resource (revising) or the content with which the resource is used (remixing). This is the same as creating a new product and implies a return to the first stage (Orr et al., 2015).

Whether as part of an OEC or OER lifecycle model the literature points to the core activities of finding, composing, adapting, and crucially, reusing and sharing OER (Gurell, 2008). Indeed, a study by Beaven (2018) validates Gurell's (2008) initial lifecycle model of engagement with OER. Even though design thinking may be implied in the OER lifecycle and the OEC the end user or learner can become an outsider in the lifecycle model. In addition, these models remain silent on questions of usability and learnability of these resources. Further, it should be noted that none of the lifecycle models describing OER practice explicitly make room for piloting, prototyping, or trialling these resources with learners, the real end users of the resource. For example, the stage that describes use in the OEC by Hodgkinson-Williams et al. (2017) references

locating and copying (use in its original form) OER. However, no mention is made of piloting, one of the methods publishers use to evaluate materials (Amrani, 2011). What is also absent from three of the above-mentioned versions of the OER lifecycle is evaluation, a starting point for adaptation. Usability and accessibility of OER (McGreal, 2013) are quality indicators that inform (re)design. Indeed, judging the worth of an OER provides the feedback loop needed for the redesign or adaptation of those resources.

Adaptation and Localization of Open Educational Resources

Adaptation is referenced as part of the UNESCO COL definition of OER. In addition, lifecycle models identified in the previous section acknowledge the importance of adapting and localizing OER, yet a major challenge of the Global South is the limited attention given to adapting and localizing OER (Hodgkinson-Williams et al., 2017; Hoosen et al., 2019). In other words, there is use in the form of locating and copying but little in the way of adaptation. The meaning of adaptation can vary. For example, a study by Weller et al. (2017) reported participants varying perceptions of the meanings of adaptation. The findings of a survey of educators, primary users of an OER, suggested that adaptation had at least two different meanings. For some educator users "adaptation means using the resources as inspiration for creating their own material" (Weller et al., 2017, p. 74). For other users "adaptation is more direct, editing or reversioning the original, or aggregating elements from different sources to create a more relevant one" (p. 74). Still, for other users "adaptation may be taking an existing resource and placing it in a different context within their own material" (p. 75). These versions of adaptation are captured in the practice of customising (revising and modifying) and combining (remixing) described by Hodgkinson-Williams et al. (2017). Adaptation may also be

conceived as two tasks of localization, adaptation of locale and of the interface (Cechinel & da Silva Camargo, 2011). According to Wiley (2009) "localization is the process of adapting educational materials in ways that make them more appropriate for target users in linguistic, cultural and other ways" (p. 362). All the above descriptions of adaptation and localization share a common exclusion of the real end user and beneficiary of the OER, the learner. Real adaption of OER cannot occur without involving the learner since only the learner can validate resource usability or learnability (Barnum, 2008a; Nathenson & Henderson, 1980, 2018). Therefore, in defining OER the problem of adaptation and/or localisation may also include the question of how to adapt OER. Studies on the adaptation and localization of OER are still emerging and a few of them are reviewed in the next section.

Research in Open Educational Resources

Open educational resources originated within the Higher Education sector (Bliss & Smith, 2017; Weller, 2014) and much of the research reports to date have drawn on data from that sector. Few reports, however, have drawn on data from workplace training environments (Cannell & Macintyre, 2017; Geith et al., 2010; Merkel & Cohen, 2015). The Open Education Research Group (n.d.), the OER research hub (Weller et al., 2017) and the Research on Open Education for Development (ROER4D) have facilitated several research projects in the field. A recent focus of research in the last group, ROER4D (Hodgkinson-Williams et al., 2017) has been the Global South. In their most recent meta-synthesis of reports in that region only one study focused on the localization of an OER repository at the Darakht-e Danesh Library (Oates et al., 2017). Despite several proposed models of localization and adaptation of OER, scholarly or applied,

research in the area is still in the early stages. The following section explores the current research into OER and their limitations, proposed models for OER adaptation and localization, and current research into the adaptation and localization of OER.

Current Research into Open Educational Resources

More than half of the studies identified in the Table 2 share a focus on adoption of OER (Siminyu, 2017; Wright, 2018) and developing quality OER (Bliss, 2013; Emmerson, 2013; Yuan, 2015). The interest in quality resources was present even when research focused on stakeholders' perceptions of adoption (another research focus) and integration of OER in higher education (Wright, 2018). Other areas of focus include creating a British literature open educational digital textbook (Moore, 2018); creating a concrete framework that allows for comparing the technical difficulty in reusing OER (Gurell, 2013); and "a new OER development model that establishes communities of practices around OER in higher educational institutions, where the knowledge production that takes place inside classrooms provides sustainable resources for the OER development process" (Fatayer, 2016, p. iv). This last work by Fatayer (2016) regarding a model for sustainable OER seems to be aligned to Downes' (2007) vision of a model for sustainable OER, that is, decentralization by collapsing the functions of producer and consumer. "The *use* of a learning resource, through adaptation and repurposing, becomes the production of another resource" (Downes, 2007, p. 41). As noted, an area that has received little attention in the research literature is adaptation and localization of OER; use precedes adaptation and localisation (Hodgkinson-Williams et al., 2017). Use in the form of expert review determines content issues for adaptation, not learnability. Only the student user validates learnability/usability/learner (user) experience and ultimately the

need for adaptation (Nathenson & Henderson, 1980, 2018). Notwithstanding the different strengths of expert trainers and learners, data from both stakeholders can be used to benefit OER adaptation and localisation efforts. The following section discusses proposed models for adaptation and localization and the extent to which these models admit learnability and the learner's experience.

Table 2

Adoption and Quality in OER Research

Author	Title	Focus	Methodology
Bliss (2013)	A model of digital textbook quality from the perspective of college students	An approach for developing a model of digital textbook *quality* from the college student perspective	Mixed methods
Emmerson (2013)	Open educational resources: A Delphi study of instructional design quality	Investigate instructional designers' beliefs about the instructional strategies and activities for a universally accepted framework for producing *quality* self-directed, multimedia OER.	Delphi study
Fatayer (2016)	Towards a sustainable open educational resources' development model: Tapping into the cognitive surplus of student-generated content	A new OER development model that establishes communities of practices around OER in higher educational institutions, where the knowledge production that takes place inside classrooms provides sustainable resources for the OER development process	Literature review
Gurell (2013)	Measuring technical difficulty in reusing open educational resources with the ALMS analysis framework	Create a concrete framework with enough detail and documentation for comparisons to be made among OER	Delphi study
Moore (2018)	Through the looking glass with open educational resources	Collaborate and receive subjective opinions on the process of creating a	Qualitative instrumental case study - semi-

Author	Title	Focus	Methodology
		British literature open educational digital textbook	structured interviews, focus group interviews, observations, documents
Siminyu (2017)	Open educational resources utilisation among learners at Makerere University: A mixed methods study	Assess the interaction between the learner and environmental, organisational, and personal factors influencing OER *adoption*	Mixed methods
Wright (2018)	OER adoption in higher education: A case study of stakeholders' perceptions at a Florida state college	Document stakeholders' perceptions of *adoption* and integration of OER in higher education	Case study – Semi-structured interviews, survey
Yuan (2015)	Does audience matter? A study of how people apply and perceive quality rubrics when evaluating open educational resources	How people applied *quality* rubrics when evaluating OER, how they perceived the utility of these rubrics, and whether teachers and non-teachers differed in terms of their application and perceptions	Surveys; In-depth interviews

Models of Adaptation and Localization of OER

Models of adaptation and localization of OER have focused on the question of sustainability. Downes (2007) initially portrays the sustainability (and scalability) of OER in terms of the three centralized models: funding, technical, and content. His discussion and recommendations later focus attention to the sustainability of OER and the need for seeing OER as only part of an open system of education, "one that includes volunteers and incentives, community and partnerships, co-production and sharing, distributed management and control" (p. 41). Sustainability through learning design is another sustainable model proposed for adaptation and localization of OER (Conole & Weller, 2008). The authors advocate learning design as a framework to support the

design and reuse and sustainability of OER. The goal was "to develop a 'pick and mix' learning design toolbox of different resources and tools to help designers/teachers make informed decisions about creating new or adapting existing learning activities" (Conole & Weller, 2008, p. 1). Learning design describes "the range of activities associated with creating a learning activity and crucially provides a means of describing learning activities" (Conole & Weller, 2008, p. 2).

Ensuring sustainability also requires attention to the culturalization of the OER. Culturalization may take two forms: one is the use of the resources to learn about other cultures, and another is to presume that users can learn with culturally repurposed OER. Amiel et al. (2011) proposed four ways to classify culturalization approaches: Learning Object (LO) – a conventional learning object in which developers create LOs in line with their own perception of learner culture; Learning Object with Multicultural Affordances (LOMA) – leading the learner to the cultural context contemplated by developers through teaching the cultural background of the original; *n*-Culture – using the experience of users and developers in the development process; and Learning Objects with Cultural Adaptability (LOCA) – creating an open structure which allows local developers to collaborate in the culturalization process (Cechinel & da Silva Camargo, 2011). The following section reviews the extent to which current research into adaptation and localization aligns with any of the models proposed in OER research in general or with those models proposed for sustainable adaptation and localization of OER.

It should be noted, however, that the above conceptions of sustainability exclude the importance of designing for sustainability (Kramer, 2012) making OER usable (learnable), useful, and desirable. Usable and learnable educational resources are less

likely to be discarded for another resource because they do not work as intended (Rosenzweig, 2009; Shedroff, 2009). In addition, usable and learnable products such as educational resources last longer because they have been designed to be customised or expanded to extend their lifetime. Similar to research in OER, design thinking techniques and the learner's experience is still absent from the conversation on models for the adaptation and localization of OER. One exception from the Global South is a proposal by Sánchez-Gordon and Luján-Mora (2015) for "an ecosystem to have a sustainable mechanism to enable accessible (useable) MOOC and OER deployment in corporate training contexts. The proposed ecosystem includes three stages: develop, publish and improve" (para. 1). While this is useful for creation of MOOCs and OER, it does not address innovative resource adaptation. The following section explores whether design thinking, and the learner's experience are the focus of research into the adaptation and localization of OER.

Research into Adaptation and Localization of Open Educational Resources

Kahle (2008) argues that design is as much a predictor of success in open educational resources and technology as the finance and governance models described by Downes (2007). In short, design matters in every OER creation or adaptation project. In addition, evaluation is critical to every design and development process model (Smith, 2010). However, reports on OER adaptation and localization projects prioritize evaluation by learners last, if at all. In fact, the research reports on OER adaptation and localization projects described in Table 2 suggest a focus on teacher reviews of these resources, ignoring a key stakeholder in the evaluation process, the learner. They also emphasize peer and expert reviews. While peer and expert reviews provide quality

monitoring mechanisms for OER content developers and subject matter experts, Nathenson and Henderson (1980, 2018) remind of the value added by student users in assessing the learnability of that content. The annotated list of adaptation and localization research in Table 3 is discussed next.

Table 3

Expert and Teacher Centric Focus in Adaptation and Localization Research

Author	Title	Focus	Methodology
Ivins (2011)	Localization of open educational resources (OER) in Nepal: Strategies of Himalayan knowledge-workers	Understand how OER content is localized for the needs of Himalayan villagers in order to support individual problem-solving and community empowerment – identifying and describing patterns of localization practices	Interviews, focus group discussions, observations, and artefact reviews
Law (2019)	Refining open educational resources for both learner and institution	Examines the impact of OER created by the Open University and recent developments to recognise, motivate, and reward learners through the issuing of free open digital badges	Surveys, website analytics
Oates et al. (2017)	An early-stage impact study of localised OER in Afghanistan	Evaluates a group of Afghan teachers' use of OER from the Darakht-e Danesh Library investigating resources impact improvements in teaching practice and improved subject knowledge	Mixed methods – pre-treatment survey, interviews, lesson plans, and classroom observation
Perryman et al. (2014)	Learning from TESS-India's approach to OER localisation across multiple Indian states	A report on the initial approach to OER localisation adopted by the Open University UK-led TESS-India (Teacher Education through School-based Support) project which is	Document analysis interviews and participant observation

Author	Title	Focus	Methodology
		developing OER for use within India's teacher education system.	
Wolfenden et al. (2012)	OER adaptation and reuse across cultural contexts in Sub Saharan Africa: Lessons from TESSA (Teacher Education in Sub Saharan Africa)	The process of supporting the user community to harness and integrate OER for their own systems and cultures	Document review (critical reader or original authors) and semi-structured interviews

Common to all the studies is the involvement of teacher participants or knowledge workers and data triangulation. Only one study targeted learners focusing on their needs to improve usability (Law, 2019). The study by Ivins (2011) sought to understand how OER content is "localized for the needs of Himalayan villagers in order to support individual problem-solving and community empowerment" (p. 81) – identifying and describing patterns of localization practices. The study by Wolfenden et al. (2012) followed a similar path focussing on the process of "supporting the user community to harness and integrate OER for their own systems and cultures" (p. 1). Participants in the adaptation process were drawn from the pool of original TESSA authors or critical readers including a minimum of two lecturers for each subject area. Teachers were also the focus in a paper reporting "on the initial approach to OER localisation adopted by the Open University UK-led TESS-India (Teacher Education through School-based Support) project which is developing OER for use within India's teacher education system" (Perryman et al., 2014, p. 1). Finally, the most recent study evaluates "Afghan teachers' use of OER from the Darakht-e Danesh Library – a digital library comprised of educational materials in English, Dari and Pashto – investigating whether these resources enabled improvements in teaching practice and led to improved

subject knowledge" (Oates et al., 2017, p. 549). A few questions arise that were unclear while reviewing the report: who were the real student users of these resources and what tasks were they attempting to complete? How did decision-makers establish that the resource selected was the right solution to the learners' problem?

A review of the data sources incorporated into the methodologies of the research reports on OER in general and of research reports on adaptation and localization shows data triangulation as the principal data collecting strategy in 8 of the 11 reports presented. Indeed, over 70% of the reports employed data triangulation. Further review of the individual data sources may support categorising data sources according to the following: behavioural data (observation – 27.3%), concurrent data (think aloud protocols – 0.0%), product data (document review or textual analysis – 45.5%) and retrospective data (interviews – 63.3%; survey questionnaires – 27.3%). It should be noted that the reports using triangulated data sources draw on combinations of retrospective, behavioural and product data sources. There is little evidence to suggest that concurrent data featured as one of the data sources employed in these projects. In fact, even though think aloud protocols have been used in educational resource adaptation (see Table 4), they are little used in higher education research generally and less so in distance education research to enhance or supplement traditional data collection methods (Cotton & Gresty, 2006; Young, 2005). The think aloud protocols is even less used in OER adaptation efforts. While data triangulation has its advantages, using data sources that rely on expert review may deliver only the expert insights about resource content. Experts are not the only users and may not be best positioned to comment on how learners experience the resource. Two of the data sources mentioned have the potential to reveal the learners'

experience: behavioural data and concurrent think-aloud data. The first was seldom used while the second was not included among the data sources.

Despite an increasingly learner centred paradigm of education (Reigeluth et al., 2017), much of the research in OER to date is yet to consider designing for the learner's experience of the content presented in OER, whether the content is print based or digital. Reasons for the exclusion of learners in designing learning experiences may be a combination of the absence of feedback loops to help improve the design of teaching (Laurillard, 2012) and the presumption by training organisations that they know best what learners need to know (Allen, 2012). Even though designing for user (learner) experience is one of five design principles outlined by Kahle (2008), research in OER has been slow to focus on this area. In addition, the research is still to explore the learnability or usability of learning objects (OER). *This means admitting that learnability or usability of OER is about the way learners interact with content, and not just about the content itself* (Duchastel, 2003; Feldstein, 2002; Quigley, 2002). It also means accepting that the learner (user) alone validates learnability (usability) (Barnum, 2008a; Nathenson & Henderson, 1980, 2018). Further, design is more than the creation of (educational) products, it is the analysis of the relationship between people (the learner) and those products (Brown, 2009); that means, it is about design thinking. Therefore, design thinking is about the learning experience.

As noted in the introduction to this section few reports have drawn on data from workplace training environments (Geith et al., 2010; Merkel & Cohen, 2015). The section below reviews reports of OER in workplace settings and considers the extent to which design thinking has been used to create or adapt OER.

Open Educational Resources in Workplace Training Environments

Research shows that learning in universities and workplaces is different because they represent different activity systems (Le Maistre & Paré, 2004). One of the differences is described in terms of formal versus non-formal education (Olcott, 2013) or lifelong learning (Lane, 2013), "just in time" learning (Le Maistre & Paré, 2004, pp. 48–49), all of which can include training in the workplace. Differences between academic and workplace contexts are illustrated through research in information literacy where fundamental differences exist in the information needs, information seeking behaviours, and information use patterns of students when compared with employees and knowledge workers (Jinadu & Kaur, 2014; Kirton & Barham, 2005; Monge & Frisicaro-Pawlowski, 2014). Reports in this section uncover some of the research literature on OER in workplace training environments such as OER creation and use in workplace settings, information literacy (skills) as workplace training, the use of studies of workplace information behaviour and the limits of the literature.

OER Creation and Use in Workplace Settings

First is the report by Geith et al. (2010), which presented the results of a three-way collaboration under the Food Safety Knowledge Network (FSKN). The network's goal was "to help strengthen the food industry's response to the complex food safety knowledge and training challenges that affect emerging markets by providing free access to high-quality, standardized learning resources" (p. 3). The report discussed the on-demand nature of the resource design and the structured nature of the learning experience. The report also noted the impact of trials of the FSKN training on participants, including the substantial improvement in knowledge. Also presented were

the steps taken to initiate an OER project on time and considering understandings of licensing, the use of open software, building capacity and partnering with corporate and global collaborators. Though there is some suggestion that one aspect of design thinking was used in the form of a pilot, it is unclear how training needs were determined and how these were translated into relevant curriculum resources. What is clear is that this was not a report on adaptation or localization of an OER.

Another report by Merkel and Cohen (2015) acknowledges the limited coverage in the literature of OER usage by instructional designers or training managers in corporations. However, their study examined the OER usage of these two stakeholders in line with Wiley's model. Merkel and Cohen (2015) distinguish between Little and Big OER repositories and argue that "Little OER repositories such as YouTube and Wikipedia are not necessarily designed to fulfil educational purposes" (p. 237). Findings suggest high reuse of little repositories by instructional designers or training managers in corporations. Reuse includes revision or modifying the form of the resource, and remixing or combining different resources to create remixed versions. The focus was on the use and re-use of resources since there was no report on the design process used or how the process was engaged.

In the two reports that follow challenges associated with OER use in the workplace are described. The first by Stoffregen et al. (2016) outlines "relevant barriers to the exchange of Open Educational Resources in local public administrations...the paper contributes to the lack of research about open e-Learning systems in the public sector" (p. 167). The second by Cannell and Macintyre (2017) reflects "on the opportunities and challenges involved in using Open Educational Resources (OER) in

workplace settings" (p. 111). Specifically, they comment on the lack of social and pedagogical dimensions to the use of OER. The authors conclude that there is little practice-based evidence of the use of OER with non-traditional learners from community and workplace settings. Neither study addresses adaptation or design processes and models for adapting workplace OER.

As mentioned in the section above on models for adaptation and localization of OER, Sánchez-Gordon and Luján-Mora (2015) proposed "an ecosystem to have a sustainable mechanism to enable accessible MOOCs and OER deployment in corporate training contexts. The proposed ecosystem includes three stages: develop, publish and improve" (para. 1). One of the strengths of this proposed model is that it attends to the need for a model to guide OER creation in workplace settings of the Global South. Another strength is its advocacy of sustainable development by its focus on accessible (useable) workplace OER. While the ecosystem model may be useful for the development phases of MOOCs and OER, its development orientation may also be a drawback.

One of the problems with a development focus is the limited involvement of corporate learner participants to establish the training need. For example, the develop phase of the ecosystem does not seem to consider the following questions: "Who are the learners and what needs to change about their performance? What can they do now? Are we sure they can't already do what we want?" (Allen, 2016, p. 311). Instead, the development focus leads users of the MOOC or OER to conduct validation testing. That kind of focus ignores the way training gaps are identified and framed, and leaves bare the learner's underlying needs (Travis & Hodgson, 2019). It can also lead to unverified

assumptions about the need for a training intervention. Agile design thinking techniques like design ethnography (discussed below) allow for testing risky assumptions about the need for a training intervention. The ecosystem model may be inadequate since it does not appear to contemplate evaluation of the needs of trainee participants. Its focus is deployment.

Information (Literacy) Skills as Workplace Training

Information literacy skills have been defined in different ways. In one definition it is "the ability to make efficient and effective use of information sources" (Julien, 2001, as cited in Case & Given, 2016, p. 371). In another, it also includes the teaching of transferable 'soft' research skills. These can include how to recognize when there is a need for information or data; how to evaluate the trustworthiness of a source; how to choose the most appropriate source for a given need; how to formulate and filter search terms to get the best possible returns; and how to extract and present the information or data in an ethical way to an audience (Sarkanen & Stoddard, 2015). The Association of College and Research Libraries (ACRL, 2000) agrees that information literacy "initiates, sustains and extends lifelong learning" (p. 3). Lifelong learning is part of workplace training described previously.

Even though there is some expectation that the information literacy competencies in academic contexts are transferred to workplace contexts a conceptual discussion from Jinadu and Kaur (2014) shows that "existing information literacy conceptualization and subsequent models do not support the perspective and understanding of information literacy at the workplace" (p. 61). In fact, both contexts may have different understandings of information literacy. In academic and school contexts information

literacy focuses on an assignment or writing project (essay). It is individual and textual. In the workplace context the textual nature of information literacy is only one dimension. Another dimension is the "complex social [and cultural] practice" (Lloyd, 2010, p. xvi) in which other people or social interactions play a role in the information literacy process.

It is useful to consider why people in occupational roles need training in information literacy or how workplace information literacy is a matter for workplace training. More than helping workers overcome the problem of information overload through lifelong learning, there is a risk or cost to the organization when employees lack training in information literacy skills. To appreciate the need for training, it is important to review examples of information behaviours and practices of concern to a few occupational contexts. Sarkanen and Stoddard (2015) cite a press release from the British and Irish Association of Law Libraries (BIALL) working group on information literacy in which newly qualified lawyers tasked with conducting research were:

> unfamiliar with paper-based sources compared with digital, relied on one-hit searching, and did not check thoroughly or contextually around their findings. Google was used extensively in searches, even for legal queries, and they [lawyers] lacked persistence, diligence, and organization in searching. (p. 162)

Sarkanen & Stoddard also report cases of journalists using Wikipedia as their only source printing false information in an article, which itself was cited on Wikipedia as evidence of the factual error. The information behaviours and practices described above can cost organizations their reputation (in the case of the new legal professional) or lengthy court

cases resulting in damages. These costs suggest a need for information services "to provide training [in information literacy] to their users" (2015, p. 162).

Discussion about who conducts the training and why also deserve some consideration. Should trainers come from database providers (vendors) or corporate specialist librarians? For librarians working with small teams or as a team of one there are benefits to delegating the training role to the dedicated trainers from the database providers. These trainers tend to have sound knowledge of how to exploit their database to get the best results. The drawback is that trainers from the database provider might spend more training time selling their own databases over other competitor databases. On the other hand, the librarian as trainer presents important advantages. Sarkanen and Stoddard (2015) identify at least six benefits to the librarian as trainer. They argue that the librarian as trainer offers:

> an important marketing tool for the library… an information professional's knowledge and increase[d]… visibility in the workplace… confidence [to users] in asking them for assistance and helps broker a relationship between staff and the library… more time [for] personalizing the training to those being trained taking into account the subject matter and the seniority of the trainees, so participants get more out of the training…a more balanced, impartial view [to trainees] on the strengths and weaknesses of the databases the organisation subscribes to and [insights into the librarian's] personal experience of getting the best from the database…[no] additional cost to arrange for external trainers to attend. (p. 164)

The Uses of Studies of Information Behaviour

What is information behaviour? Agarwal (2023) describes information behaviour as

> the many ways in which human beings interact with information - how people seek and utilize information, but also includes other activities such as avoiding/stopping, distorting, encountering by chance, organizing, storing, creating, sharing, diffusing, and deciding to stop using information. (para.1)

What has been the purpose/impact of studies of information behaviour? Reports from Wilson (2022) suggest that studies of human information behaviour have impacted disciplines such as computer and information systems, health, education, and management. Within the field of education Wilson (2022) shows how Kuhlthau's model of the information search process (ISP) has been used to evaluate digital learning systems. Kuhlthau's (2004) model has also been used to describe information seeking behaviours in educational *and* workplace contexts. Kuhlthau (2004) argues that the model is useful both for the reference and instructional service interventions in libraries, including special libraries. Few studies have employed reports of workplace information behaviour to recommend staff development in terms of information literacy (Hepworth & Smith, 2008; Ogunbodede & Ambrose, 2020; Renwick, 2019). Fewer studies have used workplace information behaviour research to inform the selection of an OER training asset for developing information literacy skills.

Design Thinking Techniques in Educational Resource Adaptation

Open educational resources research has only recently begun to explore usability and user experience. One such study by González Pérez et al. (2016) proposed to focus

on analyzing the usability of a web repository that integrates Discovery Tools, evaluating users' experience, and developing "a usability evaluation prototype which will offer new insights in the design of the information architecture" (p. 1103). Another more recent project investigated the acceptance and usability of OER in India focusing on faculty perception by applying a Unified Theory of Acceptance and Use of Technology (UTAUT) model (Padhi, 2018). The study also identified the challenges associated with OER. Other projects such as Albeanu and Posdarascu (2017) extend the focus on quality assurance criteria for OER investigated by Yuan (2015). In addition, quality from the point of view of diversity and inclusion was also the focus of the CO-CREARIA model to support the co-creation of inclusive and accessible OER (Baldiris et al., 2017). Still, other projects have analyzed faculty perception on availability and usability of relevant OER for teaching the contents and the dilemmas faced by teacher educators in integrating OER for teaching (Paleeri, 2018). The obvious limitation is that none of these projects was about OER usability in workplace contexts. Another gap is that none of these projects studies the interaction between the learner and the educational resource to adapt or improve the resource. Studies that explore the learner's experience of educational resources is considered in the section below.

Usability Testing of Educational Resources

The first study in Table 3 focused on developing a new instructional system design (ISD) process – learning object user-centred instructional design (LOUCID) through formative research methodology. The cases used to modify and extend the process were situated in a corporate training environment (Branon, 2011). The study by Cotton and Gresty (2006) reflected on their detailed evaluation of an online biological

resource for student nurses (Headstart), developed at the University of Plymouth. Initially, retrospective data were collected in the form of online questionnaires which were useful to gather student views about the resource. However, this data source gave no real insight into the ways the resource was being used by the students and its possible impact on their learning. The third study, a follow up to an initial study involving usability testing with end users, focused on finding out "whether heuristic evaluation of the multimedia e-learning resource by a panel of experts would be an effective and efficient alternative to testing with end users" (Davids et al., 2013, p. 242). The focus of the fourth study was to "conduct a randomized trial to investigate whether a usability evaluation of a multimedia e-learning resource, followed by fixing of all problems identified, would translate into improvements in usability parameters and learning by medical residents" (Davids et al., 2014, p. 155).

In another study Doubleday et al. (2011) show the importance of usability testing for adapting an online anatomy resource called the ''Virtual Lab'' and employed usability testing "to determine whether increased content would impair navigation through the interface" (p. 318). Usability testing, also known as formative research, was used to test an educational resource in a study by English and Reigeluth (1995). The study promised to fill the gap of limited empirical research on the elaboration theory of instruction through formative research to identify weaknesses in the theory and possible ways of improving the weaknesses in the theory. There was no explicit focus on instructional theory in the study by Fisher (2009). The study instead investigated the effectiveness of implementing usability testing as part of a user-centred design framework into the development of an online course in order to provide a model for

improved course design. Course improvement was hardly of interest to Grudniewicz (2015) and Kealey (2015). In its place, the authors focused on the use of printed educational materials (PEMs) by different users of the health care delivery system. Grudniewicz (2015) examined PEMs as a tool to facilitate the dissemination of clinical information for Primary Care Physicians. Since PEMs are a knowledge translation intervention for disseminating synthesized clinical evidence to end users with little expertise or low numeracy, Kealey's (2015) study focused on making PEMs usable and understandable to cancer patients by employing heuristic evaluation and usability testing.

Finally, Nathenson and Henderson (1980, 2018) report several case studies employing formative research involving students in the pilot and try-out of educational resources at the Open University. In one case study that engaged 45 students, data collection used an integrated feedback system representing the dimensions of outcome - process and concurrent - retrospective data. Integral assessment or post-test feedback questions (retrospective outcome data) were used to assess the effectiveness of the materials as well as assessing the students. In addition, in-text feedback questions linked to objectives (concurrent outcome data) were used to collect outcome data. To collect concurrent process data or record the time on task, the same in-text feedback questions not linked to the objectives were administered. Finally, post hoc interviews were used to complement the other data collection efforts. Even though the authors report on another case study in which objective data on the effectiveness of the revisions were collected, the resources were not available to conduct studies to validate revisions made to various components of one of the case studies identified in Table 4.

