

Comparing Two Information Literacy Development Strategies for Online Doctoral Students

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I. Introduction

Doctoral students are a unique group of students transitioning from information consumers to knowledge creators,¹ and information literacy (IL) is a critical component of student success. Most research on IL development focuses on undergraduate students, but research on doctoral students is less prevalent.² Doctoral students arguably have the greatest need for research support compared to other student populations, primarily due to the comprehensiveness of the dissertation literature review.³ However, many libraries do not offer services tailored to doctoral students and the dissertation.⁴ By focusing on undergraduate students and grouping support for doctoral students together with master's students, many libraries fail to support a key campus population.

The literature review is one of the most challenging dissertation components to complete.⁵ Identifying a potential original contribution to the field for the first time, the breadth and depth of interaction with the literature required to thoroughly identify and evaluate existing scholarship, the length of the dissertation manuscript, and justifying oneself as an expert in a specific research area combine to create a unique research experience. Rather than beginning with a well-formulated topic or inquiry followed by a search for information that directly addresses that inquiry, original research requires more indirect searching during the project's earlier stages.⁶ Searching systematically to identify a gap in the literature is not as straightforward or linear as many dissertation guides imply, and many doctoral students are not equipped to conduct a comprehensive review of the literature that takes multiple academic terms to complete.⁷

Doctoral Students as Adult Learners

Doctoral students are also adult learners, which presents additional challenges to developing IL for advanced literature searching and research. Although scholars have explored the intersection of adult learning theory and library instruction,⁸ fewer scholars have applied adult learning as a theoretical or conceptual lens to develop IL instruction. Like other IL research questions, scholars have focused on undergraduate adult learners.⁹ There are few studies on graduate student adult learners¹⁰ and fewer on doctoral students.¹¹

Experiential learning theory (ELT) is one example of an adult learning theory. Kolb¹² based his ELT on works by constructivists John Dewey, Kurt Lewin, and Jean Piaget, and Kolb continued to revise this theory for several decades.¹³ Kolb argued that learning occurs in all areas of life as people interact with their personal and social environments. Knowledge is constructed when a person grasps an experience and then transforms that experience. An experience can be concrete or abstract; transformation occurs through internal reflection or external action. There are three major components of ELT: (a) a four-stage learning cycle, (b) four learning styles, and (c) four learning environments.

A challenge for adult learners is that libraries and research workflows may look very different from previous higher education experiences. Catalogs, databases, software, and other library features continue to change rapidly, and the amount of information available has also increased. Students can easily find information, but they may have a more challenging time determining the relevance, importance, or accuracy of that information or improving their search strategies. As a result, students can develop anxiety about libraries, research, and information.¹⁴

Doctoral students can develop strategies for engaging with the literature using their prior experiences,¹⁵ but many adult learners have little experience navigating the online library.¹⁶ An experiential learning approach can help adult learners create new experiences that can help them construct new knowledge of how to find, evaluate, and use information.¹⁷ As students develop positive experiences interacting with and using information, they also increase self-efficacy and self-confidence.¹⁸

Researchers have incorporated ELT into studies on IL development in higher education,¹⁹ but scholars rarely articulate the particular principles or theorists used to design instruction. Often, Kolb is mentioned alongside other experiential learning scholars such as Dewey and Piaget. However, some studies do focus on Kolb's ELT as a framework for IL development in undergraduate²⁰ and graduate students.²¹ There are no published studies on designing IL development for doctoral students using ELT within a fully asynchronous context.

Instructional Support for Doctoral Students

IL instruction for doctoral students usually occurs during orientations and residencies—with the understanding that individual appointments and other research assistance are available throughout the year—but research has suggested a need for library support throughout a doctoral program.²² Continual support reflects best pedagogical practice because multiple learning opportunities can increase doctoral students' confidence in their ability to succeed²³ and the likelihood of skill development and retention.²⁴ Ongoing instruction for doctoral students can be implemented in various ways: an embedded librarian who is integrated into the course,²⁵ teaching workshops with course instructors,²⁶ standalone credit-bearing courses,²⁷ self-directed

modules,²⁸ or a series of workshops.²⁹ Each method yielded positive results, but each method also had limitations and required sufficient staffing and resources to execute correctly. Librarian-faculty collaborations typically required the most amount of time to implement.

