

Applying Universal Design for Learning to Support Non-Native English Speakers in an Embedded Information Literacy Classroom: A Case Study

Molly K. Maloney and Keith T. Nichols*

To better serve first-year international students at the University at Buffalo in an embedded, one-credit information literacy (IL) research lab (iLab), undergraduate education librarians built upon a flipped and social constructivist model by employing universal design for learning (UDL). UDL framed the creation of multimodal content targeting trouble areas. The formal assessment instrument was also revised using a pre- and post-test model. Assessment results were used to guide UDL iteration from fall 2018 through fall 2019. The assessment measured the intended IL skills reliably across multiple classes of students. Between fall 2018 and fall 2019, students' pre- to post-test growth increased by 103.92%.

Introduction

Librarians, even those engaged in classroom instruction, often lack access to accommodation information, student background details, or the time to build a relationship with students in which students might become comfortable enough to disclose accommodation needs to us (Mamboleo et al., 2015). Many librarians' standard of operation for information literacy (IL) instruction still relies on the one-shot format, where only one class period in a semester is provided as a guest lecture to cover the complexities of university-level research and information use. It is therefore crucial that IL instruction and supporting materials be as accessible and inclusive as possible so that students are not barred from content.

Further, when given the opportunity to serve a specific demographic in an embedded IL class, such as international students facing unique language and cultural barriers, it is vital to explore and incorporate pedagogy and instructional techniques that will improve the experience not only for that demographic, but for the student body as a whole.

*Molly K. Maloney is Pharmacy Liaison Librarian at the University at Buffalo, email: mkm9@buffalo.edu; Keith T. Nichols is Public Health and Health Professions Liaison Librarian at the University at Buffalo, email: ktn@buffalo.edu. ©2026 Molly K. Maloney and Keith T. Nichols, Attribution-NonCommercial (<https://creativecommons.org/licenses/by-nc/4.0/>) CC BY-NC.

Literature Review

Non-Native English Speakers in Academic Libraries

The makeup of undergraduates in the U.S. is ever-changing and, at many institutions, highly diverse, with increasing proportions of international students previous to the COVID-19 pandemic (Institute of International Education, 2021). Much literature is devoted to examining the experience of international students in American higher education and, more specifically, their libraries and information literacy classrooms. Many international students are non-native English speakers (NNEs), though not all NNEs are international students. Instead, NNEs indicates that English is not a person's primary language at home from birth but may include those who are bilingual or multilingual.

Best practices articles provide a practical approach based on experience. Clausen (2017) recognizes the diversity encompassed by terms such as English language learners and highlights many of the barriers faced by NNEs in postsecondary institution classrooms. This includes difficulties with class delivery format, linguistic anxiety and participation hesitancy, proficiency in writing, issues with testing, and integration into life at that institution. Martin (2012) specifically saw that librarians needed to be aware of cultural differences in the values and beliefs of NNE students if librarians were to effectively bridge the gaps in their information literacy skills. Carlyle (2013) offers a concise set of directives for improving international students' experiences in the library, while Albarillo (2017) makes note of strategies to improve library orientation materials such as multimodal content and attention to lexical complexity.

Using the metaphor of scholarship as a conversation from the *ACRL Framework for Information Literacy for Higher Education* (2016), Bordanaro (2011, 2015) focuses on the importance of collaboration with English as a second language (ESL) faculty when examining IL instruction in a non-native English-speaking context. Such strategies recognize that expertise in instruction for NNEs is not a credential all librarians have, making collaboration with faculty essential for success (Tran & Aytac, 2018). For embedded IL instruction to be successful, there must be open communication and collaboration between librarian and instructor to allow for a better understanding of and mutual support of overlapping learning objectives (LOs). This mutual support is particularly beneficial to building a relationship with these students and to avoid leaving a gap in their university education compared to their native English-speaking peers (Marchese, 2021; Zhao et al., 2021).

While international students may be the largest source for NNEs on many campuses, Generation 1.5 students also face linguistic and cultural barriers. Generation 1.5 refers to students for whom the majority of their secondary, possibly some primary as well, education was completed in the United States after having been born abroad and emigrating as children (Rumbaut & Ima, 1988). These students and their needs may be invisible to a librarian as a guest speaker in a classroom, creating the need for a more flexible method for engaging with IL instruction.