Table 4

Usability Testing of Educational Resources

Author	Title	Usability study type	Design research focus	Revisions completed?
Branon (2011)	Learning objects: A user centred design process	Formative research	Instructional design process	
Cotton and Gresty (2006)	Reflecting on the think-aloud method for evaluating e-learning	Think-aloud protocol		
Davids et al. (2013)	An efficient approach to improve the usability of e-learning resources: the role of heuristic evaluation	Heuristic evaluation		
Davids et al. (2014)	Effect of improving the usability of an e-learning resource: A randomized trial	User testing	Instructional design theory (Cognitive learning theory)	Yes
Doubleday et al. (2011)	The Virtual Anatomy Laboratory: Usability testing to improve an online learning resource for anatomy education	Usability testing		Yes
English and Reigeluth (1995)	Formative research sequencing instruction with the elaboration theory	Formative research	Instructional design theory (Elaboration theory of instruction)	
Fisher (2009)	Usability testing-a model for improved online course development	Usability testing		
Grudniewicz (2015)	Printed educational materials for primary care physicians	Systematic review, focus group, usability testing		Yes
Kealey (2015)	Impact of design expertise and methodologies on the usability of printed education materials	Heuristic evaluation, usability testing		

Author	Title	Usability study type	Design research focus	Revisions completed?
Nathenson and Henderson (1980, 2018)	Using student feedback to improve learning materials	Formative evaluation		Yes

The successful adaptation of educational resources through the implementation of formative usability testing both in university and workplace contexts makes the case for similar studies to be undertaken to adapt OER in workplace training environments. Even though all the studies in Table 4 employed some version of user experience design thinking (usability evaluation) to improve educational resource products, it should be noted that few of these resources focused on OER (Branon, 2011). In addition, the data sources were mostly drawn from the higher educational context, few were workplace training environments (Branon, 2011; Grudniewicz, 2015; Kealey, 2015). Further, while no study reported integration of agile development methods, a few reported tests of the effectiveness of revisions (Doubleday et al., 2011; Grudniewicz, 2015; Kealey, 2015; Nathenson & Henderson, 1980, 2018). It is unclear whether studies that managed to test the effectiveness of design revisions did so by incorporating agile methods. It is also unclear how long it took to test the effectiveness of the revisions. Further, few of the studies make explicit an instructional (design) theory of interest (Davids et al., 2014; English & Reigeluth, 1995). Finally, few studies acknowledge the value of testing the effectiveness of revisions *before* [researcher's emphasis] implementation or roll out of the resources within a course (Doubleday et al., 2011; Nathenson & Henderson, 1980, 2018)

Beyond these superficial concerns, the studies summarised above raise more substantial questions that make the case for a learning experience with agile design framework. For example, both the expert led heuristic evaluations and the formative think-aloud usability testing of these resources are techniques employed in the project development phase. A problem with formative usability testing that often goes unchecked is the assumption that the solution tested is the right solution or one that matches the needs of the user. Usability testing may not be the right tool to establish user needs (Travis & Hodgson, 2019). The studies of educational resources described above have all assumed that the solution (the course, the text, or the software/online virtual lab) is what the user needs. Only the study by Grudniewicz (2015) incorporated some form of student user research (focus groups) to check that the printed educational materials aligned with the needs and expectations of primary care physicians. In higher educational contexts with large numbers of students and limited time between course offerings validating the solution may seem a reasonable approach. Indeed, validation of the solution through iterative design techniques is useful during the development phase since iterative testing often results in incremental improvements. However, in both higher educational and workplace training environments questioning the way the problem is framed by focusing on the learners' underlying needs may lead to more innovative designs than mere incremental change.

In addition, several of the studies reported above seem unable to confirm if the recommended revisions were made and whether the changes were tested and proven to be effective. Studies by Fisher (2009) and English and Reigleuth (1995) are but a few illustrations that make the point. The problem has since been identified by other

researchers, notably those attempting to integrate agile methods within user centred design (Chamberlain et al., 2006; Gurusamy et al., 2016; McGin & Chang, 2013; Salah et al., 2014; Sy, 2007). They argue that the source of the problem is due to the priority of user centred design, excessive documentation. This may explain the need for application and integration of two of the core principles of the *Agile Manifesto* (Beck et al., 2023). The authors identify four principles from the *Agile Manifesto*. The first principle is individuals and interactions over processes and tools, which is a value shared with user centred design (Chamberlain et al., 2006). The second principle values working software over comprehensive documentation. The third principle prioritises customer collaboration over contract negotiation, which is also a value shared with user centre design (Chamberlain et al., 2006). The fourth principle values responding to change over following a plan. The second and fourth principles point to the main differences between user centred design and agile methods. Discount usability testing methods like the rapid iterative testing and evaluation (RITE) method (Medlock et al., 2002) have already demonstrated the potential for integration of key agile principles with user-centred design principles.

A third concern is that formative usability testing evaluation research within a user-centred design framework may or may not attend to learning theories and models within the instructional design knowledge base (Richey et al., 2011). It should be noted that only a few studies have attended to learning theories and models within the instructional design knowledge base (Davids et al., 2014; English & Reigleuth, 1995).

A concern voiced throughout this review is the silencing of the student end user in favour of the expert reviewer. Although the research into design thinking of

educational resource adaptation does not support this concern, it should still be noted that heuristic evaluation or expert reviewers are not learners and that they are not ultimate judges of how learnable (usable) an OER is. As mentioned under the section on design thinking above, empathy is a feature of the design thinking mindset and prioritises understanding the needs of those for whom a design is intended. Prioritising the learner may have the advantage of discovering how student users approach their goals and tasks for the purpose of learning. It is part of the design thinking process. In addition, learner empathy prioritises the idea of a learner archetype or learner persona instead of "generic definitions of a learner" (Gachago, et al., 2017, p. 11) often used as the basis for course design. Learner empathy involves learners in the design process and might inform which learning theories and teaching models are embedded into the purposeful design for learning.

Summary

This review described key concepts and elements of experience design and examined various conceptions of OER. It highlighted the need for further research into adaptation of workplace OER and for the implementation of design thinking and experience design methods for research into OER in general and into the adaptation of workplace OER. Finally, exploring the gaps in the grey and research literature suggests a need for integration of design thinking with agile methods to maximise the strengths of both. The next chapter describes the study's core and proposed conceptual framework.

Chapter 3. Conceptual Framework

Introduction

The concepts outlined above contributed to the conceptual framework proposed for this study. They have pointed to some gaps in the design research literature. Using design research techniques with OER adoption *and* adaptation is still relatively new. Similarly, using those techniques in workplace training contexts is gaining some momentum. When design thinking techniques were used in educational resource adaptation, they seemed to focus more on the intervention than the learner's experience of that intervention. One dimension of incorporating the experience of an intervention is ensuring that the intervention solves the right problem. This alignment between experience and problem is a concern for training and development in workplace settings. Another dimension is drawing on learning theory to enhance the learning experience of the intervention. The sections below explore the potential of instructional models for OER, the case for the LEAD framework, and what the framework entails.

Instructional (Design) Models for Open Educational Resources

Instructional design shares with design thinking a problem-solving mindset, a similar design process (Bell & Shank, 2007; Fila et al., 2017) and design research techniques. Beyond the shared features of both design fields Li (2002) suggests design thinking is a knowledge base of instructional design. Some researchers have demonstrated the potential for integration of design thinking and instructional design to design a distance learning course (Filantro & Costa Cavalcanti, 2018).

The research on experience design for educational resources adaptation shows that exploration of (instructional) design models and principles is not inconceivable. Two studies have demonstrated this potential. One study is by English and Reigeluth (1995). That study explored elaboration theory (an aspect of conditions-based theory). Elaboration theory addresses the scope, structure, and sequencing of content. The other study by Davids et al. (2014) explored cognitive load theory. Cognitive load theory defines three types of cognitive load on the working memory. Both these theories focus on improving the presentation of information. The point here is that usability science (Gillan & Bias, 2001) and learnability (Duchastel, 2003; Nathenson & Henderson, 1980, 2018) both have a stake in improving information presentation. While the design principles generated from usability and learnability may intuitively address theoretical concerns of instructional design, they do so assuming the presentation of the intervention and the learning theory concerns of the intervention are appropriate for all learners and learner profiles. There seems to be little differentiation among learner groups to attend to their diverse work practices. These practices refer to the methods the learner (user) employs for "conducting and ordering interactional work" (Crabtree et al., 2012, p. 187). Work practices may include learner goals, behaviours, attitudes, and intentions and motivations (Stefaniak & Sentz, 2020; Travis & Hodgson, 2019).

A related information/instructional design principle that has received some attention in distance education and e-learning evaluation theory is motivation to learn. Drawing on motivation theory, Zaharias (2009) "developed a conceptual framework for the usability evaluation of asynchronous e-learning applications used by adult learners in workplace settings" (Ruhe & Zumbo, 2009, p. 49). The framework augmented traditional

usability constructs with instructional design and motivation to learn and was used to develop a standardised psychometrically tested questionnaire (Zaharias, 2009). While the framework does provide a list of heuristics to inform and guide new designers of e-learning solutions, the use of questionnaire data alone as a tool to gather requirements is limited. The limitation stems from use of an inadequate tool for discovering the learners' context and needs when designing or selecting a suitable learning resource. Stefaniak and Sentz (2020) recommend gathering "data from multiple sources to sufficiently verify the need" (p. 169). They see the benefits of gathering data from multiple sources as enabling data triangulation and strengthening the argument for any proposed design intervention. Travis and Hodgson (2019) also recommend using observations and interviews. These techniques better assist the (instructional) design researcher to discover why a learning asset is needed. In addition, the exclusive focus on measuring motivation to learn may be misplaced. Rather, the goal should be to learn about learners' motivation (to learn) by observing (watching and listening to) the learners and their work practices.

The Nature of Learning Experience with Agile Development

Learning experience with agile design/development is a design (evaluation) research conceptual model intended for use by instructional designers and learning experience designers to inform the (re)design, selection, adaptation, and quality improvement of workplace OER interventions in the Global South. It draws on the core elements of the double diamond: discover, define, develop, and test (see Figure 1) and the user-centred design (UCD) thinking process (see Table 5) models used in software and systems development and applies it to workplace OER adoption and adaptation. It aligns with the generic model for design research process models in education

(McKenney & Reeves, 2018) and with the systematic approximation model (SAM) proposed by Allen and Sites (2012) for use in corporate workplace training contexts. As outlined in Table 5, it considers three stages of evolution: analysis or evaluation, design or selection, and development. It also considers core principles and values common to design thinking and agile development. These include focus on the user (trainer and trainee); measurement; iteration in both the analysis and development phases; minimal documentation in the analysis and development phases to ensure responsiveness to change; and the study of interactions between users and their equipment.

The analysis (Reeves & McKenney, 2018) or evaluation (Allen & Sites, 2012) phase focuses on research into the user (trainer and trainee) and their context. This kind of research can stand alone or be integrated into an iterative (agile) development cycle. Following the double diamond model illustrated in Figure 1, the user (trainee and trainer) research phase in this study was integrated into an iterative development cycle. User research relies on contextual analysis, needs analysis, and needs assessment. Contextual analysis aims at understanding and explaining the unnoticed and taken for granted work practices of users, and the machineries of interaction these work practices make visible (Crabtree et al., 2012). Interactional work takes place either with people or with the equipment of a setting. Work practice refers to the attitudes, goals, intentions, and motivations of learners. In workplace contexts, and as indicated above, this means discovering “who are the learners and what needs to change about their current performance? What can they do now? Are we sure they can’t already do what is required?” (Allen, 2016, p. 312).

One design technique the learner experience researcher can integrate with agile development cycles is design ethnography (also known as contextual inquiry or field visit). This technique is known to tease out data on the learner's work environment. It provides an iterative approach to data collection (Meligy et al., 2018) and uses multiple sources to capture that data. As discussed in Chapter 4, these data sources include observation, interviews and field notes and are used to perform contextual and needs analyses of learners. Agile development and design thinking methods share the principle of iteration (Thoring & Mueller, 2023). Iteration is the process of divergence and convergence as shown in Figure 1. The data are analysed to produce a persona description, a one-page portrayal of a learner archetype describing the learner's goals, motivations, and behaviours and needs. These persona descriptions help development teams empathise with the learner. They contain, in addition to an image of the persona, a quotation, a type of learner needs statement, that describes "the key user [learner] need" (Travis & Hodgson, 2019, p. 151). Learner (user) persona descriptions are minimalist documentations of the learner's requirements to inform the design of an OER prototype or the selection of an OER design.

The design or selection phase is the result of verifying learner requirements, actual and anticipated. It is the phase that considers the feasibility of creating or finding and selecting training solutions that match the needs of the intended learners. Design, according to the Usability Body of Knowledge (2010–2012), involves "finding solutions that fit the user, task and context of use." (para.1). Where creating a training solution is preferred, digital or paper prototypes are developed and tested with learner archetypes.

Where selection of a training solution is preferred, an (advanced) prototype is trialled with learner archetypes.

The development phase extends the design phase using the same process of iteration used in the analysis or evaluation phase. This is because the solution or the intervention has to be tested to determine what are its pain points so that developers can apply changes and test those changes.

Iteration. The principle of iteration or successive approximation describes a cycle of design, testing, redesign, testing and so on. Another way to conceptualize iteration is as a pattern of learning, making and evaluating or a cycle of divergence and convergence (Tannian, 2020). In the double diamond design thinking process, this principle is at work in both the discovery and development phases (see Figure 1). The discovery phase uses design ethnography to discover or uncover any problem(s). It asks the question why people want the things they do (Travis & Hodgson, 2019). Design ethnography uses a combination of observation, interviewing, and field notes to uncover their goals and motivations, needs, attributes, and pain points. A divergence of methods provides thick data from which to extract specific issues, define and refine the problem. Once the specific problem(s) has been defined, ideation, the identification of solutions, begins the development process. If more than one ready-made solution exists that match the requirements of users, then it is a question of selecting (converging) on the most suitable solution and testing it with intended users to find out if it works as designed. However, if ready-made solutions are scarce, then a prototype is built and tested with the intended users to find out what problems exist with the prototype. In either scenario, the

solutions or recommended changes to the designed solution (prototype) are tested again to confirm if the changes worked.

The technique that addresses the testing and retesting of designed solutions and prototypes is formative think aloud usability testing. This technique uses several data sources – observation, interviews, questionnaires, and the participants' comments as they are thinking out loud while they are trying out a prototype. Comparison of these data sources allows for convergence on the problem(s) associated with the prototype which can inform suggestions to improve it or inform decisions to select and test another prototype (a return to the ideation or creation phase). The problem(s) identified can also lead to improved understanding of the user's needs.

Interaction. Both the data gathering techniques above depend on observing interactions between users and artefacts. In both techniques observers watch and listen to the users as they interact with the artefacts. Data that emerge from those observations not only test previously held assumptions about a problem, but they also provide insights and understandings of the problems to be solved. These insights may invite a search for solutions and consideration of many options before converging on a proposed solution. Interactions between user and artefact not only provide a rich source of data, but they also take place between the different phases of the design process. As Table 5 suggests, interaction has an iterative dimension. It maintains the cycle of iteration between and among phases of the design process.

Agility. To this point the focus of LEAD has been on the design thinking (see Figure 1) and user-centred design thinking process (see Table 5). Both design processes according to Lewis and Sauro (2021) are similar. In addition, they work well with agile

values and principles. One of these is evolutionary design and iteration. Other values include individuals and interactions, working (software) products, customer collaboration and responding to change. Schneider (2017) suggests that "the agile mindset begins with a problem…delivers an elegant solution...it is rapid, iterative, easily adapted and focused on quality through continuous improvement" (p. 2).

As described above, formative think-aloud usability testing is one of the techniques used to watch and listen to users, to tease out any difficulties they experience when they interact with artefacts, to determine what changes are required, the application of changes, and the testing of those changes. However, in an agile environment that prioritises speed and iteration, the rapid iterative testing and evaluation (RITE) method can be used to prioritise responsiveness to changes. The RITE method may be applicable in both the design and development phases. However, the agile mindset and values are not only restricted to the latter phases of design and development, but they are also applicable to the user research or analysis phase.

One emerging example is in the integration of ethnography analysis with design methods. In agile development, (design) "ethnography…helps discover system [learner] requirements that reflect the actual ways people work, rather than the formal processes defined by the organisation." (Meligy et al., 2018, pp. 27–28). Another example applicable to the user research phase is the minimalist documentation of learner persona profiles to inform the design and development phases. Travis and Hodgson (2019) use the phrase "agile personas" (p. 150) to describe a lightweight persona description appropriate when working with agile development teams.

The Case for Learning Experience with Agile Development

The case for an evaluation framework to create and adapt workplace OER originates in part from the limitations of research in OER adaptation, workplace OER and the application of partial design thinking in educational resource development in higher educational contexts. It also proceeds from the limitations identified in the applied and scholarly literature about the core (original) user centred design practices (i.e., user studies, user feedback, and user testing). The main concerns include overreliance on one user-centred design practice; the apparent lack of conducting a formal needs assessment; uneven responses to recommended changes; and differences between academic and workplace learning spaces.

Figure 2

Learning Experience with Agile Design (LEAD): A Framework for Adapting Workplace OER

Note. Image from Microsoft Word 2016

The dominant user-centred practice in this review is usability testing. Constantine (2004) has criticized the exclusive user focus for the way it subtly "discourages courage" (p. 3). Although courage is central to agile development methods (Constantine, 2004) scholars further argue that user-centred design makes it too easy for designers to abdicate responsibility in deference to user preference, user opinion, and user bias. Norman (2004) raises a similar concern about behavioural design when he suggested that it has the potential to lead to design by committee. One recommendation is to focus on performance as part of the user experience. Goal satisfaction is an important part of the user's experience. The LEAD framework, therefore, prioritizes learner experience *and* performance, that is, ensuring the learner accomplishes what they intend or need to accomplish.

An issue related to the exclusive focus on the user in usability testing practice is the potential for ignoring the initial needs assessment stage. Exclusive focus on the user in usability testing practice may also assume that usability testing is an appropriate substitute for gathering user needs (Howard, 2014). The fact that several studies identified in Table 4 implemented usability testing suggests that the solution being tested was the right one for learners. How did researchers know that the solution tested was indeed the right solution? Only one study reported some form of learner research to determine learner requirements (Grudniewicz, 2015) and followed this up with usability testing. Usability testing is good at identifying problems but not design solutions. Identifying design solutions is better left to insights obtained during field visits, another form of user research that uses design ethnography (Travis & Hodgson, 2019). Not even focus groups are as effective since these often result in reports of preferences and

opinions with little reference to actual behaviour. Design ethnography (DE), different from traditional ethnography (TE) uses a combination of behavioural interviewing and observations to test risky assumptions about the needs of users. The focus is on learning about what users are trying to accomplish. The LEAD framework prioritizes learner research through design ethnography.

In addition to the inability of usability testing to generate solutions, usability studies demonstrate uneven responses to recommended changes. Van Nuland et al. (2017) describe as a worrying trend, the non-implementation of usability test results in the field of online education. In several of the usability studies of educational resources in Table 4, the recommended changes to educational resources were seldom implemented (Cotton & Gresty, 2006; English & Reigeluth, 1995; Fisher, 2009). It remains unclear which issues explain the failure to implement the recommended changes. Chamberlain et al. (2006) suggest weak integration of agile and UCD principles, which, in turn, could lead to the following: "power struggles between designers and developers, time differences between designers' and developers' capacity to create tangible outcomes from each iteration round… communication issues if members of the team do not take part in some elements of a project… ." (p. 152).

What is clear, however, is a weakness in the UCD process that prioritizes documentation, whether during the design or the development phases of a project. A strength of agile processes, as embodied in core agile principles, is support for minimal documentation. Minimalist documentation may save developers time so they can focus on translating requirements to write code and respond to recommended changes. Core agile principles prioritize working (software) products over excessive documentation of

user needs analysis before building the product. More important, they prioritize responsiveness to change over following a plan (Beck et al., 2023). Design thinking and user experience may require integration with agile development methods and principles not only to ensure implementation of revisions but also to ensure that the effectiveness of the revisions is tested. The LEAD framework supports minimalist documentation of user needs analysis to inform product development. Design ethnography (discussed further in Chapter 4) is one way to achieve reduced documentation. To ensure usability testing results are implemented quickly LEAD also supports responsiveness, addressing issues that appear to have an obvious cause and an obvious solution (Medlock et al., 2002).

With a few exceptions (Branon, 2011; Grudniewicz, 2015; Kealey, 2015), several of the design studies of educational resources were implemented in academic learning spaces with students in postsecondary settings, as opposed to workplace settings. As described above, both contexts differ because they represent different activity systems. Le Maistre and Paré (2004) suggest that learning in academic settings may be "just in case" (p. 48) while in the workplace it may be "just in time" (p. 49). Academic contexts tend to support more structured formal learning organized by the academic institution. Workplace learning contexts, on the other hand, are characterized by formal, non-formal and informal and lifelong learning organized by the workplace or through colleagues (Monge & Frisicaro-Pawlowski, 2014). Tasks tend to be context and situation specific rather than generic. The LEAD framework caters to the multiple dimensions of workplace learning through its design ethnographic focus on learner empathy.

Other features of learning experience include both attributes used to define them and ways of interrogating those attributes. Learning experience is any interaction with a

user/customer/individual in which the person is going to learn something (Interaction Design Foundation, 2020). In learning experience, the goal is to help someone learn something (Peters, 2014). Allen and Sites (2012) suggest that learning experiences are "opportunities to practice" (p. 4) and include learning events created to help others learn. Another feature of the learning experience is learnability and the user-centric design framework discussed under the section on design thinking and experience design in Chapter 2.

Regarding the approach to interrogating the attributes of learning experience, when applied to the learner, the user-centred design (UCD) framework has been relabelled learner-centred design (LCD). Fleet et al. (2008) defined the LCD framework to include: "focus on advanced data collection about the learner's requirements using human factors methodologies, the development of prototypes using actual learners, and the redesign of prototypes based on ongoing (iterative) testing with learners" (pp. 172–173). The first element of the LCD/UCD framework aligns with the evaluation and design phases of an instructional design process by Allen and Sites (2012), the systematic approximation model (SAM). The second and third elements align with the development phase of SAM. The SAM supports integration between LCD/UCD and agile methods. Learning experience with agile design/development integrates the elements of the LCD/UCD framework with the SAM instructional design process model.

As outlined in the description of the nature of LEAD above, apart from its learner orientation, the case for LEAD resides in its focus on providing a framework for adapting a design product for workplace OER. The study by Branon (2011) focused on a design process. In addition, LEAD supports integration of a modified UCD within the SAM

instructional design process. A modified UCD to reflect the more specific term "learner" aligns with the learner-centric paradigm of instruction advocated by Reigeluth et al. (2017) and Allen and Sites (2012).

Table 5

Core, Modified, and Proposed Conceptual Framework

	User Centred Design (UCD) (Core)	Learner Centred Design (LCD) (Modified)	Learning Experience Agile Design (LEAD) (Proposed)
Analysis or Evaluation	Early focus on users and tasks: that is understanding the users, the tasks that users perform, and the context in which users perform these tasks	Focus on upfront data collection about the learner's requirements	Focus on the learner and their work practices and use observation and interviews for contextual analysis and needs assessment; develop learner persona descriptions (minimal documentation)
Design or Selection	Empirical measurement: that is observing, recording, and analysing the performance and reactions of users as they engage in real tasks through simulations and prototypes	The development of prototypes using actual learners, and	Empirical measurement: The selection and trialling or development and testing of (OER) prototypes with intended trainees and
	Integrated design: that is changing all aspects of usability together		Integrated design: that is changing all aspects of usability together
Development (Allen & Sites, 2012)	Iterative design: this means that a cycle of design, test, redesign, should be repeated as often as necessary (Gould, 1988; Gould & Lewis, 1985)	The redesign of prototypes based on ongoing (iterative) testing with learners (Fleet et al., 2008)	Iterative design: this means adaptation of OER prototypes executing a cycle of design/selection, testing, modifying, and retesting of the selected OER design with learners; respond to changes (Beck et al., 2023)

As indicated in Table 5, LEAD also prioritises two areas of focus ignored in the core and modified versions of UCD and pointed out by the agile movement and

researchers supporting integration of design thinking and the UCD framework with agile methods and principles (Chamberlain et al., 2006; Gurusamy et al., 2016; McGinn & Ramírez Chang, 2013; Salah et al., 2014; Sy, 2007). One of these areas is iteration through the different types of data collection and the other is minimalist documentation through persona description. The research questions identified in Chapter One attempt to capture the arguments in favour of LEAD.

Learning Experience with Agile Design

Several gaps in the OER research literature made the case for the LEAD framework. One starting point was the near absence of design thinking in OER research (Moore, 2018; Wright, 2018), including OER adaptation research (Law, 2019; Oates et al., 2017). In addition, there was limited evidence of design thinking in workplace OER adaptation (Merkel & Cohen, 2015). Further, there was almost no concept of unification or integration of agile, instructional or user experience design traditions (Filantro & Costa Cavalcanti, 2018). The only existing research indicating some element of design thinking and experience design appears in the research on educational resource adaptation and renewal. Even when reviewing the implementation of design thinking in educational resource renewal a few more gaps in the research were discovered. One shortcoming was the fact that only four studies completed and tested revisions to the problems identified (Davids et al., 2014; Doubleday et al., 2011; Grudniewicz, 2015; Nathenson & Henderson, 1980, 2018). Another was the limited attention to contextual analysis and learner needs assessment (Grudniewicz, 2015). How were developers sure the intervention tested was solving the right problem? Usability testing may not answer this question. Finally, it is also important to note that only a few studies showed some

interest integrating design thinking techniques with instructional design models (Davids et al., 2014; English & Reigeluth, 1995).

Attending to the Intervention and the Learning Experience

As the research above on educational resources adaptation in academic contexts shows, instructional design practice places less emphasis on the experience of learning (Chang & Kuwata, 2020). Instead, it focuses on the creation and delivery of educational and training materials (Nathenson & Henderson, 1980, 2018), making sure that learning resources work (as designed), are easy to use, are intuitive, and learners can achieve the goals set out for the learning (Thurber et al., 2021). For example, Thurber et al. (2021) suggests instructional designers may concentrate on navigation, content, and cognitive load. In this respect, instructional design and information design share similar concerns (Duchastel, 2003), ensuring the learning resource is designed right by studying the interaction between the learner and the artefact. However, to understand the experience of learning or learning experience it is important to study the learner's interactions in their work practices (Stefaniak & Sentz, 2020). According to the authors, insights derived from the study of learners' work practices refer to contextual analysis. The authors suggest instructional and learning experience designers go a step further, that is, "to identify the performance gap and propose viable solutions, either instructional or non-instructional, to achieve the desired performance results." (Stefaniak & Sentz, 2020, p. 161). Insights from the performance gaps support needs assessment. Executed together, needs assessment validates the data from contextual analysis to inform design or selection of the *right* intervention. The study of interactions, whether to ensure a

training resource is designed right or to inform the design (selection) of the right intervention, is a major defining feature of learning experience (Tawfik et al., 2021).

Defining features of Learning Experience

Learning experience (LE) has been defined as "experiences through which learners construct meaningful understanding" (Chang & Kuwata, 2020, p. 149). It has also been referenced as "a collection of activities that a learner participates in or has access to that support learning something" (Boller & Fletcher, 2020, p. 8). Both definitions suggest the centrality of interaction as a feature of a learning experience. In the first definition, for example, for learners to construct meaningful understanding they must interact with a learning asset. In the second, participation in a collection of activities to which the learner has access presumes some interaction between the learner and the learning asset. Another definition of learning experience is "microlearning in the flow of work" (Yocum, 2019, p. 24). The author further explained that the learning experience describes "the process of putting together pieces of microlearning so that you cover an entire topic. It's also how the learner accesses those assets throughout the day." (Yocum, 2019, p. 27). This last definition incorporates an element of curation to promote interaction with microlearning (learning at the point of need) such as videos, books, online writing, and course modules/lessons. All the above definitions of learning experience include or presuppose some form of interaction with learning assets.

Recent Conceptions of Learning Experience Design

Approaches to defining the concept of learning experience design in the scholarly literature have either isolated each constituent of the phrase (Clark, 2021) or

have focused on key elements of the phrase. Clark's (2021) conception of LED, for example, sees the importance of:

> [f]irst, injecting learning theory, especially cognitive science, into the design process. Second, designing for learners in their world. Third, seeing experiences as more than just a flat piece of media but a whole world of learning experiences that motivate and result in lasting change to long term memory. (p. x)

Chang and Kuwata (2020) describe LED as integrating design practice from related design fields and later define it as "The practice of designing learning as a human-centred experience that leads to a desired goal" (p. 144). Wagner (2021) follows a similar design focus considering it an attempt to unify design traditions. Boller and Fletcher (2020) follow a similar design centric conception of the phrase by reworking the design thinking model for training and development. Their LXD framework includes getting perspective (empathizing); refining the problem (defining); ideating; prototyping; iterating; and implementing. Yocum (2019) focuses more on the experience element of the phrase:

> Learning experience design is not just about getting the right learning assets that are aligned to the needs of your people. It's also ensuring that they can get to that learning, they are able to use that learning, and the experience is simple and enjoyable…the experience is about the way the learning is put together, the way the learner *experiences* the learning. (p. 75)

The research evidence in support of the concept of LXD follows patterns identified in the scholarly literature. For example, in a study by Schmidt and Huang (2021) that aimed to better define the concept, the researchers assert that LXD is a "human-centric, theoretically grounded, and socio-culturally sensitive approach to

learning design, intended to propel learners towards identified learning goals, and informed by UXD methods." (para. 1). Another study by Tawfik et al. (2021) sought to define LXD using empirical evidence. Described as a work in progress study, the researchers used a grounded theory approach and corresponding think aloud and eye-tracking data and suggests that learning experience design consists of "interaction with the learning environment and interaction with the learning space" (Tawfik et al., 2021, para 1). Interaction as a defining feature of LXD aligns with this study's LEAD framework.