A strategic response to insufficient staffing and resources is identifying the most pivotal intervention points and providing instruction at those times. Identifying these points of need requires librarians to understand doctoral students' research life cycle to make the most informed decision.³⁰ Conducting a needs assessment is important when designing IL instruction, or librarians risk creating a gap between the instruction delivered and the instruction needed.³¹ Providing instruction tailored to doctoral students' needs improves student engagement, understanding of the library's role, and the development of IL skills.

II. Project Background

California Baptist University (CBU) is a mid-sized, private, faith-based university in Southern California. The university is a teaching institution rather than a research institution. The faculty and staff focus on providing faith-based academic and co-curricular programs that support students' academic development, personal well-being, and vocational advancement. Over the past decade, CBU almost tripled enrollment, growing from 4,100 students in 2009 to 11,500 students in 2022.³²

In 2015, CBU launched its first professional doctoral programs and currently offers six professional doctoral programs and one PhD program. Over time, the number of in-person courses and residencies shrunk, and all doctoral programs are currently delivered in a hybrid or online-only model. The average CBU doctoral student is in their mid-to-late 40s and has spent at least five years out of school since their master's degree. Although some students have taken online courses, many have never completed a fully online or hybrid program.

As the instructional services librarian, I oversee the library's instruction and research support services for all academic programs, including doctoral programs. In 2016, the associate vice president of CBU's online division asked me to develop online content and three in-person workshops for two fully-online doctoral programs. Administrators and faculty were concerned that students lacked the IL skills needed to succeed in their program. Workshops were incorporated into all on-campus residencies, with the goal that each cohort would have three face-to-face workshops with a librarian during their program. Although I received positive feedback from faculty members, and students appreciated receiving additional library instruction as they began their second and third years, the model was not scalable as programs enrolled more students and increased the number of cohorts. By 2018, in-person residencies were reduced or eliminated in favor of online residencies. As a result, I only met with incoming doctoral

cohorts, and students further along in their programs contacted me if they needed assistance.

A noncredit-bearing course was created for all online graduate students, and in 2018 an introduction to the library was added. However, for unknown reasons, the entire course was discontinued in 2019 and was not replaced with comparable instructional support. Although doctoral faculty requested new support, the disruption of COVID-19 delayed a new library intervention. However, the delay also provided an opportunity to design instruction that (1) addressed the unique demands of doctoral-level research identified by faculty and students and (2) would be relatively simple for a single librarian to expand to other doctoral programs.

The lack of alignment between service and needs was investigated by first conducting a needs assessment with current doctoral students and faculty members. Survey data collected from current CBU doctoral students in the fall of 2020 showed that students desired further instruction in IL skill areas. Faculty interviews conducted in the spring of 2021 revealed that faculty members try to integrate IL. However, due to time and resource restraints, creating and maintaining quality instruction in this area for online students is difficult for many CBU faculty members. Both students and faculty members wanted online support delivered in a self-paced format. The pilot data justified the creation of IL support dedicated to doctoral students and were used to inform the project's instructional modality, content, and timing.

For this project, a standalone course on developing a successful systematic literature search was created in Blackboard (CBU's learning management system) for online doctoral students. The purpose of this project was three-fold. The first purpose of the project was to address the disconnect between IL instruction provided to CBU's doctoral students and the instruction needed by doctoral students. Second, this project was created to provide a way to annually assess doctoral student achievement of the library's learning outcomes, which was a notable gap in library assessment efforts. Finally, the project was designed as a controlled experiment to test two IL pedagogical approaches within a fully asynchronous context: (a) traditional library video tutorials and (b) principles of Kolb's³³ ELT learning cycle. These two instructional approaches were each assessed for effectiveness in increasing self-confidence and developing IL skills in doctoral students.