Universal Design for Learning

The Center for Applied Special Technology (CAST), the organization responsible for the development of universal design for learning (UDL), (2021, What is universal design for learning (UDL)? section) describes it as "a framework to improve and optimize teaching and learning for all people based on scientific insights into how humans learn." Originally designed to

address learning differences in an elementary school setting, it insists on a curriculum that provides multiple means of representation, expression and engagement (Orkwis & McLane, 1998), which in practice is applicable at all levels of education. Intentionally building flexibility into a course increases the likelihood that students will be able to access that content and make use of it. Specific evidence-based guidance is graphically organized as CAST's "UDL Guidelines," which break down the framework into three principles (representation, expression and engagement) across three stages (access, build and internalize) (2018). Each resulting intersection identifies options demonstrating what implementation might look like in that area, as well as a variety of checkpoints including descriptions and examples to accomplish that goal.

UDL has been embraced by librarians and other educators in higher education to address barriers. A first-year health sciences course at a Canadian university where UDL-inspired course design was used to address accessibility needs saw students taking advantage of the multimodal methods of representation, engagement, and expression, reporting reduced stress and increased feelings of empowerment to guide their own learning (Kumar & Wideman, 2014). A systematic review on UDL in undergraduate STEM education found students increased their self-efficacy among other assessment metrics such as GPAs, test scores, and others (Schreffler et al., 2019). Several academic libraries demonstrated the impact of meeting student information needs in flexible ways, such as intentional design of instruction and tutorials and even mindful use of clear, plain language delivered at a steady pace (Chodock & Dolinger, 2009; Kavanagh Webb & Hoover, 2015; Nall, 2015). A case study by Kirsch (2024) shows that, even when one starts with small UDL-based changes in the library, success can establish a foundation from which to promote its use across campus; this, in turn, can lower educational barriers, and it demonstrates yet another vital contribution librarians make to their institutions.

The parallels are clear when comparing the UDL Guidelines with the best practices recommended for improving international students' experience in libraries (Albarillo, 2017), and go beyond by offering a single evidence-based framework to guide planning, development, and practice for learning and research support. Albarillo's case study on Brooklyn College's Library Online Orientation Program represents a unique combination of a large NNES student group and semester-long embedded instruction to be able to further evaluate the application such practices.

Research Questions

The authors, undergraduate education librarians at the University at Buffalo (UB), sought to answer the following two questions: 1. Would the inclusion of a barrier-reducing pedagogy such as UDL, positively impact information literacy learning outcomes for non-native speakers of English? and 2. Would the difference in assessment scores based on information literacy knowledge be statistically significant or not? To analyze these questions, the authors used a pre- and post-test assessment design to ascertain student learning outcomes and determine if UDL had a positive impact on the overall post-test scores. With results showing a positive impact in the UDL-adapted course, this case adds to the body of evidence demonstrating the intentional lowering barriers impeding student learning makes for more effective IL instruction and a more inclusive learning environment.

Setting

University at Buffalo: iLab

The University at Buffalo is a tier 1 research institute and part of the State University of New York (SUNY) system. Between fall 2017 and fall 2019, UB had undergraduate class sizes of 21,115 students on average. During this time period, approximately 14.9% of the undergraduate body consisted of international students (University at Buffalo Office of Institutional Analysis, 2021). As a top-ranking U.S. institution for hosting international students (Anzalone, 2020, November 25), this student group represents countries and languages from around the world.

The University Libraries Education Services Team consists of six to eight undergraduate education librarians focused on IL instruction and outreach for the university's undergraduate general education curriculum—the UB Curriculum. The UB Curriculum is developed with early undergraduates in mind, acknowledging the different backgrounds of students with varied levels of previous IL instruction and acknowledging that all require a solid foundation in these skills to succeed at UB.