Each of the above conceptions of LXD, whether scholarly or research based, contributes some insights to understanding the phrase. However, the priorities of each definition leave room for other perspectives. The research-based conception of LXD that prioritises interaction, while promising, still leaves bare the question of injecting learning theory into the design process (Clark, 2021). A more complete conception of LXD must not only consider design thinking and experience design (Schmidt & Huang, 2021), but also show some interest in or linkage to learning theory (Clark, 2021). As indicated above, a few design research studies in educational resource adaptation have shown some interest in a design-theory for learning and teaching (Davids et al., 2014; English & Reigeluth, 1995). Even though learning theories which explain learning are relevant to instructional designers (Richey et al., 2011), no design research framework can generate a learning theory. They may generate and test design principles as implemented in English and Reigeluth (1995) and in Davids et al. (2014). Learning experience design draws on the principles of user experience design and cognitive load theory that informs instructional design.

Instructional design and usability science share an interest in cognitive load theory (CLT). The theory as described by Earnshaw et al. (2017) posits that meaningful learning depends on effective cognitive processing. However, due to the limited resources available to humans for processing information, the three types of cognitive load that affect working memory include: intrinsic cognitive load (ICL), extraneous cognitive load (ECL) and germane cognitive load (GCL). Earnshaw et al. (2017) further explain each of the categories:

> Intrinsic cognitive load describes the active processing or holding of verbal and visual representations within working memory. Extraneous cognitive load includes the elements not essential for learning but are still present for learners to process. Germane cognitive load describes the relevant load imposed by the effective instructional design of learning materials. (p. 559)

Of the three types of cognitive load, the one which instructional and learning experience designers manipulate directly is ECL. It is job of these designers to intervene when an unusable interface design increases ECL and prevents meaningful learning. Ways in which an unusable interface design increases ECL include: when a learner shows ignorance of what to do next (Fisher, 2009), when the navigation structure makes a learner spend more time and energy clicking through an interface to find relevant information (Davids et al., 2014), and when "the interface uses unfamiliar terms that do not align with the user's [learner's] mental model" (Earnshaw et. al., 2017, p. 559).

Summary

This chapter focused on the need for instructional design models for OER. It made the case for the LEAD conceptual framework to support that model. The last

section provided a guide as to reasons for the focus on the concepts learning experience and learning experience design. The next chapter details how the framework was implemented.

Chapter 4. Methodology

Introduction

As indicated in Chapter 1, one of the principal goals of this study is to explore the potential of learning experience with agile development (LEAD), a framework that integrates agile principles with design thinking for the purpose of adapting, redesigning, and repurposing an Open Educational Resource (OER). A review of the research literature in Chapter 2 shows that the implementation of design thinking to select and improve learning materials and resources is still a low priority in the Global North and more so in the workplace training environments of small island developing states (SIDS) of the Anglophone Caribbean in the Global South. While the time-consuming nature of design thinking processes may be a factor, this chapter presents a method that not only explores the research questions, but does so in a time efficient manner. Before discussing the research design of the study, its rationale, and the role of the researcher, the philosophical underpinnings of the research approach are first outlined. The research questions, selection of the research site and participants, instrumentation, data collection, and data analysis conclude the chapter.

Philosophical Worldview

An important part of the research approach is the philosophical assumptions that explain a study's research design (Creswell & Creswell, 2023). The design of the dissertation research study was drawn based on assumptions from the pragmatic worldview. This worldview derives from the work of Charles Pierce, John Dewey, Herbert Mead, and William James. For usability science, the most influential of these is William James, who extended Pierce's doctrine that "thought is valuable only to the

extent that it produces observable and generally agreed-on useful actions" (as cited in Gillan & Bias, 2001, p. 360). According to Gillan and Bias (2001), James proposed that "thought is valuable if it produces an outcome in the world that is of value to the actor" (p. 360). For design thinking, the most influential was John Dewey's pragmatic maxim that theory derives from practice; that the world is emergent, never finalized; that the process of interaction is inherent to our being in the world, that all human activity is situated; that inquiry is a mode of thinking and doing; that transformation is a motive for situated inquiry; and that technology is central to the transformation of a situation through inquiry (Dalsgaard, 2014).

One of the basic ideas of pragmatism is the idea that "truth is what works at the time" (Creswell & Creswell, 2023, p. 12) or that truth is verified or confirmed by testing ideas and theories in practice (Patton, 2015). According to Creswell and Creswell (2023), worldviews arise based on "discipline orientations and research communities, advisors and mentors, past research experiences and cultural experiences" (p. 7). Past research experience conducting a usability study has shaped the researcher's approach and pragmatic stance. The pragmatic worldview is central to the research approach of this study and the specific methods that translate the research approach into practice.

Research Design

The study's research design combines replication with modifications of Fisher's (2009) single evaluative case study (SECS) and design ethnography (DE) within a multimethod research approach. Both methods are part of the qualitative paradigm. Mik-Meyer (2020), elaborating on Creswell's (2015) use of multimethod research, describes it as "research that uses multiple forms of qualitative data (e.g., interviews and

observations) *or* [original emphasis] multiple forms of quantitative data (e.g., survey data and experimental data)" (p. 357). Roller and Lavrakas (2015) also describe the multimethod approach as one in which "the researcher combines two or more qualitative methods to investigate a research question or phenomenon" (pp. 288–289). The authors, like Mik-Meyer (2020), differentiate multiple methods qualitative research from a mixed-method approach in which both qualitative and quantitative methods are used for collection and analysis of data in the same study. In this study to minimise the risks of researcher bias and threats to validity, the design ethnographic method used multiple forms of qualitative data such as observation, unstructured interviews, and field notes. Similarly, the single evaluative case study method used think aloud data, structured interviews, observation, and questionnaires. The study used triangulation in both methods for collecting and analysing data.

Both methods have their challenges. Design ethnography has often been disqualified as a method because it is assumed to be the same as fieldwork in which the focus is on observation. Crabtree et al. (2012) reminds that DE involves both fieldwork *and* analysis. In addition, there is also a requirement for the researcher to interview members of a setting to understand what members do and how members accomplish the setting's work from their perspective. It is, therefore, a multimethod approach (Roller & Lavakras, 2015). Design ethnography is also criticized for a lack of rigour. Rigour lies in the ordering of the ordinary activities of a settings work. To recognise the order in a setting's work the researcher must be prepared to develop some vulgar competence in the work of the setting. A further misunderstanding of DE is the assumption that ethnography is a user's champion. However, even if it does let users speak for

themselves, ethnography's job in design is to uncover and represent other important features of a user's experience. Design ethnography is interested in explaining the user's "work practices and the machineries of interaction that these make visible" (Crabtree et al., 2012, p. 163). These practices are often taken for granted and users have difficulty expressing them. It is the job of ethnography to capture and explain these practices using minimal documentation to inform design or selection of a solution.

Similar to Fisher (2009), the researcher used a single evaluative case study to implement a qualitative research design. Yin (2018) cautioned about the challenges of doing case study research and further warned about underestimating the extent of those challenges. Some of those challenges include several concerns about case study research such as questions about the insufficiency of rigour (Reigeluth & Frick, 1999; Yin, 2018), weak generalizability, unmanageable levels of effort, and unclear comparative advantage. However, the usefulness of the insights gained from observing and listening to the experience of real student end users as they interact with and navigate an OER more than compensates for any of the challenges of this method. Moreover, since design thinking processes and techniques are arguably time and resource intensive, the integration of agile principles into the study's framework is anticipated to increase the efficiency of both the discovery phase and the development phase of adaptation of the OER. The rationale for the use of case study considers its alignment with the study's conceptual framework, qualitative research design, evaluation research, and how it proposes to minimize threats to trustworthiness or validity. Each of these is discussed in the following section.

Rationale for Research Design

Design ethnography. Design ethnography, the first of the two qualitative methods employed in this multimethod study, is a type of contextual research (Duda et al., 2020). Rather than ask users what they want, it explores why people want those things (Travis & Hodgson, 2019). To answer that question, it must address secondary questions such as: what people do and how they do it. Answering these questions helps developers (including those on agile development teams) build or select usable and useful systems. In this study the researcher used it to adopt and select an open instructional delivery system.

Design ethnography uses an ethnomethodological approach to ethnography. That approach focuses on practical sociology or the ordinary activities of a setting's work. It examines taken for granted workplace practices, and focuses on the interactional work of a setting, whether such interactions are between people or between people and equipment (Crabtree et al., 2012). Design ethnography was chosen because it aligns with the shared principles of both the core (UCD) and proposed (LEAD) conceptual models of this study. Design ethnography is iterative, user focused and agile, three of the core principles of design thinking.

Agile means being able to "[d]eliver quickly. Change quickly. Change often." (Meligy et al., 2018, p. 27). Design ethnography is agile because it emphasises reduced timescales for conducting field work. It is also agile in its analysis since it uses sensitising concepts to produce one-page persona descriptions (Travis & Hodgson, 2019) of the user's goals and motivations, behaviours, and needs (problems). It welcomes late changes to needs identified through persona descriptions. It is user focused since it

involves end users and other stakeholders to achieve user-informed product development and quality (Tannian, 2020).

Design ethnography provides an iterative approach to data collection (Meligy et al., 2018), since each instance of fieldwork offers new insights that build on or extend those from previous field visits (Crabtree et al., 2012). In addition, Crabtree et al. (2012) see its use as "wrapped in an iterative process, where ethnography is used to shape initial development and then assesses developing solutions with the results being fed back into ongoing development cycles" (p. 196).

Single evaluative case study. Yin (2018) defines case study methodology as one that "investigates a contemporary phenomenon in its real-world context especially when the boundaries between phenomenon and context may not be clearly evident" (p. 2). Kaplan and Maxwell (2005) define a case study as "an empirical inquiry that investigates a phenomenon within a specific natural setting and uses multiple sources of evidence" (p. 49). The contemporary phenomenon of the dissertation research study was an OER tutorial intended for reuse and adaptation entitled "Search Strategies." The tutorial is currently available as a self-access resource in an online learning environment called Moodle, a learning management system (LMS). It has its own content, learning activities and tasks (Phillips et al., 2012). The boundaries between the design phenomenon and its intended context are unclear and, as discussed in the sections on instrumentation and data collection below, multiple sources of evidence were incorporated into the study's design. One necessary first source of evidence was the field visit (Goodman et al., 2012; Travis & Hodgson, 2019) or site visit (Barnum, 2002). The other source of evidence was formative (usability testing) research (Reigeluth & Frick, 1999). Each of these sources

draws on at least two methods. From a definitional standpoint, therefore, the use of a case study research design is a justified approach.

Beyond the definitional, case study aligns with the study's core conceptual framework of UCD and the proposed LEAD framework. A conceptual framework, according to Miles et al. (2014), "explains either graphically or in narrative form, the main things to be studied, key factors, variables or constructs, and the presumed interrelationships among them" (p. 20). As described in Chapter 3, the core concepts of the Gould and Lewis (1985) UCD and the proposed LEAD framework are outlined in Table 5. The first of these principles aligns with case study design since it shares with case study design a focus on the complex and contemporary phenomenon of people, their tasks and their environment and their learning goals. The second principle is consistent with case study since it implies the use of more than one source of evidence. Further, the fourth principle aligns with case study because it shares a cycle of iteration. Yin (2018) suggests that doing case study research is a linear but "iterative process" (p. 71).

Case study design is not only an iterative process (Yin, 2018) but it is also a form of qualitative research (Creswell, 2013; Kaplan & Maxwell, 2005; Merriam, 2009). Qualitative research shares with case study design the goal of understanding a particularly complex phenomenon from the perspective of participants and in its particular setting. To achieve its goals, qualitative methods use data in the form of words, and sometimes numbers (Maxwell, 2010), and often draw on several other sources of evidence including but not limited to transcripts of interviews, written observational descriptions of activities and conversations and documents (Kaplan & Maxwell, 2005). Both goal and method in qualitative research are aligned with the principles of UCD.

Qualitative research methods "are being used increasingly in evaluation studies, including evaluations of computer systems and information technology" (Kaplan & Maxwell, 2005, p. 30), and "studying educational innovations, evaluating programmes and informing policy" (Merriam, 2009, p. 51). Kaplan and Maxwell (2005) have advanced five reasons for using qualitative methods in evaluating computer information systems. Two of these reasons are relevant to this study and inform the research questions in the section below. The first is "understanding how a system's users perceive and evaluate that system and what meanings the system has for them [and the second] providing formative evaluation that is aimed at improving a programme under development rather than assessing an existing one" (pp. 32–33). Both reasons align with the principles of UCD and LEAD.

Reigeleuth and Frick (1999) support the idea of formative evaluation to improve a programme or a designed instance of a course. They have recommended formative research as a methodology that is useful for creating and improving instructional design principles and have drawn from a combination of formative evaluation and case study research methodologies to develop formative research methods. Further, Yin (2018) suggests that case study research "has a functional and legitimate role in doing evaluations" (p. 298). The combination and integration of case study, formative evaluation and research within a qualitative design resonate with the principles of UCD, which uses the insights from users to inform the design process. The challenge is to minimize validity threats of reactivity and researcher bias (Maxwell, 2013).

Role of the Researcher

Because of the interpretative nature of qualitative research, it is important for inquirers to identify reflexively how their biases and values shape their interpretation and the direction of the study (Creswell, 2023). One of these is the fact that the researcher, in his capacity as librarian, taught elements of the content of the online OER tutorial that was selected for reuse and repurposing. Even though that content was designed for face-to-face delivery any prior knowledge of the content and its challenges for students might have prejudiced approaches to data collection and analysis. For that reason, the researcher followed the example of Fisher (2009) and adopted the role of complete observer. A team of observers were recruited to assist with the data gathering and analysis of the usability testing stage of the study. The team included key decision makers with the authority to make changes to the educational material. Its members comprised an instructional developer and a course coordinator (the leader and manager of the instructional team). In addition, a field visit stage was conducted using a team including the researcher and the site librarian to collect and analyse the data. Research questions to guide the data collection process are identified next.

The Research Questions

Research questions are useful to explain what the study hopes to learn, to focus the study and to guide the researcher on how to conduct the study (Maxwell, 2013). In line with the learner and user centred framework proposed to tease out the learning experience research questions (RQ) suggested two phases of inquiry, and focused on finding out the following:

1. Why do special librarians, and member users of government and institutional libraries, require an open educational resource solution to implement information skills training? (RQ1) (Phase one)
2. How does the design of the open educational resource solution help or hinder workplace trainees as they complete their learning activities and tasks? (RQ2) (Phase two)
3. How should the design of the open educational resource solution be improved to enable workplace trainees to complete their learning activities and tasks? (RQ3) (Phase two)

Setting

A review of the National Library and Information System (NALIS) information literacy guide for secondary school librarians suggests that learning materials exist to help librarians deliver information literacy instruction to learners throughout the secondary school system. However, no such module exists for corporate (special) librarians and their clients in workplace training environments. Preliminary interviews with four special librarians not only confirmed that no training resources exist for these environments but that no self-access resources exist to guide workplace information skills training for members of these special libraries, a membership that includes mid-level civil servants. Specialist librarians also confirmed that in-house resources were mainly paper-based and forced busy mid-level civil servants to visit their information centres when a self-access resource on a web platform could be accessed from their clients' desktops. Librarians would welcome the option of OER designed to meet the needs of their patrons. As a result, the sites of several information centres were contacted

to establish the need for customised or generic self-access information skills training programmes. The researcher subsequently received approval from the Executive Director at NALIS to access 17 library sites and their clients (see Appendix A1).

The object for research was an online tutorial offered as an OER by the International Network for the Availability of Scientific Publications (INASP Moodle, n.d.). The tutorial entitled *Search Strategies* was similar in content to an onsite module: *A Complete Search Strategy,* the second module of an onsite course called *Evidence Informed Policy Making.*

A course in an evaluation research study is a case or unit of analysis (Ruhe & Zumbo, 2009). A course, module or tutorial is also a designed case, that is, an instance of a design theory (Reigeluth & Frick, 1999). The researcher became aware of the onsite course at a conference workshop in July 2017 and the online tutorial in July 2020. The OER that was considered was licensed under a Creative Commons Attribution Share-Alike Licence (CC-BY-SA 4.0). According to Perryman et al. (2014), "A CC-BY-SA licence for all resources allow for adaptation by end-users as long as the original author is attributed, and the derivative resource is shared under the same licence as the original version" (p. 1). The *Search Strategies* tutorial was trialled because field visits with special librarians and library members confirmed a need for training. Insights from think aloud formative usability testing were used to recommend changes to the module.

To confirm if librarians responsible for delivering information skills training needed OER and based on the researcher's position as a librarian, initial interview data was collected. Collection of this data was approved through the ethics committee at the NALIS authority. A preliminary report of findings is enclosed (see Appendix E). This

pilot data shaped the direction of this research project. That is to say that secondary data analysis was performed on the previously collected data in the researcher's workplace. Following the granting of ethics approval from Athabasca University (see Appendix A2), the librarians were contacted for a follow up interview but few acknowledged receipt of email communications. Even fewer participated in the formative think aloud usability tests and field visits.

Field visits are part of a technique called design ethnography that answers the question: who are the users and what are they trying to achieve? In other words, they find out how and why people do what they do (Goodman et al., 2012) or how a product or prototype is adopted and used by people in their working lives (Sharp et al., 2007). Design ethnography (DE) differs from traditional ethnography (TE) in the following areas: purpose, timescales, researcher role, data analysis and dissemination of findings. Whereas TE aims to understand culture, the purpose of DE is to gain insights, inform design decisions (Crabtree et al., 2012) or inform redesign (Goodman et al., 2012). While in TE the timescale is months and years, in DE the timescales are days and weeks. Traditional ethnographers live with participants and try to become part of the culture. Design ethnographers are visitors whose role is to interview and observe. Data in TE are analysed in detail over a period of many months. Data analysis in DE is "just enough" to test the risky assumptions. Finally, the results of TE are shared in books and academic journals while the results of DE are forwarded to a design team or organization. The results of the field visits helped the researcher determine the need for the OER, whether it was the right solution for the intended learners and what elements of the OER design needed to be (re)built. Field visits represent the first phase of the learner and user centred

design framework described above. Field visits also help learn about the participants, their context, goals, and motivations (Travis & Hodgson, 2019). The next section describes how participants for both stages of the proposed study were selected.

Participants

Maxwell (2013) suggests that in purposeful selection, particular settings, persons, or activities are chosen deliberately to provide information that is particularly relevant to the researcher's questions and goals, and which cannot be obtained from other sources. Consistent with the learner focused approach to adoption and adaptation of the OER, participants were drawn from the clients of 5 of the 17 library sites contacted. Using a type of purposeful selection called snowball sampling (Lunenburg & Irby, 2008), the researcher relied on the librarians, practitioners responsible for providing information skills training at their respective sites, to identify mid-level civil servant clients who often search for sources of evidence to complete their work tasks. In the first phase of the study field visits were conducted with 11 of these clients. In the second phase three rounds of formal usability testing with think aloud protocols were conducted. Nine participants, including learner groups from two library sites, were recruited, and selected using a purposeful sampling strategy. In addition, to derive maximum value from usability tests it was useful to include among participants those who were more likely to have difficulty using the tutorial prototype. Such a participant would be less digitally savvy or have less domain knowledge than the norm (Travis & Hodgson, 2019).

In this study, because of the low response from librarians, that initial criteria for recruitment and selection of participants for the usability tests was modified to include a mixture of first time and experienced users of self-access courses. This further lead to

modifying the criterion of including low experience with computers and the Internet, and experience with e-learning and online courses. Participants in this study were drawn primarily from civil servants who were users of special libraries at the five government institutions and ministries. These participants had varied backgrounds: some were mature students, people with low (web) (information) literacy skills and low bandwidth connections or have older technology. Most important, participants included real learners involved in the process of completing real tasks while trialling an OER. Information about the skill level of participants was obtained using a pre-test screening questionnaire. This and other instruments used as part of an integrated feedback system (Nathenson & Henderson, 1980, 2018) is discussed further under Instrumentation.

Replication with Modifications

Arolker and Seale (2012) suggest that "a replicable study is one which produces similar results if the study were repeated, most likely as a consequence of using reliable methods of analysis or measurement" (p. 590). In its design, data gathering and analysis, the second phase of this dissertation research study replicated with modifications Fisher (2009). The second phase of this study used an online education educational resource as its unit of analysis or object of study, even if this was in a workplace context. The role of the researcher was as complete observer. In addition, participants were not randomly, but purposefully selected. Further, data gathering was executed using three rounds of moderated think-aloud usability testing. Finally, data analysis was implemented using more than one observer to inductively identify themes through comparison of multiple sources of data.

Modification. Most of the modifications to phase two of the study occurred in data gathering and analysis. For example, instead of using screen recording software to capture participants comments, Zoom, a videoconferencing software, was preferred. This software seemed to better allow for remote moderated think-aloud usability testing which became necessary during the Pandemic. In addition, observers used a form that considered participants' verbalisations *and* their non-verbal expressions. Further, to provide support for the emergent themes during the qualitative analysis of the think-aloud data, phase two data included a report on the levels of success based on task completion and based on the time it took participants to complete those tasks.

Instrumentation

Several instruments were used for data collection because the data were collected in two phases as previously indicated. One of these is the field (site) visit phase and the other is the usability testing phase. For the field visit phase of the study, a combination of interview questions, prompts, and observations were used by the researcher. In addition, due to the public health restrictions imposed during the COVID-19 pandemic, data in the field visit phase were collected using in-person and remote modalities. The Zoom video conferencing software discussed below, allowed for interviewing and observation of the information behaviours of participants. Studies by Labinjo et al. (2021) and Archibald et al. (2019) have demonstrated the feasibility and acceptability of using Zoom to collect qualitative interview data. A piloted version of the interview schedule that prioritized users' information behaviour and informed by Travis and Hodgson (2019) is enclosed (see Appendix C1). In addition, digital audio and video recording equipment were used

to capture insights from the in-person interviews and observations. Further, to capture still images of artefacts in the environment a camera was used.

For the usability testing phase of the study the instrument used was originally developed for a Hotmail study by Barnum (2002) and repurposed by Fisher (2009). Barnum is an expert in usability, most notably in usability testing. Because the dissertation research study responded in part to the call by Fisher (2009) for further studies to determine the effectiveness of implementing usability testing to improve course design in other contexts, most of the instruments used by Fisher (2009) were piloted in this study and modified as needed. In an email to both researchers, permission to repurpose and use these instruments was requested and granted (see Appendix B1 & B2). The instruments included a protocol, a testing schedule, and questionnaires. A software application was also used for recording the data collection effort. The instruments are described below in the order in which they were piloted and used.

Usability Testing Resources

Various resources were used to conduct this study. A combination of people, processes and technology summarize the resources that were used to complete the data gathering process. Under people, an instructional design team were approached to assume the roles related to the study including those of observer, instructional developer, camera operator and test facilitator. The researcher in charge of this study served as test administrator and employed eight tasks (see Appendix C2). Since, according to Morville and Rosenfeld (2006), findability precedes usability, all tasks invited participants to locate information. This type of activity is similar to those used in studies by Fisher (2009) and Myers (2015). A few of the tasks, however, corresponded to activities in the

online OER tutorial. Eight preliminary task scenarios were created, and participants were invited to locate a resource and attempt the assessments (see Appendix C2).

Video Conferencing Software

As mentioned in the previous section, this study was conducted during the COVID-19 pandemic and many government offices still followed the public health guidelines. Under technology, therefore, all members of the research team were trained to use the technology resources and tools from the Zoom video conferencing software. In this study the software was used both for phase one and phase two. Zoom, used in remote moderated usability testing, video captures customers' experience of a product or design during a test session. This application was preferred because it was the most affordable among proprietary video capture applications that allowed for remote moderated think aloud usability testing during the pandemic. It offered a range of benefits not only for recording, but also for observing and managing test sessions. Gray et al. (2020) outline the benefits which included but were not limited to the following:

> Zoom [did] not require participants to have an account or to download a programme…electronic meeting invitation generated by Zoom, which [could] be edited...a live link that only require[d] a click to join the meeting…screen sharing abilities for both the interviewer and participants, who [could] display documents such as the research information letter or consent form…password protection for confidentiality and recording capacity to either the host's computer or Zoom's cloud storage...Zoom automatically save[d] of the interview in two files: an audio only file and a combined audio video file. (pp. 1294–1295)

Pre-test and Post-task Questionnaires and Exit Interviews

Pre-test questionnaires were used to gather information about the background of the participants. Post-task questionnaires were used to gather judgements and rating after each task. The benefit of the post-task questionnaire was that it provided immediate retrospective feedback without taking much time to complete. Exit interviews s were used to allow participants to share their experience in their own words without much prompting. The pre-test questionnaire was piloted with workers not part of the study to ensure content validity and reliability.

Content validity. Lunenburg and Irby (2008) argue that content validity, "the degree to which an instrument measures an intended content area… is determined by expert judgement" (p. 181). To ensure content validity, experts in the field of instructional design were approached and invited to review the instruments for appropriateness of content. The expert reviewers were satisfied that both the tasks for the usability test and the items on the post-task questionnaire measured what it intended to measure.

Consistency (Reliability). Workers not part of the study were asked to pilot the pre-test questionnaire. They were asked to evaluate it to ensure the items were clear and that forced choice items contained enough response options. These responses were not analysed. However, pilot responses from participants who completed the usability test, post-task questionnaire and the exit interview were included in the analysis since the task scenarios from the usability test remained unchanged after each iteration (round). Data were analysed using "a process of comparing separate sources of findings to look for consistencies of discrepancies" (Barnum, 2021, p. 306).

Testing Notes

Following the example of Fisher (2009), "a series of journals for each round of testing was kept … [allowing] instructional developer(s), assigned to the course, to record opinions about problems that learners encountered during usability testing as reported from analysis of the recording" (p. 55). These were helpful for the debriefing session at the end of each round of testing. This is discussed in the next section under usability testing round.

Data Collection

As indicated in the previous section on instrumentation, two phases of data collection characterised the study. The first phase of (remote) field visits or semi-contextual (ethnographic) interviews and observations aligns with both the core conceptual framework proposed by Gould and Lewis (1985), the modified version by Fleet et al. (2008) and the proposed LEAD framework, all in Table 5. The second phase, involving (remote) moderated think aloud usability testing (R)MTUT of an existing OER, also aligns with the conceptual framework. In the sections that follow the nature of the data for both phases are outlined and how those data were collected. Design ethnography is examined first in the section below.

Design Ethnography - The Nature of the Data

In the first phase the data is characterised as primary data obtained through ethnographic interviews and observations, also known as design ethnography (Travis & Hodgson, 2019). The purpose of this data is to address the need for an OER intervention which is captured in the first research question (RQ1). This type of data leads to the development of agile persona profiles (Travis & Hodgson, 2019) that, in turn, inform

design decisions. Personas are derived from specific data about real people which are used to create detailed profile descriptions of fictitious people. The artefact from these personas is a persona description. A persona description is a one-page representation of a user archetype that describes the persona's goals and motivations, behaviours, and pain points (problems). Data about the learners' goals, motivations and behaviours are accomplished not by asking them what they want but by discovering why they want those things. This is achieved through ethnographic interview and observation rather than through questionnaires and focus groups. Travis and Hodgson (2019) suggest typical questions include: "What goals are users [learners] trying to accomplish? [Goals/Motivations]; How do they currently accomplish these goals? [Behaviours]; What parts do they love or hate? What difficulties and obstacles do they experience along the way? [Problems]" (p. 98).

Procedures for Collecting Design Ethnography Data

Interviews were conducted with potential learners, users of the special libraries identified above in the section on setting. The researcher and an observer conducted a remote field visit (RFV) to build a rapport with the potential learner, conducted the interview and apprenticed with the learner by observing how the learner searches for sources of evidence to complete complex tasks that would inform policy making. While building a rapport with the learner, the researcher obtained the learner's verbal consent to capture and record the virtual site visit. A consent form was provided for both virtual and in-person visits (see Appendix D). For in-person interviews the researcher obtained the assistance of a colleague librarian while interviewing librarians on site. The role of the researcher's colleague librarian was to "take photographs of the [participant], the

environment and any artefacts, audio record the interview, make written observations, and ask clarifying and follow up questions" (Travis & Hodgson, 2019, p. 102). The data were interpreted and summarized at the end of the session. Insights from this phase were used inform selection of the intervention, to inform adoption and selection of an OER prototype, and to develop scenarios and tasks for the usability testing phase. This, in turn, led to further data collection through the usability testing of the design prototype. The nature of usability testing data is discussed in the section below.

Formative Usability Testing – The Nature of the Data

Formative usability testing or think aloud usability testing (Travis & Hodgson, 2019) refers to the watching and listening to users or learners as they interact with a design product. It may also be described as an integrated feedback system (Nathenson & Henderson, 1980, 2018) since it draws on three types of data to help product developers test and improve on design prototypes. The types of data include behavioural data (observation), concurrent data (think aloud) and retrospective data (questionnaires and interviews). Retrospective data are used before and after concurrent (think aloud) data. Questionnaires provide pre-test opinion data about how users perceive their own abilities and preferences before they use a product. Think aloud data are verbalisations by individual test participants (learners or users) about their perceptions of the product (an educational resource) and the decisions they make as they interact and use the resource. Think aloud data are the result of a moderators' prompts inviting participants to comment out loud about their thoughts and feeling as they use the resource (Cotton & Gresty, 2006). This type of data is at once behavioural and concurrent. It is behavioural because it allows for observation (watching and listening) by a moderator or facilitator and

members of the development team. It is concurrent because the thoughts, feelings and decisions are expressed by the tester while using the product. Finally, post-task questionnaires provide the testers opinions about the product after using it. The purpose of usability testing data is to determine the pleasure and pain points of the (OER) design solution and to identify how those points might be improved. Research questions two (RQ2) and three (RQ3) capture the purpose of usability testing data.