The research question that guided this project was: Are there significant differences in IL confidence and IL skills in 1st-year doctoral students who participate in asynchronous online library instruction modules designed around the principles of experiential learning compared to those who participate in traditional asynchronous library instruction modules?

III. Project Implementation and Data Collection

In the summer of 2021, module content was created and revised using faculty and librarian feedback, and the modules became available that fall. Participants were 55 1st-year doctoral students from the Doctor of Social Work (DSW) and Doctor of Public Administration (DPA) programs randomly assigned to a control or treatment group. Of those students, 16 DSW and 11 DPA students were assigned to the control group, and 16 DSW and 12 DPA students were assigned to the treatment group. Students were assigned these modules as homework but had the option not to have their data used for analysis. The final sample consisted of 26 students who submitted complete pretests and posttests for analysis, with nine DSW and three DPA students representing the control group and nine DSW and five DPA students in the treatment group.

Module Content & Delivery

Participants completed their first module in the middle of the fall 2021 semester and their second module about four weeks later. Modules for both groups addressed one aspect unique to doctoral-level research: searching systematically to identify gaps in the literature. Participants in this project were 1st-year doctoral students, so concentrating more on information discovery was the logical choice to lay a proper foundation. Indirect searching, the process by which information seekers identify gaps in the literature by determining what is already present, and strategies for conducting a literature review over several months or years were emphasized as distinct features of doctoral-level research (see Appendix for module content).

The control modules included narrated PowerPoint presentations and screencast tutorials focusing primarily on the mechanics of searching. The treatment modules were based on ELT³⁴ and emphasized the cognitive processes doctoral students need to conduct an efficient, systematic literature search. The content was delivered through short videos, screenshots and written text, short self-assessments, reflection activities, and worksheets for students to practice searching the literature using their research topics. Best practices in online instruction³⁵ were also used to construct both the control and the treatment modules.

The modules were designed to remove threats to validity. Both groups received instruction asynchronously using Blackboard, both groups were instructed by their professors to complete the modules as a class assignment, and the content itself was as similar as possible. Additionally, modules for both groups were designed to take roughly the same amount of time to complete. Students knew they were participating in a research study, but the module setting mimicked what students would do in real life.

Data Collection

Quantitative data were collected through a pretest-posttest controlled experiment using assessments administered to student participants in Blackboard. Participants completed a two-part pretest³⁶ at the beginning of the first module. There were two primary dependent variables for this part of data collection: (a) confidence with literature searching and (b) actual IL knowledge. Part 1 asked students to rate their level of confidence in 10 tasks common to the research process. Confidence was reported using a 4-point Likert scale, where a higher number indicated higher self-confidence. Part 2 consisted of eight multiple-choice questions that tested the information skills addressed in the modules.

Participants completed a posttest at the end of the second module. Parts 1 and 2 of the posttest were identical to parts 1 and 2 of the pretest. The posttest also contained a third part that was not included in the pretest. Part 3 asked students to complete an activity like the ones completed by students in the treatment modules. Students were provided a research question, and they listed potential keywords and search strategies, located two relevant journal articles, explained the rationale for selecting the sources, and described their search process. Prior to analysis, each artifact was scored using a researcher-created rubric that was previously pilot-tested. The rubric contained four measures, one for each component of the activity. Each measure was scored on a 4-point scale, where 4 was the highest possible score for each measure. Thus, scores could have ranged from 4 points to 16 points. Another librarian, who was not otherwise involved in this project, scored the artifacts to minimize researcher bias.

The posttest included a final segment that addressed an additional dependent variable: participant satisfaction with the modules. Part 4 included two open-ended questions that asked students to describe the most and least helpful parts of the modules. This posttest feedback was combined with the questions and suggestions students submitted through email, library chat interactions, and phone conversations.