The Education Services Team has delivered embedded IL instruction since the implementation of the UB Curriculum in fall 2016. This one-credit lab, iLab, is delivered as part of the writing and rhetoric course (ENG 105) as the communication literacy I requirement. In addition to weekly lectures with their English instructor, an hour-long lab was held once per week with a librarian. A portion of this course is delegated to the English Language Institute for delivery and designated as ENG 105Z. These classes must have the same rigor and learning objectives but are taught by dedicated ESL instructors to address international students' unique needs. iLab was initially designed and delivered no differently for this group. It was intended to prepare all undergraduate students enrolled in a version of ENG 105 in the same way and to rely upon external factors—such as their lecture faculty and the immersive English-language setting—to address additional needs. While iLab is still embedded in ENG 105Z, it has grown significantly from its original form.

The pedagogy on which iLab was founded in 2016 began with a constructivist model, based on the idea that knowledge is constructed at the individual level through experiences and reflection. Through evaluation and iteration, the librarians evolved the course to embrace a social constructivist model in order to allow students “to experiment with ACRL *Framework* threshold concepts through low-stakes, media-rich group projects, allowing them to construct new knowledge in a social sandbox” (Tysick et al., 2019, p. 105). Social constructivism is a learning theory that asserts “human development is socially situated and knowledge is constructed through interactions with others” (McKinley, 2015, p. 1). This also included use of flipped classroom techniques and active learning strategies. A flipped model or flipped classroom is where a portion of the learning—typically the lecture portion—is done before the students enter the class and then class time is used to practice what was learned. Active learning invited students to engage in learning through engagement with discussion, inquiry, creation and other pursuits.

The next stages can be broken down into two phases: an experimentation phase from fall 2017 through fall 2018; and a second phase from spring 2019 to fall 2019 that ran our final form. This paper will not include the spring 2020 iteration as it includes the emergency transition to remote instruction due to the worldwide COVID-19 pandemic.

In fall 2017, iLab utilized a scaffolded group research project as the context to deliver IL instruction (see Appendix A). Weekly content included a small collection of brief videos

covering the concepts and skills to be applied in class (i.e., a flipped classroom model), a short, multiple-choice quiz based on that content to be completed before class (i.e., prework quizzes), and in-class assignments recording that day’s work (i.e., class participation assessments/CPAs). This weekly work built toward a group’s outline, ultimately resulting in a group infographic and works cited page. The final assignment in iLab was an individual outline coinciding with preparation for their final research papers in ENG 105. All work involved in iLab counted as 10% of their final ENG 105 grades.

Incorporating Universal Design for Learning for Fall 2018

The intent was to continue innovating through this process of evaluation and iteration with the goal to improve the impact and efficacy of IL instruction. To begin, barriers and issues were identified each semester in a variety of forms. Librarians gathered their experiences delivering the course and working with students and considered student and faculty feedback. Summative assessments were conducted each semester in the form of a pre-test and post-test.

It became apparent that there were issues concentrated in ENG 105Z iLab sections regarding assumed cultural competencies, language barriers, participation, and output. Even though significant gains were seen in summative assessments, students were struggling to apply these skills outside of iLab, even within the ENG 105Z course.

An exploration of ways to address these needs began, and UDL was identified as a practical framework. UDL provided the guidance required to target changes and aligned with typical best practices for teaching in a classroom for NNEs (Clausen, 2017). A taskforce of three undergraduate education librarians grouped the observed barriers by theme and matched them to relevant UDL Guidelines checkpoints (see Table 1).

TABLE 1
A Sample of Compiled ENG 105Z Barriers with Corresponding UDL Checkpoints

Barrier Group	Observed Barriers	Matched UDL Guidelines: Checkpoints
Research Topic Missing Cultural Context, Relevance	Students were unable to connect with topic areas preventing engagement; sometimes cultural barriers were evident. Instruction examples used do not resonate with students. Rigidity of assigned group research topics prevent engagement and student agency.	CHECKPOINT 2.4 Promote understanding across languages CHECKPOINT 7.2 Optimize relevance, value, and authenticity
Academic English and Discipline-Specific Language (i.e., Jargon)	English-only materials and those heavy with discipline-specific jargon (e.g., scholarly materials) impede non-native English speakers from getting through the material, resulting in cascading comprehension and acquisition issues. Foundational materials/scholarly materials for research project take much more time to read and time is short. Library jargon: what parts do they really need? Variety of terms used across research platforms for synonymous functions (e.g., filter, limiter, facet) cause confusion.	CHECKPOINT 2.1 Clarify vocabulary and symbols CHECKPOINT 2.4 Promote understanding across languages CHECKPOINT 3.1 Activate or supply background knowledge CHECKPOINT 5.1 Use multiple media for communication

Brainstorming for targeted solutions that would impact the barriers as widely as possible began. Librarians strived to balance the effort required to rebuild major course elements, the time required, and impact for the students' experience and outcomes. Priority was given to addressing issues of cultural and language barriers in the areas of the research topics, background knowledge, course content, and library jargon for the first wave of changes.