Procedures for Collecting Usability Testing Data

As indicated in the section above on the role of the researcher there is the potential for bias in the collection of data in this study. In addition to assuming the role of complete observer, the following measures were taken to mitigate against researcher (evaluator) effects during interactions with participants:

- Standardization of research protocols (i.e., the moderator script, the questions and tasks participants completed).
- Seeking the help of instructional design experts as observers to implement the study.
- Establishing a protocol and a tentative test schedule.
- Assigning roles, delivery of training, download of software and configuring of it on computers.
- Determining tasks and scenarios to be performed by all participants based on the ethnographic interviews and observations.
- Conducting two pilot sessions before testing “to ensure that the usability team had understood their roles, configured the equipment correctly, were familiar with the

[Zoom video conferencing software], and established a reasonable schedule for conducting test sessions with real participants" (Fisher, 2009, p. 56).

- Establishing data collection points.

Usability Testing Session

Individuals involved in a testing session included the following: two facilitators (moderators); three observers (Programme Manager, Course/Instructional developer, the Test Administrator, the principal researcher) and one test participant. The process for conducting the testing session was as follows:

- the moderator greeted participants online, reviewed the Consent Form (see Appendix D) and obtained verbal consent.
- the test administrator received signed consent forms for co-signing and safekeeping.
- test participants were provided with instructions on their role in the usability testing session.
- the facilitator invited test participants to practise the think aloud protocol while loading a stapler to ensure that participants understood the concept of thinking aloud.

Participants were invited to log into the course. The moderator then started the Zoom software, automatically recording the session. The pre-test questionnaire was administered using google forms. Once the questionnaire was completed and submitted, participants were instructed to begin the first item on the task sheet which was emailed to them before the session. Post-task questionnaires and exit interviews were also emailed to participants. The emailed task sheet enabled participants to advise aloud when they

started and finished each task. Participants continued to progress through the remaining tasks. Upon completion and submission of the final task, they were encouraged to complete the exit interview. The session ended once the exit interview was completed and submitted. The interview recording was automatically saved to the Test administrator's computer two files: an audio only file and a combined audio video file (Gray et al., 2020).

While completing the tasks, participants were reminded to think aloud. In addition, during the session observers identified and recorded points at which participants appeared to have trouble or experienced satisfaction. To record these points, observers were provided with observer forms (see Appendix C2) adapted from Tulis and Albert (2013). These forms enabled observers to pay attention to tasks and recorded participants' verbalised comments and/or their nonverbal cues indicating trouble or satisfaction. The starting and ending times for each task, each participant's comments, nonverbal cues, and navigational paths were logged manually using these forms.

Usability Testing Round

Steve Krug (2006) argues that "testing one user is 100 percent better than testing none [and] testing one user early in the project is better than testing 50 near the end" (p. 134). Because this phase of the study used a combination of discount usability techniques (the Rapid Iterative Testing and Evaluation (RITE) plus the Krug method), slight variations on the traditional usability test were incorporated. Central to both the RITE and Krug methods is that one round of testing can employ a minimum of one tester in a session, that is, one participant. Related to this is the potential to make changes after one session or in between participants if issues have an obvious cause and an obvious

solution and can be implemented quickly (Medlock et al., 2002). The drawback is that data from the participant could be outlier data (McGinn & Ramírez Chang, 2013).

In this study, to manage the potential for outlier data, each round of testing comprised approximately three sessions, that is, three participants, each participant completing one session. Initial findings by Virzi (1990, 1992) confirm that three testers can uncover many usability problems. Nielsen and Landauer (1993) later noted that the three testers could reveal 75% of usability problems. Therefore, in this study a minimum of three participants constituted one round of testing.

Challenges associated with recruiting participants and the implementation of remote moderated testing did not support strict use of both the RITE and Krug methods. Uncovering *and* fixing problems in fewer than two days according to the literature (Krug, 2006; McGinn & Ramírez Chang, 2013; Medlock et al., 2002) was not possible. Instead rounds of testing were spread over two or three days. This gave the moderator, observers, and the researcher more time to meet for 30-minute debriefing sessions between tests and at the end of the round to analyse problems and discuss and confirm the changes that needed to be made. The debriefing session served both to provide expert analysis in the form of a heuristic evaluation and to decide and confirm which changes need to be given priority.

Both the practitioner literature on traditional usability testing (Barnum, 2021; Dumas & Redish, 1999) and the research literature (Ardito et al., 2006) suggest combining usability testing with heuristic evaluations of e-learning course products. Further, decisions about which issues should be given priority were also determined by

classification of issues as suggested by Medlock et al. (2002), early implementers of the RITE method. This is discussed in more detail in the following section on data analysis.

Remote moderated think aloud usability testing incorporated the following steps:

- Participants received eight predetermined tasks and the corresponding questionnaires in a separate email message after the Zoom link was sent.
- Participants were greeted and invited to give oral consent at the start of each test session.
- Participants completed eight predetermined tasks and the corresponding questionnaires on their computer and were asked to email their completed questionnaires to the test administrator.
- Observers received Zoom invitations to participate in the meeting as observers.
- Observers identified and recorded problems participants experienced and their successes on a computer that was captured on an observer form.
- At the end of three sessions one round was completed and the data to inform changes was discussed and confirmed in a debriefing session.
- At the debriefing sessions lead by the researcher data were analysed for common themes (Goodman et al., 2012) or issues (Creswell, 2013). Changes were recommended based on consensus by key decision makers about the priority (severity) issues identified and those identified in developers' journals (see classification of issues in the following data analysis section).
- Another round of testing began.

Confidentiality and Anonymity

To ensure the confidentiality and anonymity of participants the following precautions were taken. To ensure confidentiality, at the end of each round of testing, audio and video recorded data collected using the Zoom web conferencing software was exported to the hard drive of the researcher and password protected for safekeeping.

Journal data were submitted electronically and stored on a computer that required the researcher's password for access. Journal recordings were also exported to the researcher's external USB drive stored in a locked cabinet in the researcher's office until each round of usability testing was finished and a summary report of agreed changes was sent by email to developers. As soon as the data compiled in the summary report was sent to developers they were deleted.

To ensure anonymity "no identifying information [i.e., name, worker identification, etc.] was requested" of test participants (Fisher, 2009, p. 60).

Data Analysis

Similar to the section on data collection, data analysis was conducted for the field visit and usability testing phases of the data gathered. Analysis of the data in each phase meant comparing what users did (behaviours), what they said they did (verbal reports and interview transcripts), and what observers saw (observations and field notes). This approach of analysing multiple sources of data is called triangulation (Barnum, 2021; Patton, 2015). Triangulation of data sources was used to analyse data from both phases. In the field visit phase this meant comparing interviews, field notes, and observations. For the usability testing phase this meant that observers compared participant comments (think aloud verbal reports), observations (observer reports), and questionnaire responses

(feedback from pre-test and post-task questionnaires, and post-test interviews). Participants' task completion rates and the time on task reports were used to settle any inconsistencies between participant comments observations and questionnaire responses.

Analysis of Ethnographic Interview Data

Analysis of ethnographic interviews included the following stages: capturing and discussing initial insights; preparing the data; finding patterns and themes; and relating groups into frameworks (Goodman et al., 2012). Capture and discussion of initial insights was implemented through the analysis of data during data collection. Crabtree et al. (2012) suggest that analysis starts with fieldwork. In addition, debriefing discussions about initial observations were conducted with the site librarian to minimise threats to validity. Data preparation included: transcribing audio and video data into text files; checking with participants to confirm whether the transcriptions were an accurate representation of the meaning of what was said and observed; moving photographs and video from capture devices to file systems and labelling them using relevant metadata descriptors; and breaking up large chunks of data into smaller elements that can be recombined more easily. As an example, this last approach used handwritten quotes and paraphrases in Post-it notes. This facilitated the stage of finding patterns and themes inductively.

To initiate the finding of patterns and themes, analysis of in-person and remote field visits relied on sensitising concepts. According to Patton (2015), these concepts refer to "categories that observers bring to the data...[and] are used during fieldwork to guide inquiry and subsequent [inductive] analysis" (p. 545). Crabtree et al. (2012), as part of the practical guidelines for analysing the ethnographic record, recommends the

application of sensitising concepts that "underpin the ethnomethodological approach to [design] ethnography" (p. 130). During the field visits the sensitising concepts used in this study included goals/motivations, behaviours, needs and problems of users.

Analysis of Usability Testing Data

As indicated in the section on the usability testing round and similar to the approach to analysing ethnographic interviews and observations above, triangulation of data sources during the debriefing sessions contributed to data analysis. According to Barnum (2021) triangulation is used to show the dependability of the results by examining the data from multiple angles. It is also used as an initial step towards teasing out the real problems. Following the identification of problems, the next stage in the analysis was to organise them by level of severity.

All approaches to analysing usability test results aligned with those of qualitative case study analysis and included searching for common themes to identify the real problems. Similar problems were grouped together using a bottom-up (inductive) process called affinity matching while dissimilar problems (also known as outliers) were noted for comparison with participants in subsequent rounds in the event that some similarity was found. In addition, to preserve successful designs positive comments by participants during usability testing were included in the report (Barnum, 2021; Fisher, 2009; Goodman et al., 2012).

Participant responses to pre-test and post-task questionnaires and exit interviews captured in Microsoft Word documents were exported to Microsoft Excel. However, because it is often the case that feedback from these questionnaires conflict with observations of the user experience (Barnum, 2021), the researcher relied on

comparisons with other data sets to provide a more holistic analysis. One of these data sets was the users' comments captured by two observers in an observer report form created using Microsoft Word. Use of more than one observer in analysis is known as analyst triangulation (Patton, 2015). The other data set was participants' comments from thinking aloud.

Observations are the result of the think-aloud process. They are objective descriptions of what was seen or heard during the test. They may take the form of a direct quotation, a learner goal, a learner action, or a pain point. Observations were supported by collation of performance metrics which included the successful completion of tasks and time on task. Analysis then prioritized the level of severity of problems by considering the impact of the problem, the number of learners affected by the problem and the frequency with which learners were disturbed by the problem. Severity levels were determined based on whether a problem:

- made learners unable or unwilling to complete a task – *critical*;
- significantly slowed down some learners when completing a task – *serious*;
- made some learners feel frustrated but did not prevent task completion – *medium*; and
- was a quality problem such as a superficial issue – *low* (Travis & Hodgson, 2019).

Summary

The above chapter described the research design that drove the study. It detailed the research questions that informed the data collection and analysis processes. The context for the research was also described. This was followed by a description of the

characteristics of the research population, including how and why these participants were selected. The instruments for use with participants during data collection were identified as well as the nature of and the procedures for each of the different stages of data collection. The nature of data analysis techniques and their procedures, drawn from user research, were elaborated.

Chapter 5. Results

Introduction

As stated in Chapter 1, and consistent with its stated purpose, the study reported here examined the case for adoption and adaptation of workplace OER for information skills training for mid-level civil servants. This chapter reports on two phases of data gathered. The first phase of data addressed the first research question of whether there was a need among specialist librarians and their clients (members) for OER to support workplace information skills training at information centres. The second phase of the project responded to two questions: how the chosen OER training solution helped or hindered trainees as they completed their learning tasks and how the OER solution might be improved. As indicated in Chapter 4, data from phase one was expected to inform the creation of agile learner profiles, the selection and adoption of a relevant learning experience consistent with the needs (learner requirements) identified in the learner persona profiles, and the scenarios and tasks used to elicit the pleasure and pain points of the adopted learning experience. Data from phase two was expected to uncover the problems with the identified solution and how it might be improved. The reports on each phase of data collection below show the extent to which data from phase one and phase two achieved the outcomes identified.

Phase One – Observational Interviews

In phase one of the study, field visits or observational interviews were conducted with 11 participants from five government and institutional libraries (see Appendix F). Due to the restrictions imposed by the pandemic, nine observational interviews were conducted virtually using the Zoom video conferencing software. The observational

interview protocol (see Appendix C1) used 11 interview probes divided into initial, transitional, and closing probes. Initial probes helped determine the type of educational services provided at the research sites and the type of tasks that required specialist librarians and their clients to search for sources of evidence. Transitional probes invited participants to show and talk about their information seeking behaviours when they searched for sources of evidence. Closing probes encouraged participants to reflect on their learning preferences. Consistent with design ethnography, insights from observations and interview questions were analysed to build learner profiles drawing on participant goals and tasks, their observed information seeking behaviours and needs inferred or deduced from the participants' goals and tasks and observations of their information seeking behaviours. In the following sections, findings from the initial probes suggested three learner personas profiles: information mediator, (educational) programme specialist, and securities analyst.

The information mediator role describes librarians serving in specialist, governmental, and institutional libraries. The programme specialist describes curriculum developers at the Ministry of Education. Securities analysts describe researchers at the Trinidad and Tobago Securities Exchange Commission. Of the 11 participants in the observational interviews, these three learner personas profiles emerged due to the similarities of their occupational roles and their work contexts.

Results of Initial Probes

Information Skills Training for Users. Information mediators at government and institutional information centres all report the that the provision of information skills is not explicitly taught at their information spaces. No formal courses are delivered to

users. One professional indicated that their library was “not tasked with providing research/information skills.” Other professionals interviewed seemed to confuse information sources provision with information skills training resources. Even when the misunderstanding was resolved professionals restricted information skills training to teaching their members how to search and use electronic journal databases. One professional requested clarification of the phrase information skills training and what it involved. It was later discovered that this professional had never conducted any form of information skills training despite having completed a module on information literacy as part of a graduate degree they completed.

Tasks Prompting Information Seeking by Users. Information mediators, programme specialists and securities analysts indicated that they complete a range of tasks of varied levels of complexity. As outlined in Table 6, most of the tasks reported were written tasks which included:

- creating job vacancy databases
- drafting papers (including policy and proposal development, workshop planning and development, creating activity packs, cabinet notes, and position papers)
- producing and publishing bulletins
- producing research papers
- responding to information queries at the reference desk
- submitting newspaper articles for publication
- updating occupational dictionary
- writing (board) reports
- writing policy papers

Table 6

Feedback from Initial Probes

Initial probes	Information mediator	Programme specialist	Securities analyst
Providing information skills training	Informal, individual information skills training, research assistance and research guides, user orientations (group and individual)		
Tasks prompting information seeking	Information queries	Creating content (activity packs), writing plans for teacher development workshops, developing (home-schooling) guides, making presentations	writing policy papers, research papers, newspaper articles, reports, bulletins, and board reports)

Results of Transitional Probes

Approaches to the Implementation of Information Skills Training. The principal self-reported goals of information mediators at five sites specify provision of information sources and research assistance as types of mediation services. Information source provision refers to making information sources available through the acquisition of databases. It can also refer to conducting searches of these databases on behalf members to identify lists of relevant sources of evidence related the queries of their members. Information skills training conducted by specialist librarians is “informal” or “case by case”, if at all implemented (see Table 7). Although participants matching the profile of information mediator limited their roles to information source provision and research assistance, a few acknowledged providing information skills training at the

reference interview by helping users “narrow…down” and “focus” their queries. Another information mediator indicated that informal information skills training is provided to help users refine their searches when using databases. Although some mediators conducted “user orientations” for bibliographic and full text databases, others indicated that the library was “not tasked with providing research/information skills”. Other information mediators in judicial and legal services concluded that their users are intelligent and know how to navigate legal databases, so information skills training was assumed “unnecessary”. Still, others have reported providing a print-based desk manual if library staff are unavailable or for new law professionals seeking guidance.

Preparing to Search for Sources of Evidence. Information mediators tasked with providing research assistance indicated that their process involved reviewing information sources within their information spaces and analysing the information query. An information mediator at a securities commission, for example, would follow up with the requester to clarify any information query received through the online query form. For this mediator clarification was accomplished through checking with the requester to confirm the nature and scope of the request and agreeing timelines for fulfilling the request. Another mediator’s process included asking the requester to specify: “what exactly do you mean by this...?” and draws on institutional knowledge to direct the requester to sources of evidence relevant to their query. For example, “when you talk about budgets, you have to look at first, the financial regulations and the exchequer act and that is two major documents that deals with financial regulations in Trinidad and Tobago…”. Recording or writing down the query was also part of the process of some information (seeking) mediators. “Before I start searching, I usually record what the

officer wants... so for me it's a matter of breaking down what they have written, say like it's a statement, so then in (re)search terms I really try to identify the year…well in that case it was really a person…."

Among non-librarian participants processes varied from having no explicit search plan to a task led search strategy. One participant, a securities analyst, admits to having no fixed theme (see Table 7). When invited to show what his process looked like, the participant shared his screen and opened a word document with a draft of an article on "affinity fraud" which he started recently. He described what affinity fraud was and admitted he was dependant on the Google search engine. He then opened the search engine and typed in "affinity fraud" which retrieved several results. The participant indicated that for more in-depth searching he would go into Google Scholar and then typed the search term "affinity fraud" in the search box. After retrieving results, he indicated he would go through the results page. He clicked on the free links, selected one as an example and opened the first item of the results on that page. If looking for a more specific topic "affinity fraud within the Muslim community", he would go through each article.

Another participant used the example of a task and the role of that task in influencing where to begin searching for sources of evidence. "Listing who I would go to is based on what the question is". This participant first identified a task. The participant then visited a website. Because browsing the site was difficult the participant decided to use the site's search box and entered the search term "collective investment schemes." The participant then examined (scanned) the results to see if they pointed to reports. When no useful result was found the participant conducted a google search:

"COLLECTIVE INVESTMENT SCHEME REGULATIONS IN THE UNITED STATES." This search returned 47,700,000 results. The participant said, "If the search is too broad (referring to the previous search) then a more specific search on google is conducted." The participant then typed in: "COLLECTIVE INVESTMENT SCHEME AND THE UNITED STATES." This "narrow" search returned 52 million results.

Programme specialists admitting to tasks of average complexity, such as creating "activity packs" and "workshop" presentations, neither showed nor described any process for developing a search plan before beginning to search for sources of evidence. For example, when invited to show her process before searching for sources of evidence, the participant shared her screen and opened the Google search engine and began typing in "ECCE activity pack." Another member of the profile group of programme specialists conceded that writing "position papers" and "cabinet notes" were among the tasks he completed and that these tasks "could be quite involved." However, this participant seemed unable to demonstrate and search plan before searching for sources of evidence. Instead, similar to another member of the programme specialist profile group, he suggested he would have "discussions about a topic with the team working on a particular topic."

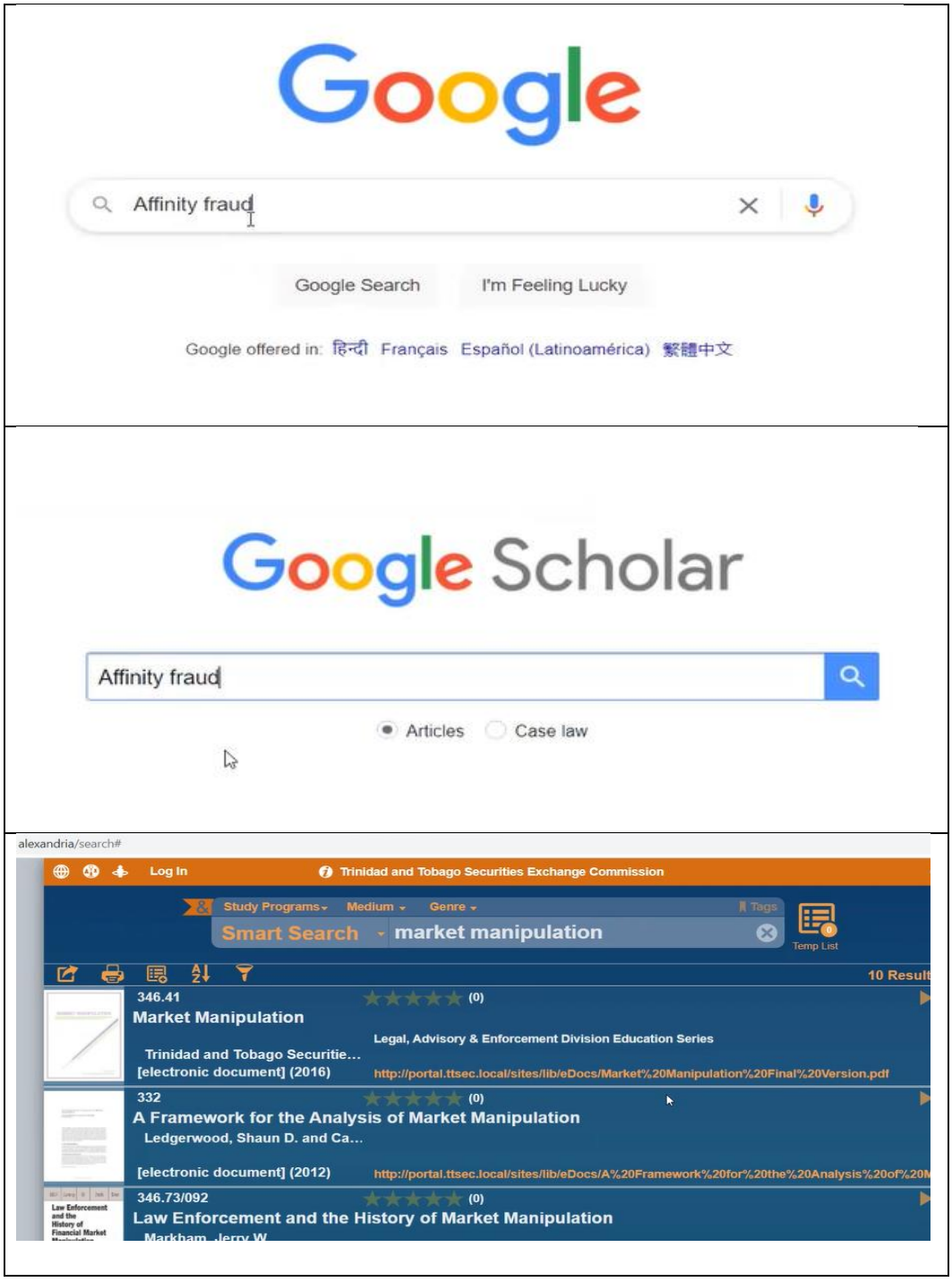
Deciding Sources of Evidence to Pursue. Participants belonging to each profile agreed that decisions about sources worth pursuing were made based on what information was available. "Basically, the sources worth pursuing is the source we have information on… If no information is available, it is stated that no information is available." The participant continued, "However, where some regulator is doing something different from other regulators, this is mentioned in the report." Other

participants used the number of results as a guide. This participant stopped the search process when she "[could] explain the topic." This participant also looked at the titles to see if they matched the question or task and relied on experience. Five to 10 sources indicated when to stop searching. Understanding the content of the results was an indication that the information was useful. Other participants indicated there was no set formula to know when to stop searching but suggested "timelines could play a role."

Preferred Search Tools. As illustrated in Figure 3, the preferred search tool among all information seekers, including information mediators in the information seeking role, was the Internet search engine Google or Google Scholar for more "in-depth" searching. Other search tools by used programme specialists and securities analysts were the websites for country specific and international organisations. Library databases and organisational websites were a first choice used by information mediators when providing research assistance. Neither the library nor its databases were the primary choice among programme specialists and securities analysts.

Figure 3

Preferred Search Tools



Using Preferred Search Tools. The observed search habits of all information seekers using Internet search engines and organisational websites suggest a similar pattern. As shown in Figure 3, these search tools were used by the searcher to perform basic searches. That is, the tools were used to type in one or two keywords or to type in a key phrase into the search facility. Information mediators also reported using and were observed using basic searches with one or two key terms.

Deciding When to Stop Searching. The main influences on decisions to stop searching were timelines for tasks and the number of search results. Due dates for tasks influenced decisions to end searches among both mediator and non-mediator profile groups. The number of search results also influenced decisions to end searches among both mediator and non-mediator profile groups. Other reported factors affecting decisions to end searches were the redundancy of results, the "experience" of the information seeker and the "audience" for the results.

Using Sources of Evidence. Participants from both information mediator and non-mediator profile groups used sources of evidence consistent with their roles. Information mediators, in their role as providers of information sources, either send full text content to their member users or provide a listing of relevant resources located. Programme specialists and securities analysts integrate content they locate into their presentation tasks through varying degrees of attribution of the sources of evidence. This ranged from copying and pasting relevant content with zero attribution (see Figure 4) to some form of acknowledgement of the source (see Figure 5). A summary of feedback obtained from transitional probes is presented in Table 7.

Figure 4

Use of a Source with No Attribution

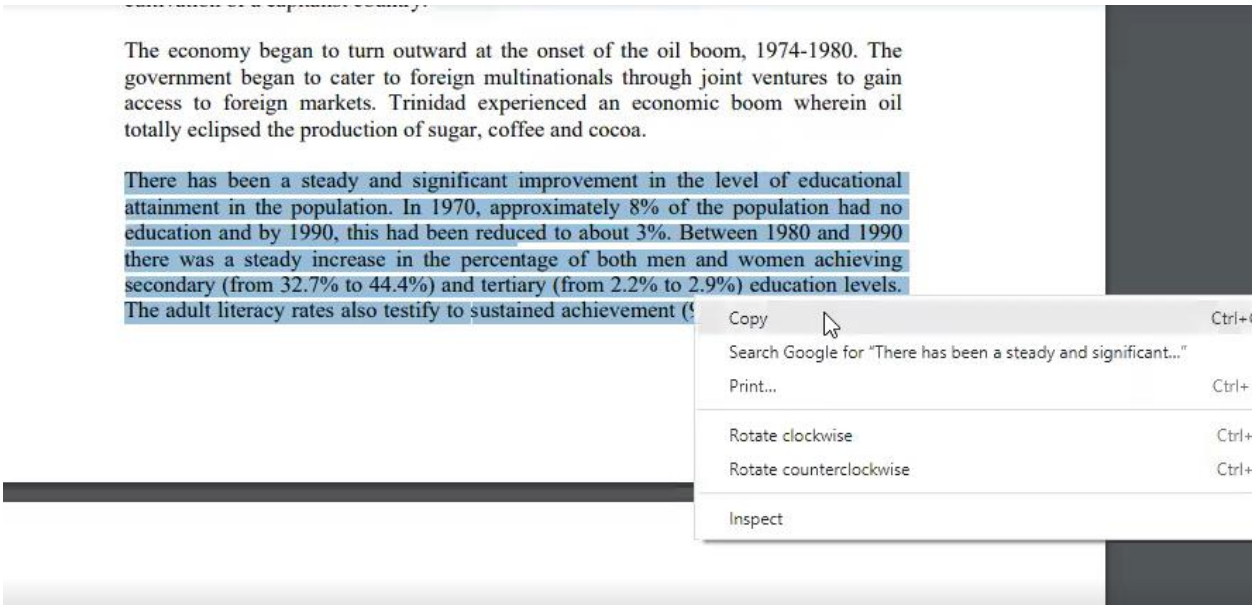


Figure 5

Use of a Source with Some Attribution

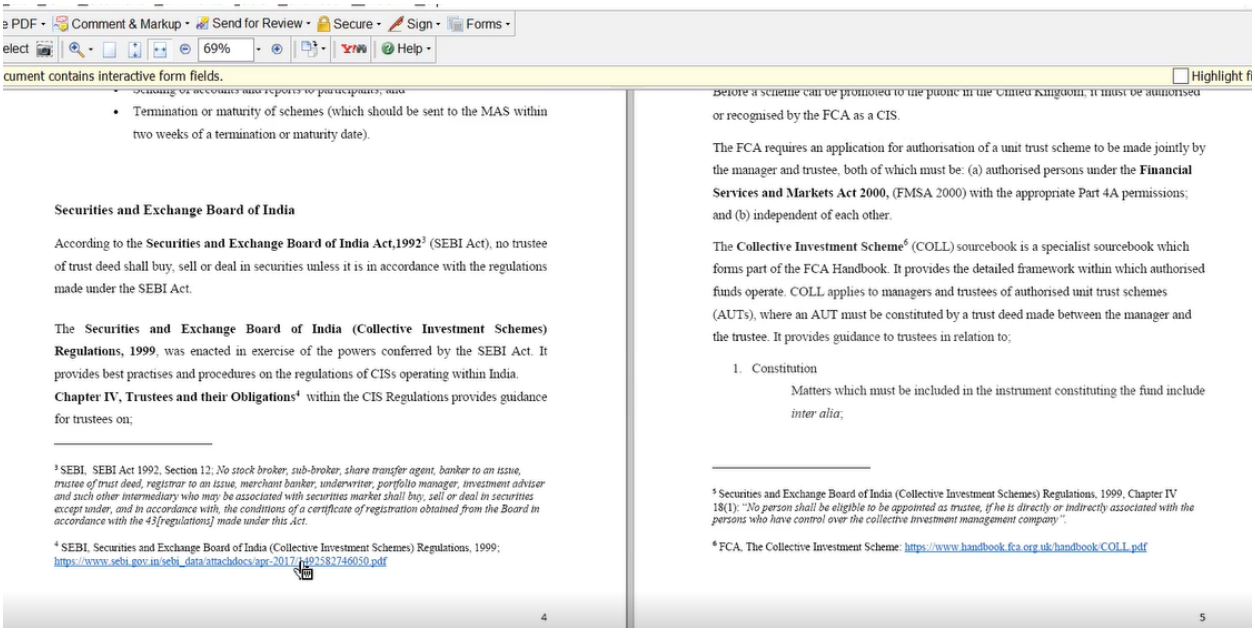


Table 7

Feedback from Transitional Probes

Transitional probes	Information mediator	Programme specialist	Securities analyst
Information skills training approaches	Reference interview Individual or case by case; informal/non-formal Desk manual		
Preparing to search for sources of evidence	Clarifies query using questions (what do you mean by…?) Recording the query	Discussions about topic with work team Thinking about ideas first	No fixed theme; Approach not definite
Deciding sources of evidence to pursue	Checking Wikipedia initially; visiting UN (web)sites	Checking the authority; relevance (to task); objectives of the presentation	Information available Timelines
Preferred search tools	Full text databases Internet search engine (Google)	Internet search engine (Google) Social media site (YouTube) UNESCO	International and country specific securities Websites; Library and business Journal Internet search engine (Google)
How search tools are used	Simple basic search and then expand; Narrow search terms; change the terminology/question	One or two keywords or pdf plus a search phrase; Iterated search and scanning of results; Trial and error	One or two keywords or a search phrase; Search and scan (Results); Trial and error
When to stop searching	"Go through the first 10 results"; timeframe; redundancy of results	Space limitations of task; Audience; Search experience	Five to 10 sources Time constraints

Transitional probes	Information mediator	Programme specialist	Securities analyst
Using sources of evidence	Emails full text content or a list (brief outline) of items located	Attributing ownership of the source; Paraphrase and quotations	Quotation; cite source in policy paper

Results of Final Probes

Trialling Training Resources to Improve Information Skills Training.