IV. Results

The research question for this project was: Are there significant differences in library skill confidence and IL skills in 1st-year doctoral students who participate in an asynchronous online library instruction module designed around the principles of experiential learning compared to those who participate in a traditional asynchronous library instruction module? To answer this question, a multivariate analysis of covariance (MANCOVA) and paired samples *t*-test analyses were conducted using pretest and posttest scores for IL confidence items and multiple-choice questions, and a multivariate analysis of variance (MANOVA) was conducted using posttest activity scores.

Confidence and IL Knowledge

To determine the effects of the treatment on confidence in IL skills, a MANCOVA was conducted on the posttest confidence scores, using the pretest confidence scores as the covariate. There was no significant difference in the total confidence scores between the treatment and control groups. However, there were significant increases in confidence as indicated in a paired samples *t* test. The posttest scores for the treatment group ($n = 14$) and the control group ($n = 12$) increased significantly. The treatment group indicated increased confidence in more areas than the control group (see Tables 1 and 2).

Table 1. Paired Samples *t* Test for Differences in Confidence Mean Scores for the Treatment Group

Item	Mean differences	<i>SD</i>	<i>t</i>	<i>df</i>	Sig. two-sided <i>p</i>
Define a topic	-.857	.864	-3.710	13	.003
Identify effective search terms	-.615	.768	-2.889	12	.014
Find search tools on the library website	-1.308	1.109	-4.250	12	.001
Find sources in library databases	-1.214	.802	-5.667	13	<.001
Find sources outside the library	-.385	.870	-1.594	12	.137
Sort through irrelevant sources	-1.214	1.051	-4.323	13	<.001
Evaluate sources	-.714	1.139	-2.347	13	.035
Integrate sources into an assignment	-.929	.997	-3.484	13	.004

Item	Mean differences	<i>SD</i>	<i>t</i>	<i>df</i>	Sig. two-sided <i>p</i>
Know when to cite a source	-.786	.802	-3.667	13	.003
Know how to cite a source correctly	-.571	.938	-2.280	13	.040

Table 2. Paired Samples *t* Test for Differences in Confidence Mean Scores for the Control Group

Item	Mean differences	<i>SD</i>	<i>t</i>	<i>df</i>	Sig. two-sided <i>p</i>
Define a topic	-.273	1.104	-.820	10	.432
Identify effective search terms	-.417	.996	-1.449	11	.175
Find search tools on the library website	-1.000	1.483	.447	10	.049
Find sources in library databases	-1.182	.874	.263	10	.001
Find sources outside the library	-1.182	1.079	.325	10	.005
Sort through irrelevant sources	-.750	.866	.250	11	.012
Evaluate sources	-.667	.651	.188	11	.005
Integrate sources into an assignment	-.167	1.115	.322	11	.615

Item	Mean differences	<i>SD</i>	<i>t</i>	<i>df</i>	Sig. two-sided <i>p</i>
Know when to cite a source	-.583	.793	.229	11	.027
Know how to cite a source correctly	-.250	.754	.218	11	.275

A MANCOVA was conducted to determine whether there were significant differences in the treatment and the control group posttest scores on IL multiple-choice questions, using the pretest scores as covariates. No significant differences were found between the control and treatment groups. However, there were some increases in IL knowledge as indicated in a paired samples *t* test. Both the treatment group ($n = 14$) and the control group ($n = 12$) increased significantly in their posttest scores (see Table 3). However, the magnitude of the increase was much greater for the treatment group than for the control group. The treatment group began the modules with significantly lower pretest scores on the multiple-choice questions than the control group, and the treatment group ended with higher posttest scores than the control group.

Table 3. Paired Samples *t* Test for Differences Between the Pretest and Posttest Multiple-Choice Question Mean Scores

Group	Pretest scores		Posttest scores		Mean difference ^s	<i>t</i>	<i>df</i>	Sig. (two-sided <i>p</i>)
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>				
Control*	4.50	1.00	5.67	1.07	-1.17	-2.88 0	11	.015
Treatment <i>t</i> **	3.79	1.31	5.86	1.09	-2.07	-3.916	13	.002

*Cohen's $d = 1.403$ **Cohen's $d = 1.979$.