A thorough review was completed of the language used for structure, complexity, consistency, and jargon. While the course itself integrated content and language learning, library-specific and academia-specific terminology was removed wherever possible. When vital for concept or skill development, definitions were explicitly stated in course materials and during instruction (e.g., clarifying the multiple meanings of terms like "scholarship" and "authority"). The flipped classroom model allowed for preteaching of vocabulary as well. Quizzes built in the Blackboard learning management system (LMS) were reviewed to ensure question and answer phrasing matched the source content. Automated responses to incorrect submissions directed students back to the content item that contained the answer.

An additional element resulting from this review included team development and discussions on the language used in class: speaking slowly and clearly; using a microphone when available; and being mindful of figurative language and cultural references. A regular exchange of feedback on student engagement with weekly lessons and content was established.

Progress toward reliable research topics and increasing the modes of representation for background information were combined by establishing "starter packs" within the LMS. Embedded TED Talks would be used as a narrative entrance into a topic. Shorter (i.e., no more than 10 minutes) talks were evaluated along the following criteria: universal appeal and relevance to international undergraduates to activate existing background knowledge; authoritative and compelling speakers; and availability of closed captions and transcript in key languages represented by UB's student population. Candidate talks were then voted upon for final selection. Examples of scholarly and popular sources were provided on the same topic area to be used as reference later for comparing source types and additional information. Instructions were provided for how to navigate the starter packs, including how to turn on closed captioning, and how to access the transcript and switch between languages for comparison.

Additional graphic and video content was created to provide guides through the course, assignments, and concepts with language reviewed as above. Short procedural videos demonstrating how to navigate the LMS for tasks such as submitting assignments proved very valuable to the librarians and students both during class and after. All videos were required to have closed captions, and general guidance was to favor brevity, splitting concepts across installments as needed. Attention was paid to colors, text size, navigation, and other basics of accessibility.

iLab assignment structure was revised during this period (see Appendix B). The seven weekly graded assignments (CPAs) were reduced to three scaffolded group assignments building to the final project deliverables in concert with low-stakes progress check-ins via collaborative assignment via Google Drive. Explicit directions were given as to how the progress made on each assignment would provide the basis for the next step in the research process. While maintaining the flipped classroom structure allowing students to complete these assignments collaboratively during a single class period, an additional day was added to the schedule before submission to lessen pressure and provide time for communication students felt more comfortable asking via asynchronous methods.

Similarly, the schedule of the course was revised (see Appendix C). Content areas where students had demonstrated further time and revision would be beneficial (see Table 1) were given additional in-class time for active application (e.g., building a focused research question). Active learning continued to be employed to improve engagement and efficacy of teaching and learning in concordance with UDL principles (Chodock & Dolinger, 2009; Spina, 2021; Zhong, 2012). Problem areas English Language Institute faculty identified as areas of need were also built out more intentionally to allow for time and application practice (e.g., indirect source citation and synthesis of information). This meant that certain skills-based practice was relegated to the low-stakes video and quiz areas and often served as areas for constructive feedback on assignment check-ins.

Assessment

Methodology: Data Collection

The undergraduate education librarians created a 10-question multiple choice test instrument for students. The instrument draws from five question banks that have five questions each for a total of 25 questions in the pool (see Appendix D). This instrument was created and administered in Blackboard, which allows for randomized questions and the ability to select how many questions from each pool are pulled into a student's session. The students' 10 questions were randomly selected with two questions from each bank and put in a random order. This was to help randomize the test instrument and allow for a fuller review of information literacy concepts within a single cohort of students while simultaneously decreasing the likelihood of academic dishonesty, as students would not all be taking the exact same test in the exact same order. Each student was individually graded out of 100 total points (i.e., 10 points per question). Each class was then averaged together in part because of ease of reporting using Blackboard.