Participants matching the profile of information mediator, that is, those responsible for reference and instructional services, indicated their openness to trying out training resources to improve their informal delivery of information skills training to clients at their information spaces. One participant acknowledged that for members at that information space "time is not enough…for them [users] to sit here and talk to you for more than five minutes is very rare". Since time is limited for member users at this space the mediator would forward the information skills intervention to users: "If information (skills) training is out there, and it's a video, I would forward it to the officers…they could just sit and go through it."

Trialling Training Resources to Improve Information Search Skills.

Participants from non-mediator profile groups indicated a willingness to try out micro training resources. One programme manager reported being always willing to try out a training programme to help him improve his search efficiency because:

> I find just searching for information, because I don't have the formal skills in doing that…sometimes it does take me…as I said, a lot of it is trial and error… because a lot of it is about trial and error. If I have skill…my thing is about competency, if I have skills in those areas, that will assist me a lot.

One lead securities analyst demonstrated an interest in formalising the team's research process:

> I think what we may need internally is probably a documented approach to standardise our research process. We have informal practices and we have agreed upon based on discussion, but I think what we might need is something to guide us internally and you know sort of like a procedure and in writing to guide us because research is very important to us and what we may need is to have that actual policy created…when I say policy is more of a procedures manual.

User Self-Reports About Learning Preferences. Participants matching the information mediator profile reported preferences for a learning/training object that included videos, offered self-paced learning experiences, offered activity centred learning by doing "hands-on, visual video-based, reader-based learning," allowing "you to access it when you need it." Participants matching programme specialist and securities analyst learner profiles reported preferences for a learning/training object that facilitates "learning by doing (activities)" and "self-paced learning," "problem-solving and critical thinking," "reading," and offering a "challenge."

Phase Two – Structured Interviews

In this phase of the study, every effort was made to replicate Fisher (2009) in the collection and analysis of data, except where modifications were necessary as indicated in Chapter 4. Three rounds of structured interviews (remote moderated think aloud usability testing) were conducted with nine participants from two of the main persona profiles generated from phase one, the information mediator and programme specialist profiles. Participants from the securities analyst profile group were unavailable. As in

phase one, due to the restrictions imposed by the pandemic, remote moderated think aloud usability testing (RMTUT) was conducted virtually using the Zoom video conferencing software. The structured interview protocol (see Appendix C2) included data from pre-test questionnaires, usability testing tasks, post-task questionnaires, exit interviews and observer notes from the think aloud protocol. Most of these instruments were intended to answer the study's second research question (RQ 2) about how the design of the open educational resource solution helps or hinders workplace trainees as they complete their learning activities and tasks. They were also intended answer the third research question (RQ 3) about how the design of the open educational resource solution should be improved to enable workplace trainees to complete their learning activities and tasks. However, data from the pre-test questionnaire focused on the digital skills of participants and their task experience with online learning products.

Participant Profiles

As indicated in the description of participants in Chapter 4 and consistent with recruitment criteria identified, participants displayed a range of characteristics including those who were more likely to have difficulty using the course prototype. For example, based on their responses to the pretest questionnaires summarised in the following overviews, some were first-time users of self-access material or first-time participants in an online course, low experience with computers and the internet and low experience with e-learning and online courses. All participants were civil servants who were users of special libraries at the five government institutions and ministries. These participants had varied backgrounds. Some were mature learners and persons with low (web)

(information) literacy skills. Table 8 captures the learner profiles of nine participants in the RMTUT.

Table 8

Participant Profile

Participants	Age	Gender	Occupation	Online course experience	Course management system experience
P 1	45 – 55	Female	Programme specialist	Three or more	Yes
P 2	45 – 55	Male	Programme specialist	One	Yes
P 3	55 – 65	Male	Programme specialist	One	No
P 4	45 – 55	Female	Programme specialist	Three	No
P 5	35 – 45	Male	Programme specialist	None	None
P 6	45 – 55	Female	Programme specialist	Three or more	Yes
P 7	55 – 65	Female	School administrator	Three or more	No
P 8	55 – 65	Female	Information mediator	One	Yes
P 9	35 – 45	Female	Information mediator	Three or more	Yes

Setting

Remote moderated think aloud usability testing (RMTUT) was conducted using the Zoom web conferencing software. As referenced in the instrumentation section in Chapter 4, national public health regulations and restrictions imposed by the pandemic

led to the discontinuation of in person meetings and the use of web conferencing software was accepted as suitable alternative. The software allowed for the audio and screen recording of all test sessions. These recordings allowed developers and observers the opportunity for retrospective review of each session. The Zoom web conferencing software was chosen because it was the most affordable and usable among proprietary web conferencing software. Remote moderated usability testing does have its drawbacks. It can be resource-intensive in terms of setting up and participant recruitment (Moran & Pernice, 2020). Setting up the meeting software, according to the authors, can increase the time and effort needed to ensure that it works for test participants and the research team. To address the extra time needed for setting up participants were advised in advance of the duration of the session and asked to ensure their spaces were free from distractions. Most participants were at their homes or in a space free from distractions. Once participants were admitted to the meeting in Zoom, to help them feel at ease, they were greeted by the facilitator, and introduced to the research team. The researcher spoke with them briefly and thanked them for helping with the research study. The facilitator shared the screen to allow participant to read the consent form. After they had finished, participants were asked to verbalize if they agreed to participate and if they wished to continue. The researcher also thanked each participant for agreeing to participate.

Remote Moderated Think Aloud Usability Testing Protocol

For this phase of the study, data were collected in rounds. Data were collected via observations, video recordings, questionnaires, and journals. Each round consisted of three test sessions. A test session consisted of a participant completing the Pretest Questionnaire and Tasks 1 through 8, along with the corresponding Post-task

Questionnaires administered at the end of each task. The tasks were consistent with authentic activities trainees would normally perform. Tasks and their optimal completion times were defined as follows, with Tasks 3, 6, and 8 grouped together because they were nearly identical:

- Task 1, Begin the tutorial – You have been enrolled in the search strategies tutorial and you want to know what the criteria are for completing the tutorial. Remember to think aloud as you explore (five minutes).
- Task 2, You want to know how to develop a search strategy. Locate a document that helps you develop a search strategy (five minutes).
- Task 4, You want a handout to summarize how to refine your searches. Where is that handout located (five minutes)?
- Task 5, Find a search tool that helps you refine your searches (four minutes).
- Task 7, Under which section do you learn how to evaluate articles you find (three minutes).
- Tasks 3, 6, and 8, Find and Complete Quiz (1, 2, and 3): Please locate quiz (1, 2, and 3). Determine how to complete and submit each quiz (five minutes each quiz). You will not focus on the answers as you complete the quiz, but we want to see how well you understand how to find, complete, and submit the quiz. Remember to think aloud as you work.

Following the Task 8 Questionnaire, the Exit Interview was administered, which signified the end of the test session. Meanwhile, two observers logged notes. A detailed description of participants' progression through the test sessions for each round is presented here. First, Tasks 1, 2, 4, 5, and 7 are described. Then, data for Tasks 3, 6, and

8 are presented together because of the similarity of the tasks and their findings. Summaries of the observers' perceptions and the instructional developer's perceptions are also presented. In addition, the researcher interprets the data and presents a summary of the major themes that emerged from each round.

Remote Moderated Think Aloud Usability Tests: Round 1.

Pretest Questionnaire Overview. Participants 1–3 completed a test session during Round 1 of usability testing. Of those, all rated themselves to be average or high in terms of computer skills. All participants reported having experience using Microsoft Word software. All reported using Laptops, whereas none reported having used a Macintosh computer (MAC). Email and Facebook were the most used platforms among participants. Only one participant reported using instant messaging (IM), whereas three used emails. None of the participants reported having used Blogs, Wikis, or Skype. All participants stated that they had accessed course materials online and that they had taken one fully online course. Two participants reported that the course they had taken was housed within the Blackboard course management system (CMS). Participants reported having used the *Assignments* and *Discussion Board* features. Each participant's experience of the tutorial is presented below.

Participants' Perceptions for Round 1. In the following section, the experiences of the first three participants are presented as they progressed through each test session. As noted earlier, each test session entailed one participant taking the Pre-test Questionnaire, working through Tasks 1 through 8, and completing the questionnaire at the conclusion of each task.

Test Session 1, Participant 1: Tasks 1, 2, 4, 5, and 7. Task 1. Having read aloud the instructions for the first task, Participant 1 clicked the *Introduction to Tutorial*, then read text under *Welcome*. The participant then scrolled to the bottom of the page and clicked *Learning Outcomes.* The participant then scanned two paragraphs on this page. When prompted to say what she was thinking she said, "Plenty text, so I'm reading through." The participant then said, "I wish it had some visual with text, it would have been easier." The participant then clicked the link at the bottom of the screen *Next: Frequently Asked Questions*. The participant then continued scanning the same page and later visited the page: *Structure of this Tutorial.* Participant 1 found the item after being asked to repeat the task and then by clicking *Next*. Participant 1 then completed the post-task questionnaire for Task 1.

Task 2. Participant 1 asked, "I am guessing Task 2 corresponds with *Step 2*?" The participant scrolled up and down the page *Planning your Search.* The participant then returned to the page *Introduction to this Tutorial,* clicked *Learning Outcomes,* then asked, "Where is it likely to be?" The participant then twice clicked *Planning your Search* under *Step 1.* The participant moved the mouse in a random way and asked, "Why is the document not on the same page?" The participant then left *Step 1* and visited Google Scholar under *Step 2*. The participant shook her head. After the task was clarified, the participant located the document under *Creating your Search* under the table of contents in *Step 1*. Participant 1 then completed the post-task questionnaire for Task 2.

Task 4. Participant 1 clicked *Step 2 Search Tools,* then under the table of contents clicked *Search Refinements* then *Truncation,* then *Field Searching,* and scrolled down

the page to locate the handout. Participant groaned with a deep sigh and said, “So many times I have to click to get this handout…three times.” Participant 1 then completed the post-task questionnaire for Task 4.

Task 5. Participant 1 clicked *Step 3* in the left sidebar, then clicked *Step 2,* scrolled up and down the page, then clicked *Search Refinements,* then *Truncation,* then *Field Searching.* The participant claimed to have located the search tool. Participant 1 then completed the post-task questionnaire for Task 5.

Task 7. Participant 1 clicked *Step 3,* then moved the cursor to the table of contents in the right sidebar, then clicked *Evaluating Articles* to complete the task. Participant 1 then completed the post-task questionnaire for Task 7.

Test Session 1, Participant 1: Tasks 3, 6, and 8. ***Task 3.*** From the *Search Strategies* home page, Participant 1 clicked *Step 1 Quiz,* then, after reading the instructions clicked *Attempt quiz now* and proceeded to complete the quiz.

Task 6. Participant 1 clicked *Step 2* in the left sidebar, then clicked *Step 2 quiz.* The participant returned to the *Step 2 Search Tools* for help to complete the quiz.

Task 8. Participant 1 clicked *Step 3* in the left sidebar, then clicked *Step 3 quiz.* The participant did not attempt quiz.

Test Session 2, Participant 2: Tasks 1, 2, 4, 5, and 7. Task 1. Participant 2 clicked *Introduction to this Tutorial,* scrolled down the page and opened the drop-down menu labeled *Jump to.* The participant then moved the cursor to the *Planning your search* label, moved the cursor to the bottom of the screen and clicked *Step 1 Planning your search.* The participant then clicked the tab with the tasks and reviewed the task. When prompted to think aloud, participant 2 verbalized the task completion criteria

without looking for them. He then clicked the *General* tap in the left sidebar. He then returned to *Introducing this tutorial,* clicked *Planning your search,* moved the cursor from top left to the bottom right of the screen, then scrolled up. "If I had to look for the criteria for a tutorial, I would type in that…you know normally if I am doing a search go on the Google Scholar, type it in." Participant 2 then clicked *Defining a search topic* thinking this was what he had to do. After having the task clarified, Participant 2 clicked *Grades* and then *Step 1,* then under *Required criteria* clicked *More details.* The participant thought the task was complete.

Task 2. Participant 2 clicked the *Search Strategies Tutorial.* The participant scrolled down the main page and said: "It should be under search tools". He then clicked *Step 2: Search Tools.* The participant then clicked *Search Strategies Tutorial* and said: "It should be under search tools" but instead clicked *Step 1: Planning your Search*. Then, when asked what a search tool was, said: "A tool is what you will use to make anything easier". After the participant was reminded about the task, he clicked the back button to return to the home page, then clicked *Dashboard* and returned to the main page. Prompted to think aloud, the participant said: "I'm looking for a page that will have documents stored." The participant, having exceeded the optimal time for completion of the task, received assistance to complete the task. He clicked *Next* at the bottom of four pages before locating the document.

Task 4. Participant 2 clicked *Step 2: Search Tools.* He then scrolled to the bottom of the page, clicked *Next: Search refinements.* After scrolling to the bottom of the page and receiving clarification on the task, he said, "I guess the handout is under *Successful Searching*." The participant returned to the home page, clicked *Planning your Search,*

then *Describing your Concept* and scrolled down the page. He later returned to *Search Tools* and clicked *Next: Search Refinements.* He continued clicking at the bottom of the page *Next: Truncation,* then *Field Searching* where he located the document two minutes beyond the optimal time for finding the handout.

Task 5. After reading the task aloud, Participant 2 said: "That will come under search tools". He then clicked *Step 2: Search Tools.* The participant scrolled down the page. He then clicked the following headings at the bottom of the page: *Search Refinements,* then *Truncation,* and then *Field Searching.* While on that page he noted, "I am seeing the headings, well-labelled." He then clicked *Investigating Google Scholar.* Following this, he clicked *Review of Findings,* then *Optional Resources, Explore DOAJ,* and *Search Strategy Form.* After being reminded of the task the participant was able to complete the task.

Task 7. After clicking *Step 3: Successful searching,* Participant 2 clicked the following links at the bottom right of every page *Opening Articles, Finding Openly Available Content* and then *Evaluating Articles.* The participant then noted, "There's an entire section for evaluating articles."

Test Session 2, Participant 2: Tasks 3, 6, and 8. Task 3. After reading task three aloud Participant 2 noted, "I saw the first quiz." He then clicked *Step 1* at the left sidebar and landed on the home page where he clicked *Step 1 Quiz* within one minute.

Task 6. From the *Search Tools* page Participant 2 clicked the *General* tab at the left sidebar to locate the home page and then clicked *Step 2 Quiz.*

Task 8. Participant 2 clicked the *General* tab at the left sidebar to locate the home page. He then clicked *Step 3 Quiz* and attempted it. He commented, "To locate the quizzes are very easy."

Test Session 3, Participant 3: Task 1, 2, 4, 5, and 7. Task 1. Participant 3 clicked *Introduction to this Tutorial.* The participant read content under the heading. He then clicked *Learning Outcomes* at the top of the page. The participant then said, "I wanted to keep the goal, what I am looking for, close by." He then read aloud the learning outcomes. He then reflected, "Let me continue and then I'll see…Oh wait! Look at it here." The participant used the cursor and pointed to the completion criteria under the Table of Contents but decided to click *Frequently Ask Questions.* When the participant read that the tutorial could take four to six weeks and having been reminded to check the task, he reasoned, "So I should just jump to here?", pointing with the cursor to the *Completion Criteria* under the table of contents. He clicked the link labelled *Completion Criteria* and said, "That's it, that's the answer there." The participant ended the task and completed the Task 1 questionnaire.

Task 2. Participant 3 clicked *Planning your Search* on the homepage and landed on the page titled *Defining your Search.* The participant then expressed the certainty that he had completed the task. When he was asked to review the task's instructions he reconsidered and continued browsing. He continued exploring by clicking *Defining a Search Topic.* He later clicked *Describing your Concept* and then read aloud *Your own Search.* The participant then returned to *Defining your Search* and asked himself, "Have I found a document?" He then repeated his browsing pattern clicking *Defining a Search Topic* and then *Describing your Concept.* This time the participant clicked and browsed

content under *Your own Search.* He later clicked *Creating your Search Strategy.* The participant claimed that he found a document, then he clicked *Developing your Search Strategy Skills.* Convinced this time he had found the document he asked, "This is not it here?" He then read aloud *Developing your Search Strategies* and said, "Here it is and here it is, the same place it was the last time." Only when asked about the kinds of documents he was familiar with, was the participant able to complete the task and complete the Task 2 questionnaire.

Task 4. Participant 3 clicked *Search Strategies Tutorial* to locate the main page, then clicked *Introduction to this Tutorial.* After being prompted to think aloud the participant restated the task, visited *Step 1: Planning your Search,* and used the cursor to survey headings under the table of contents and said, "I'm thinking of a quick way to find it [the handout]." He later read each heading aloud as he browsed each element of the Table of Contents and said, "Hmm…That doesn't help. Maybe I should go through them one by one…". The participant then clicked through each link under the table of contents in *Step 1,* then asked "Am I in the right thing?". The participant then clicked *Wrap Up* and returned to the main page. He then clicked *Successful Searching* and once again returned to the main page. Later, he clicked *Search Tools* confirming that he was in the right "ballpark." The participant next explored the following headings under the table of contents: *Search Refinements, Truncation* and then *Field Searching* where he located the handout and completed the task and the Task 4 questionnaire.

Task 5. After reading the task aloud, participant 3 continued exploring *Search Tools and Refinements.* The participant reminded himself to "start all over again, do it logically, start from the top, it may have been at the top." He then browsed content under

Search Refinements and *Google Scholar,* which he later confirmed to be the search tool. He completed the task and the Task 5.

Task 7. After reading the task aloud, participant 3 selected the *General* tab on the left sidebar, returned to the home page and explored *Step 3.* Under the table of contents, the participant then selected *Evaluating Articles.* He completed the task and the Task 7 questionnaire.

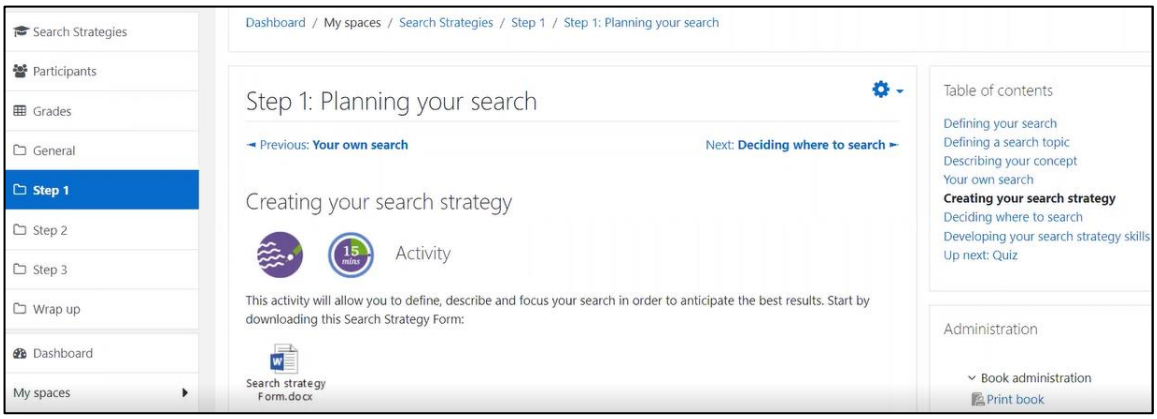
Test Session 3, Participant 3: Tasks 3, 6, and 8. Task 3. Participant 3 read the task aloud and used the back button to get to the home page. The participant revisited the page *Introduction to this Tutorial.* He then clicked *Step 1*, reviewed the table of contents in *Step 1* and located a quiz to end the task. He later completed the Task 3 questionnaire.

Task 6. While preparing to exit the *Search tools and Refinements* page and return to the home page, the participant said, "I'm not sure if this is the second quiz." He was referring to the link labelled *Up next: Quiz* located in the table of contents. After repeated attempts to return to the home page, Participant 3 selected *Step 2 Quiz* from the home page, attempted and completed the quiz and completed the Task 6 questionnaire.

Task 8. After reading aloud the task instructions, Participant 3 selected the *General* tab on the left side bar to return to the home page and then clicked *Step 3 Quiz.* He later attempted and completed the quiz and the Task 8 questionnaire.

Figure 6

Low Visibility of the Table of Contents Heading



Observers' Perceptions of Test Sessions for Round 1. Observations were held concurrently and consecutively since Observer B was unable to attend the test sessions. Both observers A and B logged points on the recording in which learners experienced difficulties or satisfaction. These observations are summarized here by task, starting with Observer A and then Observer B. A summary of the observers' perceptions toward participants' responses on the task questionnaires and exit interviews is provided as well.

Observations of Task 1. Regarding this task Observer A noted that only Participant 3 used the table of contents (TOC) to explore the requirements of Task 1. Participant 1 chose to click the links labelled *Next* at the bottom right of the page only during Task 1, while Participant 2 chose to use the links labelled *Next* for Task 1 and all subsequent tasks. Participant 1 completed the task, but Participant 2 did not. Both Participant 1 and Participant 3 completed Task 1 with assistance. Observer B found that all participants were focused mostly to the left and middle of the screen. This suggests that they did not see the TOC on the far right of the screen (see Figure 6).

Observations of Task 2. Observer A noted that learners expected documents and handouts that support learning to be in a single or separate space. Participant 1 in her think aloud raised the question, "Why is the document not on the same page [Step]?" Participant 3, in a more direct think aloud statement, remarked, "I am looking for a page that will have documents stored." Observer B noted that participants were frustrated by having to go back and forth into the tabs to complete the task. The frustration was seen in their facial expressions, name calling and self-blaming for not clicking "Next". Observer B also noted that the use of technical terms in the tutorial headings was unfamiliar and confusing to participants. Observer A noted that all participants not only exceeded the time allotment for completing this task but completed it with assistance.

Observations of Task 4. Observer A noted that learners did not like hunting for learning resources or guessing where those resources were located. They wanted a shorter route to those resources. Observer A found that the think aloud comments of Participants 2 and 3 were instructive. Participant 2 said "I guess the handout is under *Successful Searching*". Participant 3 said, "I'm thinking of an easy way to find it [handout]." Even Participant 1, who completed the task within optimal time limit, exclaimed, "So many times I have to click to get this handout, 3 times!" Observer B also noted that two participants expressed frustration at the difficulty in finding the handout. Once again Observer B pointed to participants' ignorance of the terminology used as headings in the tutorial. The handout was placed under a heading different from the label of the handout. Two participants exceeded the time allotment for completing this task.

Observations of Task 5. Observer A found that all participants completed the task. Two participants completed the task within the optimal time. Only Participant 2 seemed to struggle and needed some assistance completing the task.

Observations of Task 7. Once again, both Observer A and Observer B found that all participants completed the task. This time, the tasks were completed by all participants within the optimal time and without assistance.

Observations of Tasks 3, 6, and 8. Task 3. Observer A noted that all three participants located the quiz without assistance and within optimal time frames. Participant 3 alone experienced some confusion when trying to locate the *Step 2 Quiz.* The source of this confusion was an incomplete label. The label *Up next: Quiz,* located in the table of contents, did not make clear to the participant which quiz he was about to take. Expressing confusion, the participant said, "I'm not sure if this is the second quiz." The participant then made repeated attempts to return to the home page. Even though he eventually located and attempted the quiz, a more accurate label might have avoided repeated attempts to return to the home page.

Observations of Tasks 1-8 and Exit Interviews for Round 1. It is important to note that observers found some inconsistencies in participants' responses to the task questionnaires and exit interviews. Even though for Task 1 all participants exceeded the allotted time for completion of the task with two of the three participants completing the task with assistance and one participant unable to complete the task, Participants 2 and 3 still agreed on the post-task questionnaire that finding the information was easy. In addition, all participants indicated that they found the course contents page helpful in terms of finding the information they needed when only one participant used that page.

Further, responses to open ended questions in the post-task questionnaire contradicted earlier responses. For example, when asked what was most difficult to do or understand, Participant 1 said, “The information was not difficult for me to understand. It is just, I wish there were more graphics or an interactive video for the introduction.” This participant initially disagreed that finding the information was easy. Participant 2 agreed that finding the information was easy but when asked in the exit interview what was the most difficult to do or understand he said, “Finding the criteria.” The observers’ notes on the remainder of post-task questionnaires were similar. Both the observers’ notes and the responses the post-task questionnaires and exit interviews were provided to the instructional developer to inform decisions regarding revisions.

Instructional Developers' Revisions for Round 1. The OER, Search Strategies Tutorial, was developed by an international organization (INASP). Communication between that organisation and the researcher had been established in 2020. Following the advice of one of the course writers, the researcher reached out by email to the lead for Technology Enhanced Learning and the Subject Matter Expert (SME) in December 2021. He advised both about the design research being undertaken and invited their development team to observe learner users as they trialled the tutorial. To date, the researcher has received no response from the developers at INASP, even after the researcher submitted a review of the INASP search strategies tutorial entitled *A Brief Report for the INASP Instructional Development Team* following two rounds of remote moderated think aloud usability testing. The themes in each of the rounds reported below related to problems encountered after three rounds of testing and could only be noted for redesign of the OER by the development team in the researcher’s country of origin. No

changes were made locally and developers at INASP applied none of the recommended changes in between rounds of testing. This remained the case months after the submission of this report.

Summary and Themes for Round One

A few themes emerged from the data presented in round one. Video recordings of participants' progression throughout the test sessions and observers' logs were the primary sources. An outline of the themes is presented in Table 9. The most urgent problems and solutions (the severity rating mentioned in Chapter 4) appear first in the list of problems found and solutions proposed (see Table 10).

Table 9

Themes Related to Problems Encountered in Round 1

Participant	Navigation	Terminology
Participant 1	X	
Participant 2	X	X
Participant 3		X
Total Number of Trainees	2	2

Theme 1: Navigation. In the first round, two of the three participants experienced difficulty finding content because they were unable to locate and use TOC, which impeded their progression through prescribed tasks. They spent much time reading through too much text. Observers noted that participants did not see the TOC on the far right of the screen. Because of its location, the TOC was not intuitive to the participants, they often focused their gaze on the central pane of each page and seldom looked to the sidebar to the right of the screen.

Theme 2: Terminology. This theme referred to two phenomena: use of technical language or jargon unfamiliar to participants and the mismatch between headings in the TOC and the content they describe. Participants in the first round were also unable to make sense of the technical language located under the TOC. Phrases like *Completion Criteria, Field Searching, Search Refinements and Truncation* made it difficult for participants to locate learning and training resources in Task 1 and Task 4. This occurred with Task 4 where the label of the handout did not match the heading that described the section under which the handout was located. Worse, there was no additional level of heading in the TOC to lead the participant to the handout. Compounding the difficulty in finding training resources was the use of technical language used as headings instead of using phrases that defined those terms.

Table 10

Problems Found and Solutions Proposed in Round 1

Problems Found	Solutions Proposed
1. The location of the TOC was not obvious to all participants in round 1	Put the TOC heading in bold font. Use dark blue for content headings on the content page
2. No direct label or link exists for learning resources in any step	For each *Step* add a link labelled *Learning Resources* at the end of the TOC and create a subheading labelled *Search Strategies Form* and other resources
3. Participants didn't like that there were no visual aids to help them complete the task	A video to navigate the site could be helpful for visual learners
4. Participants didn't understand the technical language used in the tutorial	Use jargon free language in the heading of the TOC. Replace phrases like *Search Refinements, Field Searching and Truncation*

	Problems Found	Solutions Proposed
5.	Participants were frustrated by having to go back and forth into the tabs to complete the task	A hyperlink to the documents contained within the course could be provided under the heading
6.	Participants had to read through a lot of text to find the *Search Tools*/complete the task	List tools as headings in the TOC

Remote Moderated Think Aloud Usability Testing: Round 2

Pretest Questionnaire Overview. Participants 4-6 completed a test session during Round 2 of usability testing. Of those, all rated themselves to be average or high in terms of computer skills. All participants reported having experience using Microsoft Word software. All reported using Laptops, whereas none reported having used a Macintosh computer (MAC). Email and Facebook were the most used social networking tools among participants. Only one participant reported using instant messaging (IM), whereas three used emails. None of the participants reported having used Blogs, Wikis, or Skype. All participants stated that they had accessed course materials online, but only two reported that they had taken one fully online course. One participant reported that the course they had taken was housed within the Blackboard course management system (CMS). Another participant had taken a course on a website. One participant reported having used the Assignments and Discussion Board features. Each participant's experience of the tutorial is presented below.

Participants' Perceptions for Round 2.

Test Session 1, Participant 4: Tasks 1, 2, 4, 5, and 7. Task 1. Participant 4 visited *Introduction to this Tutorial* on the Homepage, scanned the section *Welcome* and initially assumed that the *Learning Outcomes* were the criteria for completing the

tutorial. The participant then clicked *Next: Learning Outcomes,* followed by *Next: Frequently Asked Questions* and read aloud the content in each section. She later returned to *Learning Outcomes* and then clicked *Next: Structure of this Tutorial.* When prompted to think aloud the participant said, "I'm thinking I probably don't know what criteria means". After the participant visited *Next: Read, Watch, Listen, Next: Reflect and Reveal,* and later *Next: How Can I Monitor My Progress,* she completed the task.