Demonstration of IL Skills

A MANOVA was conducted to determine whether there were significant differences in the treatment group and the control group's posttest scores on an IL activity scored by a librarian. There was a significant difference in overall activity scores: The treatment group had significantly higher scores on the activity than the control group (see Table 4) and performed significantly higher than the control group in demonstrating IL skills.

In addition to the significant differences in overall activity scores, there were significant differences in scores between the treatment and the control group for two of the four activity questions (see Table 4). The treatment group had significantly higher scores than the control group when asked to demonstrate their ability to: (a) provide effective keywords for a sample research question and (b) describe their search process in detail.

Table 4. Multivariate Analysis of Variance for Differences in Ability to Demonstrate IL Skills

Skills	<i>F</i>	<i>df</i>	Sig.	Group	<i>M</i>	<i>SD</i>
Overall scores	3.586	4	.030	Control	9.33	1.32
				Treatment	11.81	1.66
Identify keywords	8.241	1	.010	Control	2.00	1.00
				Treatment	.301	.701
Describe the search process	8.730	1	.008	Control	2.11	.601
				Treatment	2.91	.831

*Wilks' Lambda = .511

Findings from Student Feedback

Students were asked to answer two open-ended questions during the posttest: what was most helpful about the modules and what should be improved. Feedback from 19 students on module utility fell into three categories: (a) knowledge of available tools and resources, (b) ability to improve a search strategy, and (c) knowledge of search documentation. Additionally, students from the treatment group commented on the modules' challenging but valuable nature. One student from the treatment group concisely summarized this idea, "This module provided an opportunity for practice; although challenging for me, it was very useful."

When asked for recommendations in the posttest, 16 students responded, and four themes emerged: (a) module navigation, (b) timing of module delivery, (c) instructional modality, and (d) additional module content. Students thought additional written or visual cues, such as a status bar, would improve navigation in a module. On timing and

modality, two students suggested offering module access before the start of the fall semester, and one would have preferred a live or in-person workshop. Suggestions for other content were additional examples of refining a search and adding content about APA style. There were no suggestions to remove or change any content.

Students also provided feedback through email, library chat interactions, and phone conversations. Each email thread, phone conversation, and relevant chat conversation were documented and categorized by type of question or suggestion. Most of this feedback came from DSW students, who were the first group to complete the modules, and were related to module navigation issues. Adjustments to pressing navigational issues were made immediately during the first week of implementation. The remaining feedback from DSW and DPA students were positive remarks and queries for additional resources on topics introduced in the modules, such as reference management software and APA Style.

V. Discussion

The major finding of this project was the significant difference in IL demonstrated by doctoral students who completed activities similar to those required to complete course research assignments and the dissertation. Students in the treatment group used their own research questions to practice information skills and were provided the opportunity to reflect on their search attempts. As students reflected, they articulated what they would do differently next time or new ideas about their topic and search strategy. This cycle of activity and reflection gave students in the treatment group direct experiences that simulated real-world processes and improved their ability to demonstrate more developed IL than students in the control group. Previous research has demonstrated that conducting effective and efficient literature searches takes practice and experience;³⁷ because students in the control group had fewer required opportunities to engage in real-world experiences, they were less successful in applying abstract concepts to concrete situations.