Task 2. Participant 4 clicked *Next: Planning your Search,* then *Next: Defining a Search Topic,* then *Next: Describing your Concept*, then *Next: Your Own Search.* In a moment of confusion, the participant said, "I wonder if I'm consistent with what you are looking for…I feel like I'm not sure what I am doing." At that point the participant returned to *Next: Defining a Search Topic,* then *Next: Describing your Concept* until *Next: Creating your Search Strategy* and completed the task.

Task 4. Participant 4 clicked *Step 2: Search Tools,* then *Next: Search Refinements* and started reading aloud. Later, the participant discovered the TOC and said, "everything is right in the Table of Contents right here, man.". Despite her discovery of the TOC the participant still clicked *Next: Truncation* then *Next: Field Searching* and completed the task, all within the allotted time.

Task 5. Participant 4 scanned the TOC on the right sidebar and clicked *Investigating Google Scholar* and completed the task via a different route.

Task 7. Participant 4 clicked *Step 3: Successful Searching*, scanned the TOC on the right sidebar and clicked *Evaluating Articles* to complete the task within the allotted time.

Test Session 1, Participant 4: Tasks 3, 6, and 8. Participant 4 experienced no difficulty locating and completing the quizzes. To locate each quiz, the participant scrolled to the bottom of the page and clicked *Step 1, Step 2, and Step 3 Quiz*.

Test Session 2, Participant 5: Tasks 1, 2, 4, 5, and 7. Task 1. Participant 5 visited *Introduction to this Tutorial* on the Homepage. The participant then clicked *Learning outcomes* and read them aloud. He initially struggled to distinguish between learning outcomes and criteria for completing the tutorial. Then he concluded they are the same. He believed, therefore, that the task was complete because he located the learning outcomes. The participant then completed the post-task questionnaire.

Task 2. Before selecting *Planning your Search* on the Home Page, Participant 5 asked, "This is the main page here that I'm perusing…I'm not missing anything, here, right?" Then, upon landing on the page *Planning your Search* the participant initially thought, "I'm assuming that this is supposed to be the document here." When asked about the types of documents he was familiar with, he exclaimed, "Or, Document! He then returned to the home page and once again selected *Planning your Search.* The participant said, "I'm moving through the page and so far, I not seeing anything that reveals a document." When asked if he explored everything on the page, the participant looked to the sidebar on the right and acknowledged the links in blue under the TOC, read aloud each sub heading and selected *Creating your Search Strategy* to complete the task.

Task 4. After selecting the *General* tab in the sidebar to the left, Participant 5 clicked *Planning your Search* in *Step 1* and said, "I'm thinking that all along the same path where you may have your planning is where you should have the thing to refine."

After landing on the *Planning your Search* page, he clicked the *Back* button to return to the homepage. The participant then said, "I am thinking it could be search tools." He selected *Search Tools* and checked that the task asked for a handout. He then selected *Search Refinements* and later *Search Tools and Refinements* from the TOC and returned to *Search Refinements*. The participant later selected *Truncation,* then *Search Refinements.* After taking a brief detour by the *Administrative Box,* he tried to use the *Print book* and *Print this chapter* links, thinking that the handout would be located there. The participant then selected the subheadings *Search Strategy Form* and *Search Refinements*. At that point, Participant 5 reread the task, and questioned, "Am I in the wrong search?" He returned to the homepage, selected *Successful Searching,* and then returned to the homepage and selected *Search Tools* again. When asked about what he expected to see, the participant said, "Similar to the last search where I was actually able to see a word document attachment, I was expecting to see something like that, an attachment like that…you know…a file or something attached, saying a handout." When asked where he expected to see that, the participant said, "in the same location as the last time, on the side under table of contents…under *Search refinements*." Asked where else he would expect to find the handout, the participant revisited *Truncation* and then visited *Field Searching* for the first time. After scrolling down the page and locating the handout, the participant exclaimed, "Really!" The participant continued,

> I think it's the wording…The question is straightforward; the task is straightforward. When it comes to the location [wording], the location is not pointing me in a clear enough manner…it is not directing me as to where to find, where am I to find that particular handout.

Task 5. Participant 5 selected the *General* tab from the left sidebar and returned to the home page. The participant selected *Search tools* from the TOC and later *Investigating Google Scholar.* He then selected *Optimal resources.* After scrolling up and down the page he asked, "Would you say like *Google Scholar* is a search tool? I keep seeing that coming up." In a series of actions to answer his own question, he reasoned, "So it has to be some kind of ah like engine…or would it be something like ah *Google Scholar*...Not too sure?" At that point, the participant revisited *Investigating Google Scholar,* opened *Search refinements* then *Search tools and Search refinements.* After verifying the task, the participant concluded *Google Scholar* was the search tool: "So I'm thinking in this case it will have to be something along the lines of *Google Scholar.*" The participant later completed the post-task questionnaire.

Task 7. Participant 5 selected the *General* tab from the left sidebar. Thinking aloud, he said, "I'm thinking probably it will be somewhere here." He then visited *Successful Searching,* selected *Evaluating articles* under the TOC and then clicked *Reviewing results.*

Test Session 2, Participant 5: Tasks 3, 6, and 8. Task 3. From the page *Planning your search,* Participant 5 clicked the back button to return to the main page. The participant then read aloud Task 3, clicked *Step 1 Quiz* and attempted the quiz.

Task 6. Participant 5 selected the *General* tab from the left sidebar, reviewed the task by reading it aloud, clicked *Step 2 Quiz* and attempted the quiz.

Task 8. Participant 5 repeated the same sequence of activities. The participant selected the *General* tab from the left sidebar, reviewed the task by reading it aloud, clicked *Step 3 Quiz* and attempted the quiz.

Test Session 3, Participant 6: Tasks 1, 2, 4, 5, and 7. Task 1. Participant 6 scanned the Tutorial homepage and attempted to complete Task 1 using an alternative route. Drawing on prior experience with a similar site, the participant selected *More Details*, one of the subheadings under *Completion Status* assuming the task was completed. When invited to explore where the tutorial completion criteria were to be found on the site, the participant selected *Search Strategies Tutorial,* then *Introduction to this Tutorial.* After being reminded of the task, the participant reviewed subheadings under the TOC and identified the task requirement. She then completed the post-task questionnaire.

Task 2. Participant 6 clicked the menu bar *Search strategies tutorial* to return to the homepage. Thinking that the document was part of *Step 2*, the participant selected *Search tools* and then *Search strategy form* under the TOC. Under this latter heading, the participant expected to find a form: "I thought what would have appeared would have been an actual form." She later selected *Field searching* and commented on the TOC. She returned to *Search strategy form,* then selected *Search tools and refinements.* Thinking she was in the wrong place, the participant reread the task and then returned to the homepage. She then selected *Planning your Search* under *Step1* and then selected *Creating your search strategy* under the TOC to complete the task. The participant later completed the post-task questionnaire.

Task 4. Participant 6 selected *Step 1* at the left sidebar them selected *Search Tools,* then selected *Step 1* at the left sidebar to return to the *Search Strategies* homepage. The participant then selected *Planning your research* then *Search Strategies* homepage. She then selected *Step 2* to return to the homepage. When prompted to think aloud she

then reminded the moderator of the task she was working on by reading the task aloud. The participant then selected *Step 3: Successful Searching,* then concluded she was in the wrong place. As a result, she selected *Step 1* returning to the homepage, then returned to *Planning your research.* Concluding there was no need to scan *Step 1,* the participant selected *Step 2* and clicked *Search tools,* then *Search Refinements.* After scrolling up and down the page and reading aloud the elements of the TOC she asked, "What is this?" She then selected *Step 3* to return the homepage, then clicked *Step 3: Successful Searches* and admitted "I feel lost now." As she read aloud content on the page, the participant exhibited nonverbal behaviours that confirmed her stated confusion and sense of lostness. She rubbed her forehead starting with temples using both hands. She then reread the task aloud then selected *Step 1* to return to the homepage. Despite receiving assistance to focus on the keywords of the task, the participant abandoned the task saying, "I don't think I'll keep trying." She then proceeded to complete the post-task questionnaire.

Task 5. Participant 6 selected *Search tools* then *Search tools and Refinements* to complete the task.

Task 7. Participant 6 clicked *Step 1* then *Successful searching.* After selecting *Evaluating articles,* the participant was able to complete the task.

Test Session 3, Participant 6: Tasks 3, 6, and 8. Task 3. Participant 6 selected *Step 1* at the left sidebar to return to the homepage, then clicked *Step 1 Quiz.*

Task 6. Participant 6 selected *Step 2* from the left sidebar and then *Step 2 Quiz.*

Task 8. Participant 6 repeated the same sequence of steps to complete task 8.

Observers' Perceptions of Test Sessions for Round 2.

Observations of Task 1, 2, 4, 5, and 7. Observations of the participants' experience from the observers' points of view are presented in this section. Since the development team at INASP made no changes, the observers noted that some of the same problems revealed in round one still surfaced. These observations are summarized here by task. In addition, a summary of observations of the post-task questionnaire and exit interviews is provided.

Observations of Task 1. Regarding this task Observer A noted that two of the three participants used the TOC to explore the requirements of Task 1. Participants still did not seem to notice the TOC on the far right of the screen. Both observers noted that one participant navigated the tutorial site and completed the task using the links with *Next* or *Previous.* In addition, two participants perceived no difference between *Learning outcomes* and *Completion criteria* and assumed that the *Learning Outcomes* were the criteria for completing the course. Observer A noted that the phrase "completion criteria" was not intuitive and confused participants. Observer A also noted that content under *More details* under *Completion criteria* were different.

Observations of Task 2. Observer A noted that Participant 4 consistently used the *Next* link to complete tasks instead of using the TOC. Participant 5 focused on the content pane and had to be prompted to view other parts of the web page. Observers A and B noted that Participant 6 used the TOC, viewed the Search Strategy Form link, but did not see an actual form when she selected that link. Even though one participant located the link labelled *Creating your Search Strategy* in the TOC, Observer B noted that one participant said she expected to see the document when she clicked on search tools. Observers A and B agreed that participants were unable to locate training resources

(including documents) in spaces intuitive to them or consistent with the labels. Participants had to click many times before finding the document. This problem persisted in the Task 4.

Observations of Task 4. One participant exceeded the time allotment for completing this task while the other abandoned the task. Participant 4 still used the Next button despite discovering the TOC. Participant 5 expected to see the handout under a different heading from the one described in the TOC. That participant completed the task after lots of back and forth between tabs and expressed surprise at where it was found. Participant 6 felt lost and abandoned the task even when she eventually started following the right path.

Observations of Task 5. Observer A and B found that all participants completed the task. Two participants completed the task within the optimal time and without difficulty.

Observations of Task 7. Once again, both Observer A and Observer B found that all participants completed the task within time and without assistance.

Observations of Tasks 3, 6, and 8. Observers A and B noted that all three participants located all quizzes without assistance and within optimal time frames.

Observations of Tasks 1-8 and Exit Interviews for Round 2. As at the end of Round 1, observers noted variable consistency in a few of the responses to the post-task questionnaire compared with the observed experiences of participants. For example, Participants 5 and 6 agreed that the Information on how and where to begin the tutorial was easy to understand when they both were unable to appreciate the difference between "completion criteria" and "learning outcomes." Participant 5 did not complete the task

because he, like all participants in this round assumed the learning outcomes and completion criteria to be the same. Participant 6 followed the wrong path initially and even when she received assistance made a similar assumption. Participant 6 also agreed that the information was easy to find when she took over 10 minutes to complete Task 1. Observers of Round 2 participants found it surprising that all participants experienced varying degrees of difficulty as they attempted Task 4. The surprise stemmed from comparisons between the pre-test self-reports of participants and completion of the task. One participant reported no previous experience with online courses, yet he was able to complete the task with assistance. Two participants with previous experience of online courses struggled to complete the task even with assistance, one of whom gave up after 19 minutes.

Instructional Developers' Revisions for Round 2. As was noted in the corresponding section above, the researcher received no response from the developers at INASP, even after submitting a review of the INASP search strategies tutorial entitled *A Brief Report for the INASP Instructional Development Team* following two rounds of remote moderated think aloud usability testing. The themes in each of the two rounds reported so far could only be noted for redesign of the OER by the development team in the researcher's country of origin. Once again, as at the end of round one, no changes were made locally and developers at INASP applied none of the recommended changes in between rounds of testing. This remained the case until months after the submission of this report.

Summary and Themes for Round Two

A few themes emerged from the data presented in round two. Video recordings

of participants' progression throughout the test sessions and observers' logs were the primary sources. A summary of the themes is presented in Table 11. The most urgent problems and solutions (the severity rating mentioned in Chapter 4) appear first in the list of problems found and solutions proposed in Table 12.

Table 11

Themes Related to Problems Encountered in Round 2

Participant	Navigation	Terminology
Participant 4	X	
Participant 5	X	X
Participant 6	X	X
Total Number of Trainees	3	2

Theme 1: Navigation. Problems under the themes from the first round were repeated in round two. Participants in round two still confused *Learning Outcomes* and *Completion Criteria.* In addition, content under *More details* under *Completion status* and content under *Completion criteria* were discovered to be different even though Participant 6 initially believed them to be the same. In addition, finding the *Search Refinements Handout* remained problematic both due to the mismatch between the label of the handout and the heading under which it was located and because the TOC did not contain any additional levels of headings. Further, the technical heading *Field Searching* gave no indication that a handout was likely to be one of its contents.

Theme 2: Terminology. Inconsistency between labels (headings) and the content they described continued to be a problem in round two. The inconsistency was uncovered in Tasks 2, 4, and 5 and affected Participants 4 and 5.

Table 12

Problems Found and Solutions Proposed in Round 2

	Problems Found	Solutions Proposed
1.	The phrase "completion criteria" was not intuitive and confused participants	Introduce a phrase or question that is more intuitive to learners and less technical. *To Finish this Tutorial…*
2.	The *Search Refinements Handout* was located under the heading labelled "Field Searching" within a page. The label for the handout did not appear to be hyperlinked under the TOC	For each *Step* add a link labelled *Learning Resources* at the end of the TOC and create a subheading for the *Search Refinement Handout*
3.	The heading under the TOC that read *Search Strategy Form* did not have an actual form	Check that the link labelled *Search Strategy Form* is still a live link

Remote Moderated Think Aloud Usability Testing: Round 3.

Pretest Questionnaire Overview. Participants 7–9 completed a test session during Round 3 of usability testing. Of those, all rated themselves to be average or high in terms of computer skills. All participants reported having experience using word processing and spreadsheet software. All reported using Laptops, personal computers, and Smart Phones, whereas none reported having used a Macintosh computer (MAC). Email and Facebook were the most used social networking tools among two participants. Only one participant reported using Blogs, instant messaging (IM) and Wikis, whereas 3 used emails. All participants stated that they had accessed course materials online, and that

they had taken one fully online course. One participant reported that the course they had taken was housed within the Blackboard course management system (CMS). Another participant had taken a course on a website. Participants each reported having used different features: Assessments, Assignments, Discussion Board, Live Chat and Videos. Each participant's experience is presented.

Participants' Perceptions for Round 3.

Test Session 1, Participant 7: Tasks 1, 2, 4, 5, and 7. Task 1. Participant 7 first selected *Introduction to this Tutorial* under the TOC. She then chose *Learning Outcomes.* Afterwards, she selected *Defining a Search Topic.* After clarifying the task, the participant selected *Introduction to this Tutorial* and then *Completion Criteria* to complete the task.

Task 2. Participant 7 selected *Planning your Search* from the TOC. After clarifying the task a few times, the participant selected *Define a Search Topic,* then *Describing your Concept,* then *Developing your Search Strategy Skills.* The participant later selected *Creating a Search Strategy* to complete the task.

Task 4. Participant 7 selected the *Search Tools and Refinements* link then returned to the *Search Strategies Tutorial* main page. The participant then returned to the *Search Tools and Search Refinements* page and selected the *Search Strategy Form.* She returned to the *Search Tools and Refinements* page, selected *Next: Search Refinements,* then *Optimal Resources.* After reviewing the task instructions, the participant selected *Field Searching* and exclaimed: "Found!" Describing her experience, the participant said: "It's like a treasure hunt…Ideally, it should be under *Field Searching*." Continuing

her suggestion for improvement, she suggested that developers should "put a submenu in *Search Tools* – summary of Search Refinement Tools or something to that effect."

Task 5. Participant 7 selected *Step 2* to return to the homepage, then clicked *Search Tools.* After reading aloud paragraph 3, the participant selected *Search Strategy Form,* then *Field Searching* and then *Investigating Google Scholar.* The participant made a positive comment: "I like the way/word they have, *Search Refinements…*I keep going to that."

Task 7. Participant 7 selected *Search Strategy Tutorial* then selected *Successful Searching* and later clicked *Evaluating Articles.* After reading aloud the paragraph below the heading, the participant expressed confusion. "They say how to evaluate and then they say it doesn't say how to evaluate."

Test Session 1, Participant 7: Tasks 3, 6, and 8. Participant 7 clicked *Step 1 Quiz 1* then *Attempt Quiz.* For Task 6, Participant 7 clicked *Exit Resource.* Then, from the home page, the participant selected *Step 3 Quiz.* After being reminded of the task a few times the participant was then able to complete the second quiz. For Task 8, Participant 7 selected *Exit Resource* and then *Step 3 Quiz* to attempt and complete the quiz.

Test Session 2, Participant 8: Tasks 1, 2, 4, 5, and 7. Task 1. Participant 8 selected *Introduction to this Tutorial* from the home page. The participant then selected *Next: Learning outcomes* and after reading aloud the learning outcomes identified these as the criteria for completing the course. When asked if the learning outcomes were the same as criteria for completing the course, the participant said "No" and continued browsing the TOC and selected the subheading *Completion Criteria* to complete the task.

Task 2. Participant 8 first selected *Step 1 Planning your Search*, then under the TOC, she selected *Creating your Search Strategy* without any assistance. After completing the task, the participant said, "The table of contents made it easy for me to see what I needed to read."

Task 4. Participant 8 selected the *Step 2* on the left sidebar to return to the homepage. The participant then selected *Search Tools.* After reading aloud the task instructions and scanning content under the *Search Tools and Refinements* heading, she then visited the TOC and selected *Search Refinements* and then *Search Strategy Form.* Still using the TOC, the participant then selected *Explore DOAJ,* then *Review of Findings* and later *Field Searching.* The participant's misreading of the task led her to another path. After the task was clarified the participant returned to the subheading *Field Searching,* where she was able to locate the handout and complete the task.

Task 5. Participant 8 scrolled upwards from the subheading *Search Refinements Handout* and selected *Search Refinements* under the TOC. The participant confirmed that she first expected to find a search tool there. She later decided to select *Search Tools and Refinements.* After scanning content under that heading, the participant selected *Explore DOAJ.* Later she returned to *Search Tools and Refinements.* When prompted to think aloud, the participant said,

> I went to explore DOAJ, but it's not telling me very much…so I went back to *Search Tools and Refinements* and they're putting Google Scholar as the best search tool but, actually, I would have preferred to find something else, but I guess it's the easiest one to get that you don't have to pay for.

The participant also returned to *Explore DOAJ* and identified it as another search tool, thus completing the task without assistance.

Task 7. Participant 8 selected *Successful Searching* from the home page then *Evaluating Articles* under the TOC to compete the task without assistance.

Test Session 2, Participant 8: Tasks 3, 6, and 8. Task 3. Participant 8 selected *Exit Resource* to return to the home page. The participant then selected and attempted the *Step1 Quiz.*

Task 6. As with the first quiz, Participant 8 selected *Exit Resource* to return to the home page and then selected and attempted the *Step 2 Quiz.*

Task 8. Participant 8 selected *Up next: Quiz* from the TOC, then selected *Exit Resource* at the foot of the content page to return to the home page. The participant then selected and attempted the *Step 3 Quiz.*

Test Session 3, Participant 9: Tasks 1, 2, 4, 5, and 7. Task 1. Participant 9 initially followed the wrong path by trying to read aloud the content in *Step 1*. When the task was clarified, the participant selected the *Search Strategies Tutorial* link to return to the home page. The participant then browsed the *More Details* subheading of the heading *Completion Progress Details* and declared that she discovered the task requirements.

Task 2. Participant 9 expected to find the information under *Step 1: Planning your Search.* The participant selected the link, then, under the TOC, selected the subheading labelled *Creating your search strategy* and located the document.

Task 4. Having completed the first quiz, Participant 9 selected *Step 1* on the left sidebar to return to the home page. The participant then selected the *Search Tools and Search Refinements* page and scanned its content. Under the TOC the participant selected

Search Refinements and proceeded to scan its content. After clarifying the task, the participant returned to *Step 2.* This time the participant verbalised her plan to search through the TOC, starting with the subheading on *Truncation.* Having located nothing under that link, the participant selected *Field Searching* where she located the handout.

Task 5. Participant 9 selected *Step 1* to return to the home page. The participant then selected *Search Tools,* then *Field Searching,* then *Investigating Google Scholar,* then *Explore DOAJ.* The participant then returned to *Search tools and Refinements* after exploring several unproductive paths. After the task was clarified, the participant selected *Search Refinements* and then returned to *Field Searching,* scrolled down to the heading *Access to Documents,* and selected the link for Google Scholar. The participant then declared that the task was completed.

Task 7. Participant 9 selected *Step 2* on the left sidebar to return to the main page. The participant then read the task aloud and selected *Step 3: Successful Searching*. Thinking aloud, the participant said, "on the right-hand side under the TOC, it says *Evaluating Articles…*I'm going to select that." The participant concluded the task.

Test Session 3, Participant 9: Tasks 3, 6, and 8. Task 3. Participant 9 returned to the landing page of the of the tutorial and selected *Step 1 Quiz* and attempted and completed the quiz.

Task 6. Participant 9 selected *Step 2* on the left sidebar to return to the landing page, then selected *Step 2 Quiz,* and attempted and completed the quiz.

Task 8. Participant 9 selected *Step 3 Quiz* and attempted and completed the quiz.

Observers' Perceptions of Test Sessions for Round 3.

Observations of Task 1, 2, 4, 5, and 7. Since many of the suggested changes by observers and participants in the previous round were left unattended, recurring problems persisted in Round 3. Some problems identified in the two previous rounds resurfaced. To avoid redundancy, they are discussed briefly here. These observations are summarized here by task. In addition, a summary of observations of the post-task questionnaires and exit interviews is provided.

Observations of Task 1. Observer A noted that the phrase "completion criteria" was not intuitive and confused participants. In addition, observer A noted that the content under *More details* under *Completion status* and content under *Completion criteria* were different. Participant 9, like Participant 6, unintentionally exposed incomplete or inconsistent content. Observer B noted that one participant still did not see a TOC on the right sidebar. The TOC to guide participants was still outside their line of sight. Moreover, the heading *Table of Contents* remained without bold face font.

Observations of Task 4. Both Observer A and Observer B noted that one participant found the search for the handout to be a "treasure hunt". Observer B noticed that participants did not notice the small icon for the handout in the middle of the page. Observer B also noted that participants did not understand technical terminology.

Observations of Task 5. Even though all participants completed the task within three minutes, they were not confident when they found the search tool(s). Both Observer A and Observer B noted that tools were not listed clearly and were not easily identifiable. In fact, the tools were mentioned as part of the text and description. One participant said,

> I went to explore DOAJ, but it's not telling me very much…so I went back to *Search Tools and Refinements* and they're putting Google Scholar as the best

search tool but, actually, I would have preferred to find something else, but I guess it's the easiest one to get that you don't have to pay for.

Observations of Tasks 3, 6, and 8. Observers A and B noted that all three participants located all quizzes without assistance and within optimal time frames.

Observations of Tasks 1-8 and Exit Interviews for Round 3. Although to a lesser extent than in previous rounds, participants' post-task responses continued to be inconsistent with their observed behaviours. Participant 8, for example, agreed that for task one it was easy to find the information she was looking for. However, responding to the question on what was most difficult to do or understand, the participant cited finding the criteria on introduction to the tutorial (Task 1). Observers noted that only one participant verbalized an inconsistency between the heading *Evaluating Articles* and its content. At first this appeared to be an outlier. However, a closer review of the response to the post-task questionnaire by Participant 6 confirmed that this was indeed an issue of concern to more than one participant. The participant, responding to the second question of the Task 7 post-task questionnaire, disagreed that the section heading or guide word(s) for locating the content matched the content.

Summary and Themes for Round Three

A few themes emerged from the data presented in round three. Video recordings of participants' progression throughout the test sessions and observers' logs were the primary sources. A summation of the themes is presented in Table 13. The most urgent problems and solutions (the severity rating mentioned in Chapter 4) appear first in the list of problems found and solutions proposed (see Table 14).

Table 13

Themes Relating to Problems Encountered in Round 3

Participant	Navigation	Terminology
Participant 7	X	X
Participant 8	X	X
Participant 9		X
Total Number of Trainees	2	3

Theme 1: Navigation. Even though participants in this round successfully completed most tasks, some of the unattended issues from previous rounds persisted though with minimal effect on this round of participants. The location of the TOC was still counter intuitive to one participant. The source of the first problem in Table 14 is the lack of visibility of the TOC. Participants tended to read each web page from left to right. The TOC was at the far right of the page. It is also possible that the light blue font colour used under the darker blue heading was difficult to read and easy to overlook. This navigational theme is a recurrent one after three rounds of testing.

Theme 2: Terminology. In this round all participants uncovered instances where the terminology or the heading was inconsistent with the content it described. Heading and content misalignment was uncovered in a few new areas, but the problem persisted in from previous rounds. For example, the source of the second problem in Table 14 was perhaps the use of jargon unfamiliar to participants (see also Figure 7). The source of the fourth problem was the use of headings that were too specific or the use of unfamiliar acronyms. More recent cases of misalignment between heading and content were found in the third and fifth problem. The source of the third may have been because of

incomplete editing, while the source of the fifth could be that the tutorial writers focused on clarifying the scope of the content before ensuring alignment of the content with its heading.

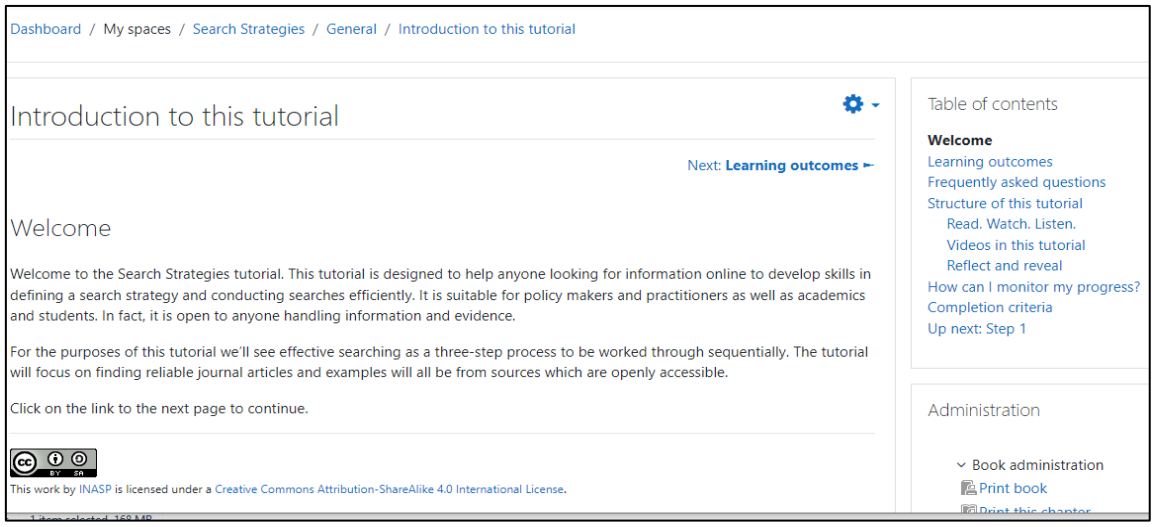
Table 14

Problems Found and Solutions Proposed in Round 3

Problems Found	Solutions Proposed
1. The location of the TOC was not obvious to one of the participants in this round	Put the TOC heading in bold font Use dark blue for content headings on the content page
2. The phrase "Completion Criteria" was not intuitive and confused participants	Introduce a phrase or question that is more intuitive to learners and less technical. *To Finish this Tutorial*
3. Content under *More details* under Completion status and content under *Completion criteria* are different	Match content with headings and cross reference table of contents entries with entries on the home page
4. Headings do not describe learner tasks and are unclear	Introduce more learner centric terms (e.g., academic search engines in place of Google Scholar and open access directories in place of DOAJ)
5. Content under the heading *Evaluating Articles* appears to contradict the heading	The text of the disclaimer should be last in the content and could be a footnote

Figure 7

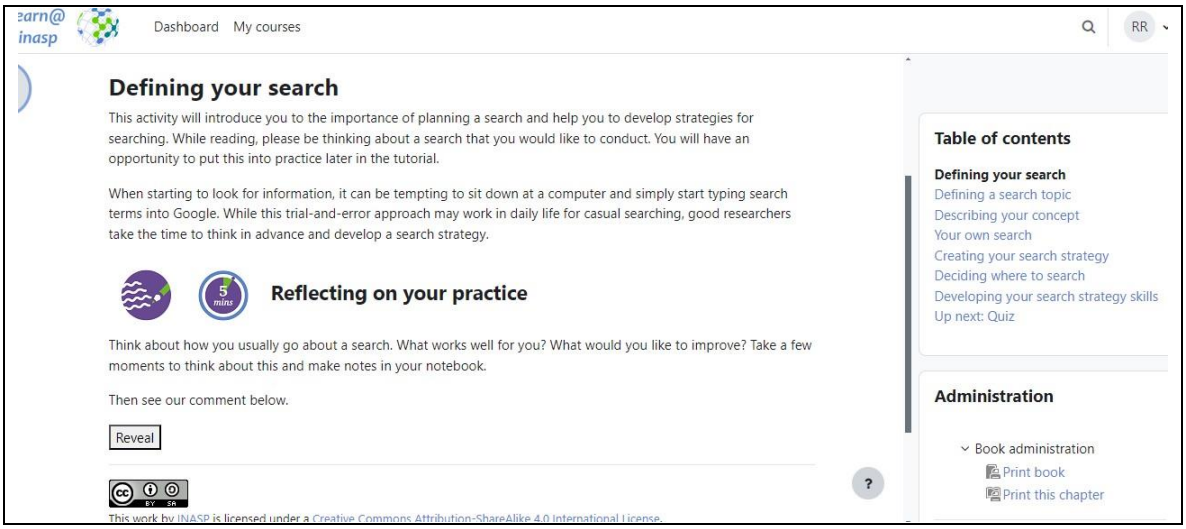
Unclear Table of Contents Heading



After submitting both the summary of findings to the development team at INASP and the dissertation report for approval, the researcher continued to monitor the site of the *Search Strategies Tutorial* to learn if any changes to the tutorial had been made. The researcher discovered months after approval of the dissertation that several changes to the tutorial's interface were made. One of those changes was applied in response to the most severe problem identified in the dissertation report, the low visibility of the TOC heading (see Figure 6). It was suggested in that report that the TOC heading use bold face. This was also the most urgent of the recommended changes in the summary of findings sent to the head of the INASP development team (see Appendix G) at the end of the second round of usability testing. Figure 8 shows the revised TOC heading.

Figure 8

Revised Table of Contents Heading



Task Completion Metrics

Success Rates. Performance metrics included in Table 9 have been included to supplement qualitative insights identified in the data presented above and to suggest which design issues should be prioritised (Tullis & Albert, 2013). The metrics of interest are the success rate and the time on task. Before exploring the success rate by participant and by task, it is necessary to define what is meant by completion of tasks. A task may be fully complete. That is, it did not require the intervention or assistance of a moderator, and there is *no problem*. A task that is complete with assistance means that there was *some problem* that required the assistance of a moderator. Finally, a task that is *incomplete* means either the participant gave up the task, the moderator called the task, or the participant thought the task complete, but it was not.

As suggested from detailed descriptions of the perceptions of participants, the logs from observers and the themes that emerged, participants experienced the most

challenges when they tried to locate training resources. Task 2 and Task 4 stand out as the most problematic. Seven participants had some problem completing Task 2, six completing Task 4. In addition, while participants seemed to know where to go to begin the tutorial, locating information about what they had to do to finish it was not always clear. Eight participants struggled to locate that information. Table 15 captures the extent of the challenges identified. Figure 9 shows the levels of success based on task completion.

Table 15

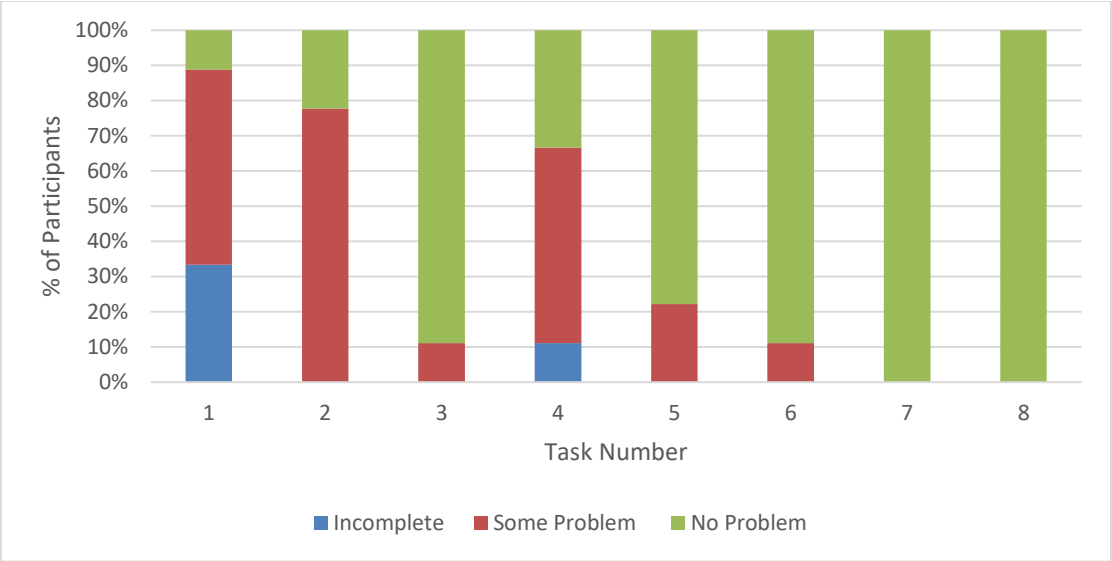
Task Completion Rates

Participant	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6	Task 7	Task 8
P1	1	2	1	1	1	1	1	1
P2	3	2	1	2	2	1	1	1
P3	2	2	2	2	1	2	1	1
P4	2	2	1	1	1	1	1	1
P5	3	2	1	2	2	1	1	1
P6	2	2	1	3	1	1	1	1
P7	2	2	1	2	1	1	1	1
P8	2	1	1	2	1	1	1	1
P9	3	1	1	1	1	1	1	1

Note. 1=No Problem; 2=Some Problem; 3=Incomplete

Figure 9

Levels of Success Based on Task Completion



Time on Task. An important consideration when presenting time on task data is whether to include successful tasks alone or all tasks. Successful tasks, on the one hand, may offer a cleaner measure of efficiency because time data for unsuccessful tasks are difficult to estimate. On the other, they may not be an accurate reflection of the user experience. A small percentage of successful participants in an efficient group can result in misinterpretation of the data when analysing successful tasks alone. Tullis and Albert (2013) recommend the following guidelines for including all tasks or successful tasks:

- Successful tasks should be included when the moderator sometimes determined when to end an unsuccessful task.
- Data for all tasks should be included when the participants decided when to stop/give up on unsuccessful tasks.

In this study, participants determined when to stop an unsuccessful task, as was the case for Participant 6 regarding Task 4. Therefore, data for all tasks were included in the time on task metric.

Just as the task completion data above, the time on task data confirms the detailed descriptions of the perceptions of participants, the logs from observers and the themes that emerged. More than supplementing the insights derived from these reports, the time on task data corroborates the data on success rates described above. For example, the time on task data supports the idea that participants experienced the most challenges when they tried to locate training resources (i.e., Tasks 2 and 4). Table 16 indicates average time taken to complete all tasks, including Tasks 2 and 4. Figure 10 highlights the mean time on task for all tasks.

Table 16

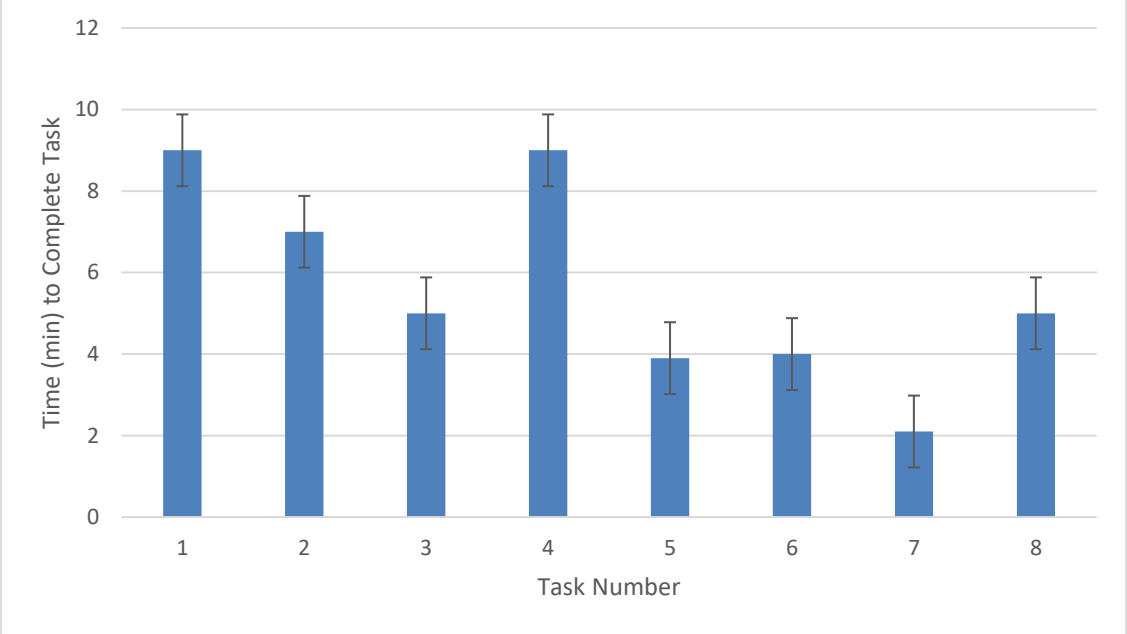
Time-on-Task Data in Minutes for Nine Participants and Eight Tasks

Participant	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6	Task 7	Task 8
P1	8	14	5	2	4	4	2	2
P2	8	9	4	6	9	5	2	9
P3	5	11	5	10	2	5	2	5
P4	14	5	6	3	1	8	2	8
P5	17	6	6	21	3	4	6	8
P6	11	12	7	20	4	5	1	5
P7	14	7	5	6	5	4	1	6
P8	2	1	3	9	3	2	1	4
P9	1	1	3	3	3	2	1	2

Average	8.9	7.3	4.9	8.9	3.8	4.3	2.0	5.4
Mean	6.6	5.3	4.7	6.6	3.2	4.0	1.7	4.8
Median	8.0	7.0	5.0	6.0	3.0	4.0	2.0	5.0
Count	9	9	9	9	9	9	9	9
Standard Deviation	5.6	4.6	1.4	7.1	2.3	1.8	1.6	2.6
95% Confidence interval	3.6	3.0	0.9	4.6	1.5	1.2	1.0	1.7

Figure 10

Mean Time-on-Task for Eight Tasks



Summary

This chapter provided a rich description of data from phases one and two. Participant profiles were developed from phase one data. These profiles informed the selection of the OER and the development of task scenarios to test its design. They also formed part of the demographic included in phase two of the study. Moreover, a rich

description of the data collected and analyzed from usability test sessions, questionnaires, and observation logs, was presented. The next chapter provides a discussion of the findings, implications, and recommendations for further study.

Chapter 6. Discussion and Conclusion

Introduction

The purpose of this study was to implement a multi-method strategy that combined design ethnography and a single evaluative case study to adopt and adapt an OER design for workplace information skills training in the English-speaking Caribbean. Another anticipated outcome of the evaluation was to reuse and repurpose the resource for use in a self–access online course. A further purpose was to confirm whether the proposed LEAD framework, which included the core UCD framework, was necessary and sufficient to select the right intervention for the right problem and to adapt and improve that intervention. The two design thinking methods driving the LEAD framework have been criticized for different reasons. Design ethnography and the persona profiles it produces has been criticized for lacking methodological rigour (Crabtree et al., 2012). Usability testing has also been criticized for its inability to provide innovative solutions (Travis & Hodgson, 2019). Despite their individual limitations, when appropriated for the purposes outlined, both agile design thinking techniques complement each other in the iterative cycle of discovery and development research outlined in the design research process described in Figure 1. The results of this study have demonstrated how the cycle of iteration can work for OER interventions. This chapter presents a brief re-statement of the problem, a review of the methodology, a summary of the results, a discussion of the results by research question, theoretical implications of the study, implications for practice, explanations of unanticipated findings and recommendations for future research.

Restatement of the Problem

A recent meta-synthesis of research on OER in the Global South shows that the use of OER learning assets has been limited to copying (downloading) without adapting or localising (Hodgkinson-Williams et al., 2017). More recently, a critical review of the growth of OER (achievements and challenges) by Hoosen et al. (2019) shows mixed reports on the balance between OER reuse and OER creation. In that review, respondents from Canada and the United Kingdom also reported weak OER adoption/adaptation and renewal in favour of creating new materials. Respondents from Mongolia, Nigeria, and China reported a balance between OER reuse and creating new materials. Although the authors proposed a more nuanced review of their findings suggesting that the "balance between OER reuse and creating new materials tends to depend on levels of OER activity in the country" (Hoosen et al., 2019, p. 30), the problem of weak OER renewal is no less real. In small island developing states like Trinidad and Tobago there is limited awareness of OER in academic (Stewart, 2021), let alone workplace training and development contexts.

Another concern is that creation and renewal of OER learning or training assets still prioritise expert and trainer centric perceptions of quality (Irvine et al., 2021). Few studies have involved learners and performers in identifying knowledge/performance gaps (Grudniewicz, 2015). Fewer have observed learners and performers in the wild to identify their requirements. Even though Nathenson and Henderson (1980, 2018) suggest a role for learners and performers in determining learnability, studies are still slow to embrace learner performers as key informants about decisions to create, renew and select education and training solutions like OER. Learners are still not seen as the best judges

of what makes these assets learnable. Reasons for the slow uptake of learner involvement in the (re)design of learning assets include the absence of feedback loops in learning design (Laurillard, 2012), the assumption that educators and subject matter experts (SMEs) and training organizations know best what learners need (Allen & Sites, 2012; Boller & Fletcher, 2020), and a focus on the intervention over the interaction with the intervention – the learning experience. Finally, workplace OER for information skills training are as limited as workplace OER research.

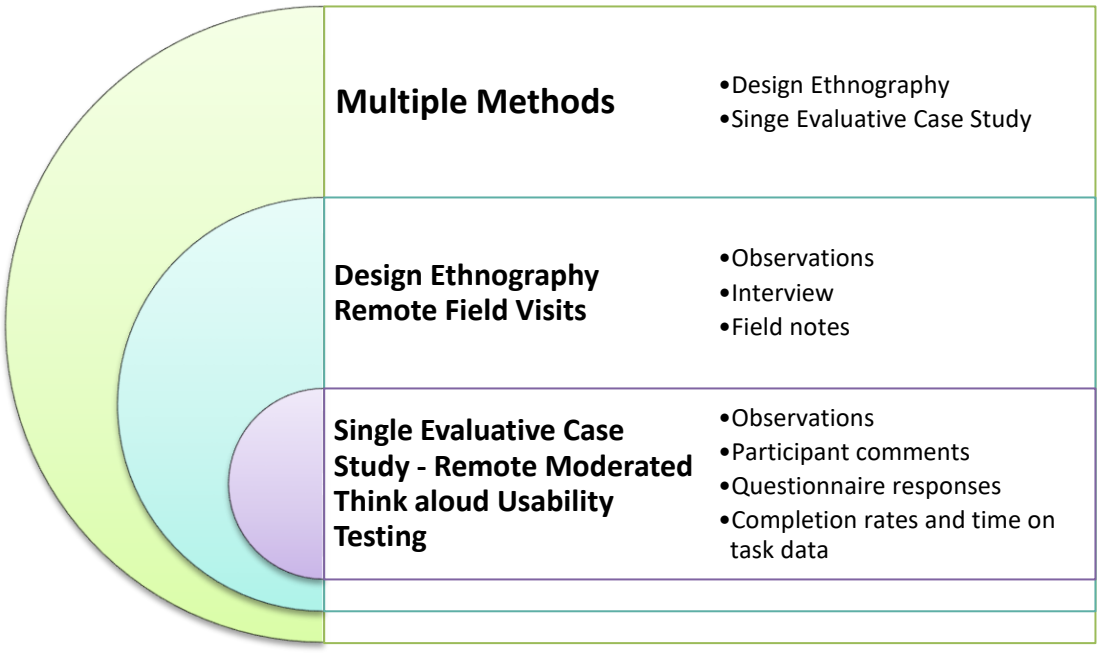
Review of the Methodology

As indicated in Chapter 4, a pragmatic worldview underpinned the study's multi-method strategy combining design ethnography (DE) and single evaluative case study (SECS) designs (see Figure 11). The SECS replicated Fisher (2009) with modifications. Both methods use LEAD to leverage the combined strengths of two agile design thinking techniques, remote field visits (RFV) and remote moderated think aloud usability testing (RMTUT). Triangulation of data sources was used to collect and analyse data across two phases with a total of 20 participants. Field visits captured data through observation, interviews, and field notes, while usability tests used observation, participants comments, questionnaires, and interviews. The core principle that guided the collection and analysis of data in both methods was iteration. Crabtree et al. (2012) describes fieldwork as an "iterative and elaborative process" (p. 99). This suggests that what the researcher observes in the space of one participant may develop and evolve from what the researcher sees in the space of another. Another way to understand iteration is as a cycle of testing risky assumptions about a problem, finding a solution aligned to the problem and testing and retesting the solution.

Data were drawn from semi-contextual (observational) interviews to derive agile (emergent) learning profiles of participants. Observational data illustrated how the three learner profiles drawn from 11 participants engaged the information search process, from planning their searches, searching, evaluating the results of searches to incorporating search results into final products. This data was combined with retrospective interview data from the profiles and started the iterative (design) cycle to select an OER design matching the requirements of potential trainees and their learning preferences. The selected OER design was trialled by test participants matching the learner profiles derived from the semi-contextual interviews. Three rounds (iterations) of RMTUT were conducted to uncover issues with the OER design. Issues uncovered resulted in the implementation of one of the recommended changes to be tested in the future.

Figure 11

Methodological Framework



Note. Image from Microsoft Word 2016.

Summary of the Results

Phase One Results

In-person and online observational interviews revealed the following insights:

- Information skills training is accomplished through informal or non-formal means: the reference interview, on an individual or case by case basis; or through a desk manual.
- A search plan is not part of the users' approach to searching for sources of evidence. Both observational evidence and data from self-reports confirm that participants from the information mediator, programme specialist and securities analyst profile groups started their searches for sources of evidence using a search tool without thinking through key concepts or with no particular "theme". They admitted using the Google search engine as their primary online search tool. Google scholar is used only for more "in-depth" searching. Knowledge and Information Centres were not consulted.
- Both information mediators and non-mediators perform basic keyword searches only. They do this by typing in the search box a keyword or phrase.
- Browsing the first page of search results is used to determine the usefulness of results, to check the results against the task requirements, and to determine when to stop searching.
- Time pressures also influenced the perception of the usefulness of results and when to stop searching, but it can play a role in influencing what source of evidence to pursue.

- Learning preferences among information mediator (IM) profile groups include hands-on, visual video-based learning and reader-based learning. Among securities analyst (SA) profiles self-paced learning, course-based learning was reported. Also reported were learning through challenge, "putting your self in spaces for opportunities to learn something new," learning through reading and learning by doing. Programme specialists (PS) preferred a mixture of in-person instruction and self-paced instruction, reading, listening to audio, and listening and viewing.

These insights informed the selection of the *Search Strategies Tutorial*. The content of the tutorial aligned with the goals, behaviours and needs of the emergent profile groups. Of the 11 participants in the observational interviews, three learner profiles emerged: an information mediator, a programme specialist and a securities analyst. The most common requirement among these learner groups was to have a search plan prior to the start of their searches, since none of the observed participants demonstrated any planning before starting their searches. A search strategy is needed to reduce uncertainty before conducting searches, increase the efficiency of locating useful sources of evidence and to achieve the goals of written presentation identified in each learner profile. The *Search Strategies* microlearning tutorial was selected as a preferred solution that would address those needs.

Phase Two Results

The results of phase two suggest that two themes emerged that responded in part to the second research question (RQ2). One theme that responded to the RQ2 is that the navigation tools in the content pane of the tutorial, *Next* and *Previous,* helped trainees

complete their tasks even though at times this was inefficient (Participants 1, 2, and 4 from Rounds 1 and 2 of testing). Another navigational tool, the TOC, also helped some participants locate training resources, but it cost some participants time and some even abandoned their search for the resource. Even those who successfully completed tasks, found they had to click too many times to locate a handout. The other theme that responded to the RQ2 was the terminology. This aspect of the interface at once helped and hindered participants in their search for learning resources. While terminology helped some participants, as evidenced by participants who had no problem completing tasks, (see Figure 6), it slowed down other participants' ability to locate resources and, in some cases, forced them to abandon their searches. The problem of terminology was a function of inadequate levels of headings in the TOC that would lead participants directly to a learning resource. The theme of terminology also emerged due to the use of unfamiliar or unclear jargon in the TOC. Phrases such as "completion criteria", "Search Refinements" and "Field Searching" were not encoded using the language of the learner, which caused them some confusion.

Concerning answers to RQ3, the summary of themes from the instructional developers suggests solutions to the issues of navigation and terminology. These solutions are captured in Tables 10, 12, and 14. They include:

- Making the TOC more visible (Put the TOC heading in bold font).
- Creating a separate heading in the TOC for Training Resources.
- Using the language of the learner for headings (Introduce a phrase or question that is more intuitive to learners and less technical. For example, *To Finish this Tutorial…*).

It should be noted that despite the issues identified with the navigation of the interface and the terminology, five participants in the profile groups that tested the tutorial have indicated in the exit interviews that they would enrol in the tutorial. Those participants would also recommend the tutorial to others.

Discussion of the Results

Research Question One – Why an OER Solution for Information Skills Training

As indicated in Chapter 5, data from phase one were intended to establish emergent learner profiles and the training needs related to those learner profiles, allow for choosing a learning experience (intervention) matching the training needs and inform the development of task scenarios related to the training needs of the emerging learner profiles.

Following the call by Rogers and Preston (2009) for more ethnographic approaches like contextual inquiry to distinguish the information behaviour of Caribbean user groups, results of the first phase of the present study suggest that the online information-seeking behaviours are similar for civil servants in the Anglophone Caribbean and other regions. Participants preferred to search using online search engines when completing complex writing tasks (i.e., newspaper articles, research papers, cabinet notes, etc.). It should be noted that the phrase complex task or task complexity is used only to distinguish it from routine tasks and to appreciate the experience of uncertainty in the information search process. The phrase refers to a task in which considerable construction is required (Kuhlthau, 2004) or one for which "a person lacks an adequate mental model that would enable them to judge exactly what needs to be done" (Case & Given, 2016, p. 154). To conduct their online searches, all profile groups used basic

searches (i.e., two or three key words). Knowledge workers from both the programme specialist and securities analysts profile groups shared similar information seeking behaviours – use of basic searches and reliance on trial and error. This accords with both the research literature on online searching (Foreman & Thomson, 2009) and the literature related to online searching guidelines (Bell, 2015).

Basic and advanced searches may or may not be the most effective and efficient searches (Bell, 2015; Gwizdka & Cole, 2011) because they each have the potential to lead to satisficing or the principle of least effort (Case & Given, 2016), the path of least resistance (Brown, 2021), and to "trial and error." Searchers matching each participant profile all used basic searches. Advanced searches are also advised for complex tasks. However, the use of advanced search techniques, like basic ones, presupposes a search strategy or plan. None of the searchers matching the profiles demonstrated use of a search strategy *before* they began their searches.

Reasons for this are not immediately obvious. However, one possible explanation is that the participants did not know/recall how to plan to search. This reason responds in part to the first research question (RQ1) about the need to implement information skills training or micro training. Another possible reason is searcher anxiety created by time pressures or "timelines" imposed on participants to complete their complex tasks. Even though none of the question probes used during the observational interviews asked participants about their emotional state when they were faced with a complex task and had to search for sources of evidence, it is possible to deduce from the behavioural data that time pressures might have induced some level of anxiety, more so if they had no search plan and were uncertain about how to conduct efficient searches. This

interpretation aligns with Kuhlthau's (2004) principles of anxiety and uncertainty. It also aligns with research that suggests that complex tasks can affect information seeking and use (Byström & Järvelin, 1995), reinforcing the need for micro training in search strategies for the emergent trainee profiles.

Another reason is related to the fact that neither information mediators nor their information centres were reported by programme specialists and securities analysis as playing any role in their in their information search process. In fact, the first choice among these knowledge workers was a search engine. Research literature in the United Kingdom (Foreman & Thomson, 2009), the United States (Heinström, 2006; Novotny, 2004) and in the English-speaking Caribbean (Renwick, 2019) confirmed that knowledge workers in workplace contexts such as the civil service choose online searches over local information spaces.

Research Question Two – How the OER Design Helped/Hindered Trainees

The themes emerging from the data suggest that navigational aids to locating training resources were both helpful and deficient. The presence of the hyperlinks "Next" and "Previous" helped more than a few participants to find their way around the tutorial site, especially those to whom the TOC on the sidebar to the right was not immediately visible. Those participants were still able to complete their tasks, sometimes within the allotted time, at other times exceeding the time limit.

On the other hand, while participants who did notice the TOC completed their tasks successfully, there were those who did not. Even worse, one participant who noticed and used the TOC abandoned one of the tasks in frustration. This participant reported considerable experience with the Moodle software used for the tutorial. Another

participant from the same round of testing and new to online courses and tutorials took over 15 minutes using the TOC to complete the same task with assistance from the moderator.

The success or failure of navigational aids signalling sequential relationships (i.e., hyperlinks "Next" and "Previous") versus those using a non-linear TOC may not be the core issue, even though on the surface, they may appear to have some relationship to task completion and time on task, two critical performance metrics in usability testing.

Perhaps the more telling issue is that of the terminology used as headings or subheadings in the TOC. One dimension of the problem is the use of jargon, words that do not match the mental models of the trainee participants. Redish (2012) suggests "Put your site visitors' words in the headings." (p. 181). Technical words like "Completion Criteria", "Field Searching", and "Truncation" may not reflect words used by trainee visitors to the tutorial site. Another dimension of the problem is the misalignment between content and headings such as inclusion of a "Search Refinements Handout" under the heading "Field Searching". Both dimensions of the issue of terminology can contribute to extraneous cognitive load and create learner anxiety.

It should be noted that the navigational and terminological issues identified in the present study compare with the issues of layout identified in Davids et al. (2014) and with the lack of clarity and readability found in Fisher (2009).

Research Question Three – Suggestions for Improving the OER Design

Some of the solutions proposed were responses to the two dominant themes emerging from participants' perceptions and observers' logs. To minimize learner anxiety navigational aids like the TOC should be in the line of sight of the learner.

Redish (2012) recommends placing the TOC at the top of the page. The TOC should also be made obvious by using bold face font for the heading TOC (Dumas & Redish, 1999). In addition, light blue font used in Figures 6 and 7 should be converted to dark blue. The design principle is that blue fonts can be difficult to read (Dumas & Redish, 1999).

In response to the use of jargon in the subheadings of the TOC, the language of the trainee as user should inform the design of these subheadings. For example, "Increasing search results" should be used in place of "Truncation." "Reducing search results" should be used in place of "Field Searching." Responding to the second dimension of the problematic headings and labelling, handouts and training documents should be given a separate hyperlink in the TOC labelled "Training Resources." This can include sub subheadings for specific training resources such as the "Search Strategies Form" and the "Search Refinements Handout".

Even though suggestions for modifying the terminological challenges in the *Search Strategies Tutorial* went unheeded, the most severe navigational issue, the low visibility of the TOC heading, was addressed as part of several changes to the tutorial's interface. It is reasonable to assume that the development team at INASP focused on the easiest and most impactful change that could be made to minimize the cognitive load in the learning experiences of trainees.

Regarding the non-implementation of the suggested terminological changes where the result was a recurrence of the same problems, the research team can only speculate about the possible reasons no changes to the terminology were made up to the time of writing this report. An obvious consideration is that the terminological issues

were not the most severe ones. In addition, those changes may require more time to fix given the other changes the development team at INASP made to the tutorial interface.

Whatever the reasons, the problem of the non-implementation of recommended changes for the improvement of online courses is not new. Fisher (2009) encountered a similar challenge after three rounds of usability testing with 14 participants. What is new, however, is the impact of the non-implementation of the changes on the feasibility and sustainability of adapting OER. Questions about the degree of openness of the OER design cannot be avoided. For example, to allow for adaptation, was it enough for the tutorial developers to provide access only to portable document format (PDF) files of the tutorial content? In addition, should users (including other developers) also have access to editing tools to facilitate technical revisions instead of having "to contact the original authors in order to ask for a source file?" (Amiel, 2013, p. 138). Poor technical choices can make open content less open (Wiley, 2021). A defining and distinguishing feature of OER is the capacity for these resources (content *and* technological) to be adaptable. If access to editing tools is disabled by site developers, this raises questions about the extent to which the OER is open and its potential for adaptation. Adopters may consider whether it is more feasible to create their own OER rather than to adapt them.

Theoretical Implications of the Study

Data from the two phases presented in the previous chapter suggest some relationship to emerging and established theory. Data from phase one suggest a strong connection to the principles of uncertainty and anxiety, part of the emerging model of the information search process (ISP) proposed by Kuhlthau (2004). The navigational and terminological insights from phase two data point to some relationship to an aspect of

cognitive load theory (CLT) that learning experience designers can change. Both data sets contribute to building a design-theory appropriate for designing and building OER learning experiences.

Phase one results contribute to building theory on the information seeking behaviours of knowledge workers in the English-speaking Caribbean. Results in this phase seem to suggest that the principles of uncertainty and anxiety are features of the information seeking behaviours of these knowledge workers. According to Kuhlthau (2004):

> uncertainty is a cognitive state that commonly causes affective symptoms of anxiety and lack of confidence. Uncertainty and anxiety can be expected in the early stages of the information search process. The affective symptoms of uncertainty, confusion and frustration, are associated with vague, unclear thoughts about a topic or question. (p. 92)

One of the insights emerging from both observational and retrospective data in phase one is the absence of a search plan among profiled participants, whether information mediators, programme specialists or securities analysts. This observation accords with Kuhlthau's (2004) principle of uncertainty. In addition, the observed use of basic searches for complex user tasks and goals reinforces a lack of planning among all searchers. The result of lack of a search strategy among information seekers under all learner profiles is inefficient search behaviours such as satisficing (convenience over quality) and trial-and-error. The principle of uncertainty was also explored in self-reported data regarding the information use behaviour of decision-makers for food security in the English-speaking Caribbean (Renwick, 2019). Similar to the present

study, time constraints for retrieval of information might have contributed to searcher anxiety both in the early stages of a search (when deciding which sources of evidence to pursue) and in the later stages of a search (when deciding if to continue or stop a search).