Students have few chances to develop and practice IL skills apart from high-stakes assignments, such as final term papers, which can impede IL development.³⁸ Asynchronous ELT modules offered a low-stakes environment for doctoral students to practice the cognitive and mechanical processes of literature searching using their research topics without the pressure of performing well for a grade. The asynchronous modality allowed students who were already skilled in certain areas to complete activities faster, and students who were less familiar with using library search tools could spend more time if needed.³⁹

This project offers a practical example of an IL development intervention that can be adapted and scaled to meet the needs of doctoral students in other programs and institutions. The ELT modules created for this project were revised using participant feedback and made available to all CBU doctoral students in the fall of 2022. Student

feedback on the revised modules is being collected. In future semesters, content coverage will be expanded to include other requested topics, such as guidance on submitting final manuscripts to ProQuest's electronic theses and dissertations database, APA Style, and in-depth information on research software and tools.

Limitations

There were two primary limitations of this project. The most significant limitation was the final sample size of 26 students. Although the statistical analyses used support some confidence in the findings, the findings cannot be generalized to all doctoral students. As evidenced by student feedback, navigating the Blackboard platform was a significant challenge. Several students began the first module but did not complete it, and navigational issues potentially contributed to lower completion rates. The second limitation was the lack of follow-up qualitative data. Qualitative data would have provided a more nuanced understanding of the differences between treatment and control group performance in the posttest and how students applied what they learned in the modules to their course assignments.

Implications for Practice and Research

There are two major implications of this project for library practice and assessment. The first implication is that multiple instructional modalities can be effective, but the **magnitude** of effectiveness varies among instructional approaches, which previous research has not addressed sufficiently. Although both sets of modules in this project successfully increased participants' confidence and skills in both groups, the findings suggested that traditional video tutorials may not be the **most** effective option for asynchronous IL development in doctoral students.

The second implication is that actual student work (e.g., research papers) will more accurately gauge IL development. This project's findings suggested a difference between IL knowledge and applying that knowledge to actual research tasks. Although multiple-choice assessments are easier to administer, score, and analyze, they may not be as effective at measuring higher-order thinking if poorly written.⁴⁰ Multiple data points may be needed to obtain a holistic view of a student's abilities because different assignments measure different IL skills and dispositions. Dissertation literature reviews, in particular, would be a valuable data source for measuring IL.⁴¹

The findings of this project support several possible directions for future research. Replicating the study design with a larger sample size could yield other statistically significant differences in posttest confidence and multiple-choice scores between instructional modes. Future studies should also include students in other professional doctoral and PhD programs to increase the generalizability of findings. Longitudinal studies, where researchers embed IL development and data collection throughout a doctoral program, would also be appropriate for future research.

Providing literature searching experiences in an active learning environment that allows students to explore their research topics and experiment with various search tools and strategies helps doctoral students develop self-confidence and results in greater information skill transfer. Librarians who take the time to investigate the instructional needs of doctoral students they serve can create rich learning experiences that support developing scholars on their journey from information consumers to knowledge creators.

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Carolyn Heine oversees the library's instruction and research support services for all of CBU's academic programs and serves as the campus library's assessment coordinator. Carolyn earned her MLIS from the University of British Columbia and her EdD in Higher Education Leadership from Azusa Pacific University.

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Appendix

Table A1. Control Group Module Topics

Module 1	Module 2
Research topics for doctoral students	Module 1 review
Indirect and preliminary searching	Introduction to subject databases
Understanding library search tools	Boolean operators and modifiers
Library website tour	Item records
Introduction to OneSearch	Citation chaining
Library services and assistance	Research software and tools

Table A1. Treatment Group—Module 1 Topics

Engagement method	Content
Activity	Narrowing a research topic
Short video and reflection	Research topics for doctoral students Reflection on activity
Activity	Generate search terms
Short video and reflection	Indirect searching Reflection on activity
Activity	Try a search
Short video and reflection	

Engagement method	Content
	Example of a basic search Reflection on search activity

Table A2 Treatment Group—Module 2 Topics

Engagement method	Content
Short video	Module 1 review
Activity	Search in a subject database
Short video	Navigating subject databases
Activity	Evaluating quality of search results Exploring item records
Short video and reflection	Creating a systematic search Reflection on activities
Short videos	Citation chaining Research software and tools
Reflection	Reflection on citation chaining/research software videos