Data from phase one also has implications for building a comprehensive design-theory for learning, teaching, and training. Kuhlthau (2004) notes that "an important consideration for educational programmes [in libraries] is whether instruction is integrated into the user's problem-solving situation" (p. 121). The user's perspective on the information search process can inform decisions regarding the choice, design, or redesign of interventions to improve information seeking behaviours. One such user perspective or theoretical statement is the uncertainty principle mentioned above. It is one of three design principles that provides a basis for a process to intervene with users. Renwick (2019) also confirms that studying information seeking behaviours through the lens of the principle of uncertainty and anxiety can assist in designing and developing learning experiences that could improve the search experiences of information seekers.

Only a few previous studies have taken a holistic approach to design research from requirements gathering to usability testing (see Grudniewicz, 2015). While most other studies have focused on partial design research through usability testing to improve the designed intervention and reduce extraneous cognitive load, the present study follows other holistic design studies by asking three questions. One is whether the selected intervention was the right one for the profile needs of the intended trainees. Another is how the proposed intervention helped or hindered the completion of tasks by potential trainees. The final question is how to improve the designed intervention. Results suggest

that the proposed design (evaluation) research framework LEAD is useful for requirements gathering *and* adaptation or improvement of workplace OER interventions.

Data from phase two provided insights and evidence for improving or adapting the selected OER intervention. One of the insights or themes that surfaced in the first two rounds of testing was navigational challenges experienced by the trainees as they tried to locate training resources and handouts. Both the Time on Task metrics (see Table 16) and the Task Completion metrics (see Figure 6) confirmed this. Even though there were participants in every round of RMUT who completed some tasks with no problem, those completing tasks one, two, four, and five experienced some problem, exceeded the time limit, and received assistance from the moderator. Detailed reports from two observers and the perceptions of participants suggest that finding information (i.e., training resources) and the use of technical terminology on the interface confirm those challenges. More important, these challenges suggest some connection to one dimension of cognitive load theory, extraneous cognitive load. Phase two results, therefore, confirm that usability testing is needed to identify areas of extraneous cognitive load (Huh, 2021).

Finally, the study contributes to the theory building effort of Fisher (2009) which confirmed usability testing as a model for improving online course design. The results from phase two of the present study confirm that usability testing can be considered a potential model for improving tutorial design.

Explanation of Unanticipated Findings

Research on information behaviours, that is, any means by which people discover what they want to know (Wilson, 2022), suggests that a difference exists between information behaviours in academic and workplace contexts (Jinadu & Kaur, 2014;

Kirton & Barham, 2005; Monge & Frisicaro-Pawlowski, 2014). Information behaviours in academic contexts are directed toward an assignment or writing project (essay) whereas those behaviours in workplace contexts depend on social interactions and the person as source to get work done. The results of this study did not support this latter position.

In addition, the use of Remote Field Visits (RFV) or Semi-Contextual Inquiries (SCI) yielded more usable data than in-person field visits. This was another unintended outcome of phase one of the project. Participants were willing to show how they conducted their searches both for recently concluded projects and for those currently in progress. They were also willing to show the documents and artefacts under development without sacrificing the confidentiality of those artefacts. Overall, RFV/SCIs provided more search specific insights into the information seeking behaviours of information mediator and non-mediator knowledge workers.

An unanticipated outcome of findings from phase two is the revelation of technical sustainability challenges associated with OER adaptation. Instructional developers from the Global South discovered that they had no access to editing tools of the LMS. The *Search Strategies Tutorial* was only available for download in PDF format. Although PDF files can be opened with free software, they often cannot be edited or adapted using free software (Hilton III et al., 2010; Joseph et al., 2019). This raised questions about the degree of openness intended by the designers of the tutorial. While the initial step of using an open license was included in the design of the tutorial, the "important concomitant step" (Amiel, 2013, p. 6) of providing access to the source file (e.g., HTML) and editing tools seemed to be omitted.

A further unanticipated outcome of phase two of the research project is the fact that experienced learners and inexperienced learners alike needed help to complete Tasks 1, 2, and 4.

Implications for Practice

- The study confirms the role of information mediators in specialist libraries to serve as trainers and coordinators of training experiences dedicated to reducing uncertainty in online searching, not just as information providers (Bell, 2015; Corrall, 2010; Kuhlthau, 2004).
- The LEAD design (evaluation) research framework can contribute to quality assurance (Zawacki-Richter et al., 2022) of OER interventions. It provides transparency in the design of learnable, usable OER. It enlists trainers *and* trainees in the quality assurance process and provides an alternative to expert centric design guidelines (Irvine et al., 2021). It can guide learning experience designers, training organizations, and trainers in their adoption, adaptation, and localisation of OER interventions, ensuring that the OER is fit for purpose.
- The results of the study have implications for the use of design research techniques in instructional design or learning experience design. If learner (searcher) anxiety exists prior to or during their encounters with a learning experience (searching to learn), then it is imperative to (re)design and localise OER learning experiences so that they reduce learning anxiety and cognitive load for learners as they learn anything, including leaning how to conduct efficient searches.

Study Limitations

- Changes to the OER training material, including change to the most severe problem reported in this study, were only made a number of months after the writing up this report. This made it difficult to test any changes. This leaves open the possibility for future research, discussed below.
- Even though usability testing has the potential to test extraneous cognitive load (Huh, 2021), this study, like Fisher (2009), can make no claims for confirming extraneous cognitive load since the proposed changes to the interface have not been tested.
- Instructional developers at the INASP have not responded to *all* the suggested changes.
- Not all profile groups tested the OER design, only the information mediator and programme specialist profile groups.

Recommendations for Further Research

- Testing and application of the framework should be implemented in other workplace contexts, including academic workspaces.
- Agile OER design should be incorporated as part of open educational practices.
- An attempt was made to recruit a differently abled participant, but the participant did not attend the test session. Inclusive design (evaluation) research should also be conducted elsewhere to ensure the OER is both usable *and* accessible.
- Since neither all the profile groups participated nor were all recommended changes made, a redesigned tutorial is recommended for specialist libraries

adopting the intervention followed by another iteration of a usability test of the suggested changes.

- The research should be used to promote awareness of the potential of OER use and reuse for both government and workplace training audiences.

Conclusion

This study began with the modest goal of adapting an OER design. To achieve that outcome a proactive evaluation framework called LEAD principles was also proposed to support the single case evaluation methodology. This meant that a secondary aim of the study was to explore whether the proposed LEAD framework, which used the core UCD framework, was necessary and sufficient to select the right intervention for the right problem and to adapt and improve the OER intervention.

The results of both phases of this project, which used the design (evaluation) research framework LEAD, seem to suggest the framework can implement OER selection and adoption through requirements gathering during phase one. It can also initiate and implement OER adaptation by identifying problems and recommending changes.

Phase one results showed that searcher anxiety and uncertainty are features of online searching among mid and senior level civil servants in the English-speaking Caribbean. In this respect it accords with recent self-report data by Renwick (2019). More important, the observational data from the present study transcends the self-report data by uncovering how civil servants, when assigned complex tasks, actually conducted their searches and demonstrated the need for a microlearning tutorial on search strategies because a search plan was absent from their informational search process. Rigid

timelines for complex tasks combined with the absence of a search plan might have led to basic searches and trial and error.

Phase two results show that even though some participant profiles had satisfying experiences using the OER intervention to complete their learning tasks, other participants experienced frustration with some of the navigational tools and the headings on the tutorial site. Previous research suggests linkages between the problems and themes identified through moderated think aloud usability testing and cognitive load theory, specifically extraneous cognitive load (Fisher, 2009; Grudniewicz, 2015). Data in this study using remote moderated think aloud testing suggest a similar association.

The combined results of phase one and phase two of the present study suggest an increased role for collaboration between the learner/trainee and the information mediator in selecting and improving OER learning designs. In the same way that the role of the instructional/learning experience designer is to reduce extraneous cognitive load, so too, the role of the information mediator in specialist knowledge and information spaces is to reduce searcher uncertainty (Case & Given, 2016; Kuhlthau, 2004) through selecting and providing relevant training experiences.

The non-implementation of one of the recommended changes raises important questions about the degree of openness of OER. A defining characteristic of OER designs is their capacity for adaptation. However, if technical barriers to adaptation exist, as seen in the results of this study, adopters from the Global South may be forced to consider the feasibility of creating their own rather than struggle with the technical barriers to adapting OER. Perhaps developers of OER need to strive more authentically to incorporate feedback from agile design research for these interventions to fully live up

to their potential (Irvine et al., 2021). This, combined with adherence to OER policy development guidelines on the importance of technical openness (Miao et al., 2019), is more likely to ensure sustainable OER development, not just creating OER that cannot be adapted.

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Appendix A1: Approval to Access Research and Institutional Library Sites

Documentation Centre
Trinidad and Tobago National Commission for UNESCO
Level 5 Education Towers, Tower A
Ministry of Education
#5 St. Vincent Street
Port-of-Spain.

October 9, 2019

Ms. W. Catherine Romain 25.10.19 Dated with approval 25.10.19
Executive Director
National Library and Information System (NALIS)
Hart and Abercromby Streets
Port-of-Spain

u.f.s. Ms. Beverly Williams
Deputy Executive Director (Ag.)
NALIS

u.f.s. Ms. Helen Gilbert
Librarian IV - Special Library Services
NALIS

Seen 16.10.2019

Dear Ms. Romain,

Further to my letter forwarded to you on September 20, 2019 please find enclosed my proposal on page two of this letter as requested.

Thanking you in advance for your kind consideration,

Kind regards,

Richard Rogers

Librarian I

Enc:

1 | Page

Appendix A2: Certification of Ethical Approval

Athabasca University
RESEARCH CENTRE

CERTIFICATION OF ETHICAL APPROVAL

The Athabasca University Research Ethics Board (REB) has reviewed and approved the research project noted below. The REB is constituted and operates in accordance with the current version of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS2) and Athabasca University Policy and Procedures.

Ethics File No.: 24479

Principal Investigator:
Mr. Richard Rogers, Graduate Student
Faculty of Humanities & Social Sciences\Doctor of Education (EdD) in Distance Education

Supervisor:
Dr. Marti Cleveland-Innes (Supervisor)

Project Title:
Adapting a workplace open educational resource design with agile design thinking techniques

Effective Date: October 12, 2021 Expiry Date: October 11, 2022

Restrictions:

Any modification or amendment to the approved research must be submitted to the AUREB for approval.

Ethical approval is valid for a period of one year. An annual request for renewal must be submitted and approved by the above expiry date if a project is ongoing beyond one year.

A Project Completion (Final) Report must be submitted when the research is complete (i.e. *all participant contact and data collection is concluded, no follow-up with participants is anticipated and findings have been made available/provided to participants (if applicable))* or the research is terminated.

Approved by: Date: October 12, 2021

Davina Bhandar, Chair
Faculty of Humanities & Social Sciences, Departmental Ethics Review Committee

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Athabasca University Research Ethics Board
University Research Services, Research Centre
1 University Drive, Athabasca AB Canada T9S 3A3
E-mail rebsec@athabascau.ca
Telephone: 780.213.2033

Appendix B1: Permission to use and repurpose resource materials from Fisher (2009)

From: Elizabeth A Fisher <efisher@uab.edu>

To: Richard Rogers <richard184@gmail.com>

Thu, Nov 7, 2013 at 6:09 PM

Hi Richard,

Congratulations for making it this far! I am honored that you would like to replicate my study, with just one caveat. Please share your dissertation with me when completed. I am so interested in what you will find.

You are welcome to use my materials for the purposes of your study providing you cite appropriately. Additionally, my materials must be used solely for the purposes of the study.

In regards to contacting Dr. Barnum, I would recommend that you do. The working documents for the usability study were adapted from Dr. Carol Barnum's work on testing web sites. Though, my research was based on developing the design of a course, which had not been done to date. Therefore, the tasks, pre and post-test surveys, etc., from my study are markedly different.

Hope this helps and good luck with your study.

Elizabeth

Elizabeth Fisher, PhD

Director of Online Learning University of Alabama at Birmingham

COLLAT School of Business

Dean's Office 208-B Business-Engineering Complex 1150 10th Avenue South

Birmingham, AL 35294-4460 Office: 205.934.1271 Fax: 205.976.6575

uab.edu

Knowledge that will change your world

Richard Rogers <richard184@gmail.com> To: efisher@uab.edu Cc: Richard Rogers <richard184@gmail.com> Wed, Nov 6, 2013 at 9:48 PM

Dear Dr. Fisher,

Meet Richard Rogers. I am a doctoral student at Athabasca University (AU) and having read and reviewed your dissertation of 2009 and your subsequent publication of a paper from the dissertation in MERLOT coauthored with Dr. Wright, I'd like to take up the call in the dissertation for replication of your study in the Caribbean.

My previous experience with usability testing was when I conducted a usability analysis for redesign of an academic library website (Rogers & Preston, 2009) and ever since I started doctoral studies in 2011 I've been wondering if this type of study was possible. Your work has answered my query and convinced me of the possibility that usability testing can work as a model for improving online course design.

I am at the proposal writing stage for my dissertation and would welcome your advice on how I could proceed with my attempt to replicate such a detailed and thorough project as the one you completed in 2009. For a start, I was wondering if I'd need to contact Dr. Barnum for permission to use the resources from her book and website (observation

record forms, pre and post test questionnaires etc.).

Looking forward to reading your reply,

Richard

EdD student Athabasca U

Appendix B2: Permission to use and repurpose resource materials from Barnum (2011)

Carol Barnum <cbarnum@spsu.edu> To: Richard Rogers <richard184@gmail.com>

Tue, Nov 12, 2013 at 10:56 AM

Thank you for asking permission to reuse and repurpose materials from my book and website. Yes, of course, you have my permission, which I assume you will state in your work.

I would be glad to offer advise, if I can, on your research as the project develops.

All the best,

Carol M. Barnum, Ph.D.

Professor Emeritus Southern Polytechnic State University Co-Founder, Usability Center usability.spsu.edu

---------- Newest book: *Usability Testing Essentials: Ready, Set . . . Test!* 2011 Morgan Kaufmann

http://booksite.mkp.com/barnum/testingessentials/

LinkedIn http://www.linkedin.com/pub/carol-barnum/2/961/367

Richard Rogers <richard184@gmail.com> To: cbarnum@spsu.edu

Dear Dr. Barnum, Tue, Nov 12, 2013 at 8:15 AM

Meet Richard Rogers, a doctoral student at Athabasca University (AU). I am at the

proposal writing stage of the dissertation project and would like to request permission to reuse and possibly repurpose resources from your latest book *Usability testing essentials...ready, set, test* and website (observation record forms, pre and post test questionnaires, etc.).

You see, I'm hoping to replicate in the Caribbean, a study done by Fisher (2009), which employed usability testing to improve online course development and your resources can help my replication effort.

I'd also like to count on you, if this is at all possible, for any additional advice you can offer as this project develops.

Looking forward to reading your reply,

Richard

EdD Student Athabasca U

Appendix C1: Semi=structured Ethnographic Interview Guide Video Recorded

Research question (RQ1): Why do special librarians, and member users of government and institutional libraries, require an open educational resource solution to implement information skills training?

Icebreaker

- What made you choose this kind of work?

Initial Probes

- Tell us some of the tasks you get at work that would force you to search for sources of evidence.
- How do you classify the tasks you get? Are some more complex than others?

Transitional Probes – I'd like to learn by watching you and asking questions. Can you:

- Show/tell me how you provide information skills training for your users **OR** Show/take me through your process ***before*** you begin searching for sources of evidence.
- How do you decide what sources of evidence are worth pursuing?
- Show me what search tools you use and how you use these tools?
- Show me how you know when you search results are useful and when to stop searching.
- Show me how you use the source after you find it

Closing Probes

Would you be willing to try out any training resources that would help you improve:

- How you provide information skills training?
- How you gather information sources or how you solve your information seeking problems?

Describe some of the ways you think you learn best…

Appendix C2: Usability Testing Resources – Pretest Questionnaire

Thank you for completing this form before evaluating the learning site. Your answers help the development team learn how comfortable you are using technology for learning.

1. How would you rate your level of proficiency with personal computers? 1=Low and 9=High

   •1 •2 •3 •4 •5•6 •7 •8 •9

2. Which of the following software programs are you familiar with? (Select all that apply).

• Word Processing • Spreadsheets • Graphics• Other(s) specify

3. What types of technology tools do you use? (Select all that apply)

•PC •Laptop • Mac • Tablet) • Smartphone• Other(s) specify • None

4. What social networking tools do you use? (Select all that apply)

• Blogs • Wiki's • Email • Facebook• Instant Messaging • Other(s) specify • None

5. Have you ever accessed course materials online?

• Yes • No

6. Have you ever taken a fully online course?

• Yes • No

7. If you answered no, please stop here. Otherwise, how many online courses have you successfully completed?

• 1 • 2 • 3 • More than three

8. In which course management system (CMS) was the course delivered?

• Blackboard (eLearning) • Desire2Learn •Edmodo • The online course was delivered via a website. • Other(s) specify

9. With which activities have you had experience using in online courses?

• Discussion Board • Live Chat • Assignments • Assessments

• Calendar • Web links • Student Portfolios • Podcasting • Video

• Other(s) specify

Appendix C2: Usability Testing Resources – Task Sheet

	Tasks	Completed	Duration
1.	Begin the tutorial – what are the criteria for completing the tutorial		
2.	You want to know how to develop a search strategy. Locate a document that helps you develop a search strategy		
3.	Find and complete the first quiz		
4.	You want a handout to summarize how to refine your searches. Where is that handout located?		
5.	Find a search tool that helps you refine your searches		
6.	Find and complete the second quiz		
7.	Under which section do you learn how to evaluate articles you find		
8.	Find and complete the third quiz		

Appendix C2: Usability Testing Resources – Post-task Questionaire 1

Task 1 survey - Task 1: Begin the tutorial – what are the criteria for completing the tutorial?

1. Information on how and where to begin the tutorial was easy to understand.

• Strongly agree • Agree • Disagree • Strongly disagree

2. It was easy to find the information I was looking for.

• Strongly agree • Agree • Disagree • Strongly disagree

3. Did you find the Course Content page helpful in terms of finding the information you needed? Explain. _____

4. Did you find the course tools menu helpful in terms of finding the information you needed? Explain. _____

5. What was MOST DIFFICULT to do or understand?

6. What was EASIEST to do or understand?

7. When you were exploring the course, what components did you explore? Why?

8. Optional: Please add any additional comments you would like to make.

Appendix C2: Usability Testing Resources – Post-task Questionnaire 2

Task 2 - You want to know how to develop a search strategy. Locate a document that helps you develop a search strategy

1. Finding the document was easy.

• Strongly agree • Agree • Disagree • Strongly disagree

2. Instructions for using the document were easy to understand.

• Strongly agree • Agree • Disagree • Strongly disagree

3. What was MOST DIFFICULT to do or understand?

4. What was EASIEST to do or understand?

5. Optional: Please add any additional comments you would like to make.

Appendix C2: Usability Testing Resources – Post-task Questionnaire 3, 6, and 8

Task 3, 6 and 8 - Find and complete the first (second) (third) quiz.

1. Finding the quiz was easy.

    • Strongly agree • Agree • Disagree • Strongly disagree

2. Instructions for completing the quiz were easy to understand.

    • Strongly agree • Agree • Disagree • Strongly disagree

3. Instructions for submitting the quiz choices were clear.

    • Strongly agree • Agree • Disagree • Strongly disagree

4. What was MOST DIFFICULT to do or understand?

5. What was EASIEST to do or understand?

6. Optional: Please add any additional comments you would like to make.

Appendix C2: Usability Testing Resources – Post-task Questionnaire 4

Task 4 - You want a handout to summarize how to refine your searches. Where is that handout located?

1. Finding the handout was easy.

• Strongly agree • Agree • Disagree • Strongly disagree

2. Instructions for using the handout were easy to understand.

• Strongly agree • Agree • Disagree • Strongly disagree

3. What was MOST DIFFICULT to do or understand?

4. What was EASIEST to do or understand?

5. Optional: Please add any additional comments you would like to make.

Appendix C2: Usability Testing Resources – Post-task Questionnaire 5

Task 5 - You want a search tool to help you refine your searches. Where is that search tool located?

1. Finding the search tool was easy.

• Strongly agree • Agree • Disagree • Strongly disagree

2. Instructions for using the search tool were easy to understand.

• Strongly agree • Agree • Disagree • Strongly disagree

3. What was MOST DIFFICULT to do or understand?

4. What was EASIEST to do or understand?

5. Optional: Please add any additional comments you would like to make.

Appendix C2: Usability Testing Resources – Post-task Questionnaire 7

Task 7 - You wish to learn how to evaluate the articles you find. Locate the section helps you learn how to evaluate articles you find.

1. Finding the section heading was easy.

• Strongly agree • Agree • Disagree • Strongly disagree

2. The section heading or guide word(s) for locating the content matched the content.

• Strongly agree • Agree • Disagree • Strongly disagree

3. What was MOST DIFFICULT to do or understand?

4. What was EASIEST to do or understand?

5. Optional: Please add any additional comments you would like to make.

Appendix C2: Usability Testing Resources – Exit Interview

1. What was your favourite thing about this tutorial?

2. What is your least favourite thing about this tutorial?

3. What opinions about the tutorial do you have?

4. Would you enrol in this tutorial?

5. Would you recommend this tutorial to others

Appendix C2: Usability Testing Resources – Observer Form

Participant #:
Task #:
Start Time
End Time

Nonverbal Behaviours	**Notes**
Frowning/Grimacing/Unhappy	
Smiling/Laughing/Happy	
Surprised/Unexpected	
Furrowed brow/Concentration	
Evidence of Impatience	
Leaning in close to screen	
Variation from expectation	
Fidgeting in chair	
Random mouse movement	
Groaning/Deep sigh	
Rubbing head/eyes/neck	

Task Completion Status		Notes:
Incomplete:	Complete:	
Participant gave up	Fully complete	
Task “called” by moderator	Complete with assistance	
Thought complete, but not	Partial completion	

Appendix D: Statement of Informed Consent Form

Your signature on this form means that:

You have read the information about the research project.

You have been able to ask questions about this project.

You are satisfied with the answers to any questions you may have had.

You understand what the research project is about and what you will be asked to do.

You understand that you are free to withdraw your participation in the research project without having to give a reason, and that doing so will not affect you now, or in the future.

You understand that if you choose to end your participation during data collection, any data collected from you up to that point will be destroyed.

You understand that your data is being collected anonymously, and therefore cannot be removed once the data collection has ended.

	Yes	No
I agree to be audio-recorded		
I agree to be video recorded		
I agree to the use of direct quotations		
I allow data collected from me to be archived on an encrypted and password protected USB stick entitled Doctor of Education dissertation that will be secured with lock and key for five-years post completion.		
I am willing to be contacted following the interview to verify that my comments are accurately reflected in the transcript.		

Your signature confirms:

You have read what this research project is about and understood the risks and benefits. You have had time to think about participating in the project and had the opportunity to ask questions and have those questions answered to your satisfaction.

You understand that participating in the project is entirely voluntary and that you may end your participation at any time without any penalty or negative consequences.

You have been given a copy of this Informed Consent form for your records; and
You agree to participate in this research project.

_____ _____
Signature of Participant Date Principal Investigator's Signature:

I have explained this project to the best of my ability. I invited questions and responded to any that were asked. I believe that the participant fully understands what is involved in participating in the research project, any potential risks and that he or she has freely chosen to participate.

_____ _____
Signature of Principal Investigator Date

Appendix E: Report of Findings of Informal Interviews with Information Professionals

Learning Materials for Delivery of Information Skills Training

Information professionals from three (3) special libraries confirm that no training materials exist, whether digital or print-based, to provide information skills training to meet the needs of library members in their individual contexts. One professional relies on a print-based desk manual to guide members in their use of journal databases. The manual may be used as a self access guide if no library staff is available to guide library members. Apart from the single instance of a desk manual no other professional confirmed the existence of self-access materials (digital or print-based) to support the delivery of information skills training at their respective library institutions.

Content for Information Skills Training

Most professionals interviewed seemed to confuse information sources with information skills training resources. Even when the misunderstanding was resolved professionals restricted information skills training to teaching their members how to search and use electronic journal databases. One professional requested clarification of the phrase information skills training and what it involved. It was later discovered that this professional had never conducted any form of information skills training despite have completed a module on information literacy as part of a graduate degree.

Preferred Educational Resource Type

Even though only one (1) professional was aware of or had heard about open educational resources (OER), all professionals expressed an interest in learning about and using OER to help them deliver information skills training to their library members.

Appendix F: Information, Knowledge, and Library Centre Participants

Information Centres	Contacted	Acknowledged	Participants
Environmental Commission of Trinidad & Tobago	✓	✓	
Environment Management Authority	✓	✓	
Industrial Court of Trinidad & Tobago (North)	✓	✓	2
Ministry of Energy and Energy Affairs (North and South)	✓	✓	
Ministry of Finance	✓	✓	
Ministry of Agriculture Lands and Fisheries	✓	✓	
Ministry of the Attorney General of Trinidad & Tobago	✓	✓	1
Ministry of Foreign and CARICOM Affairs	✓	✓	1
Ministry of Health			
Ministry of Labour and Small Enterprise Development			
TTPS The Police Academy, Ministry of National Security	✓	✓	
Ministry of Planning and Development	✓		
Ministry of the Social Development and Family Services			
Customs and Excise Division, Ministry of Finance			
Ministry of Education Corporate Libraries (RCLRC, Documentation Centre)	✓	✓	12
Ministry of Public Utilities	✓	✓	
Trinidad and Tobago Securities Commission	✓	✓	5

Appendix G: Summary of Findings

Search Strategies Tutorial: A Brief Report for the INASP Instructional Development Team

Purpose: Share initial insights from think-aloud observations and exit surveys and suggest changes to the tutorial interface
Audience: INASP Instructional Development Team
Period: January 7 to February 22, 2022.
Participant Profile: Mid-Level Civil Servants and Knowledge Workers in Trinidad and Tobago
Number of Participants: Six
Participants with Experience in Online Learning Events: Five
Methods Used: Remote Moderated Think-Aloud Usability Test; a pre-test questionnaire; a post-task questionnaire and an exit interview (Fisher, 2009)
Nature of Tasks: All participants were given scenarios and tasks inviting them to find learning resources and quizzes on the Search Strategies Tutorial. The task scenarios were derived from an assessment of the information seeking behaviours that uncovered the profile needs of trainees. The learner profiles suggested that not all trainees needed to proceed in a linear fashion since they had different knowledge gaps. The task types were almost identical to those used in research by Fisher (2009). The task rationale followed the assumption that findability precedes usability (Rosenfeld & Morville, 2006) and learnability (Duchastel, 2003; Nathenson & Henderson, 1980, 2018).
Summary of Issues and Findings:
After two rounds of remote think aloud usability testing, participants' verbalisations and observers' reports suggest two areas of concern: navigation and terminology.
Navigation: The location of the table of contents (TOC), in the sidebar to the right seemed counter intuitive to how participants scanned tutorial pages. Four participants from the two rounds of testing[1] [1]did not immediately notice the TOC. Even though two participants from each round completed the task scenarios with assistance, they used the *next* button and never used the TOC to help them complete their tasks.
Terminology: Participants uncovered a mismatch between the headings in the TOC and the content. For example, participants in both rounds struggled to locate the "Search Refinements Handout." One participant abandoned the search. The handout was lodged under the heading "Field Searching" on one of the pages. The TOC provides a hyperlinked heading *Field Searching* but no such heading for the Search Refinements Handout. One participant commented that "it needed to be more visible."
Our research team includes both the pleasure points and the pain points (See Tables 1 and 2 below) participants encountered as they worked through the tutorial. We also include suggestions for changes in both tables.
Pleasure points
Despite the navigational and terminological challenges described above, respondents to the exit interview enjoyed navigating the tutorial and the quizzes. Other respondents

[1] One round of usability testing includes three participants

found the tutorial relevant and useful. Respondents also indicated they would enrol in the Search Strategies tutorial and that they would recommend it to others.

Table 1

Summary of Pain Points and Recommended Changes after Round 1

Problems Found	Solutions Proposed
7. The location of the TOC was not obvious to all participants in round 1	Put the TOC in bold font Use dark blue for headings under the TOC
8. No label or link exists for *Learning Resources* in any of the Steps 1, 2 or 3.	For each *Step* add a link labelled *Learning Resources* at the end of the TOC and immediately below, create a subheading labelled *Search Strategies Form*.
9. Participants didn't understand the technical language used in the tutorial	Use jargon free language in the heading of the TOC. Replace phrases like *Search Refinements, Field Searching and Truncation* with their meanings

Table 2

Summary of Pain Points and Recommended Changes after Round 2

Problems Found	Solutions Proposed
4. The phrase "completion criteria" was not intuitive and confused participants	Introduce a phrase or question that is more intuitive to learners and less technical. *To Finish this Tutorial…*
5. The *Search Refinements Handout* was located under the heading labelled "Field Searching" within a page. The label for the handout did not appear to be hyperlinked under the TOC.	For each *Step* add a link labelled *Learning Resources* at the end of the TOC and create a hyperlinked subheading for the *Search Refinement Handout*
6. The heading under the TOC that read *Search Strategy Form* did not have an actual form	Check that the link labelled *Search Strategy Form* is still a live link

References

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