The test instrument was designed in-house by the undergraduate education librarians based on the following criteria: course goals; course content; prior experience; *Framework for Information Literacy for Higher Education* (Association of College & Research Libraries, 2016); and finally, perceived information literacy needs unique to the ENG 105Z students.

The pre-test was given during the first session librarians had with their students before any content delivery. The post-test was given during the final class session, after all content had been delivered, and students were using class time to finalize their projects. For each testing period, students were given 10–15 minutes to complete the test; however, the LMS allowed the test to be completed after time expired, and students were informed of this. We cannot account for previous information literacy skills or knowledge taught to our students as we did not incorporate questions about prior knowledge into the instrument.

The pre-post model was selected for several reasons. First, it fit into the natural schedule of the class, allowing an easy way for the librarian to take attendance in the first session while also determining where the class as whole was situated in the information literacy landscape. Second, it helped to frame the class by covering the topics that were going to be taught. This assisted in both course creation and instruction delivery. Finally, the model allowed the librarian to see where students started and where they ended. This gave a degree of knowledge about the impact the librarian made on the class and if learning outcomes were being met. Without a pre-test it would be impossible to know where the students were at the start of the intervention compared to where they ended. Results for each class were averaged together.

Participants

Our total sample of students ($n = 317$) who took the information literacy lab pre-test and post-test were in 17 sections of ENG 105Z over three semesters (see Table 2). We accounted for the minor difference in pre and post completion in the fall 2018 and fall 2019 semester based on students being absent when the pre- or post-test was given. One hundred percent of students who started the pre- or post-test are included in the results. We did not exclude student scores from our analysis if they took only one of the tests as the overall average of all students was the desired outcome for review. The reason there were more sections in the fall 2019 semester is due to front loading of the ENG 105 course (i.e., most first-year students take it in their first semester).

TABLE 2
Participant Totals from Fall 2018 Through Fall 2019

Semester	Number of Sections	Total Number of Students
Fall 2018	2	36
Spring 2019	7	121
Fall 2019	8	160
Cumulative Totals	17	317

Results

The first hypothesis (H1) tested whether there is no statistically significant difference in pre-test and post-test scores based on information literacy knowledge. The second hypothesis (H2) tested whether the expansion of UDL content into the course had no impact on student outcomes.

T-Test

Fall 2018 saw a pre-test mean of 60.885 and a post-test mean of 68.89, showing an 8.005 (95% CI +/- 0.312) growth in pre-test versus post-test means. The results of the t-test show a statistically significant difference between the performance level of the pre-test and post-test scores of the population ($t = 35.578$, $p < .05$).

Spring 2019 saw a pre-test mean of 55.157 and a post-test mean of 74.656, showing a 19.499 (95% CI +/- 2.34) growth in pre-test versus post-test means. The results of the t-test show a statistically significant difference between the performance level of the pre-test and post-test scores of the population ($t = 15.139$, $p < .05$).

Fall 2019 saw a pre-test mean of 60.542 and a post-test mean of 76.866, showing a 16.324 (95% CI +/- 0.959) growth in pre-test versus post-test means. The results of the t-test show a statistically significant difference between the performance level of the pre-test and post-test scores of the population ($t = 31.182$, $p < .05$). Between fall 2018 and fall 2019, students' pre- to post-test growth increased by 103.92%.

TABLE 3
Statistical Results by Semester

Semester	Pre-test	Post-test	Growth	Confidence Interval	t-Test	p-value
Fall 2018	60.885	68.89	8.005	95% CI +/- 0.312	$t = 35.578$	$p < .05$
Spring 2019	55.157	74.656	19.499	95% CI +/- 2.34	$t = 15.139$	$p < .05$
Fall 2019	60.542	76.866	16.324	95% CI +/- 0.959	$t = 31.182$	$p < .05$

Based on these findings, hypothesis 1 was found to be false. Every measured semester produced a statistically significant difference between the pre-test and post-test (see Table 3). The new pre-test implemented in spring of 2019 and run again in the fall of 2019, reliably examined the students' understanding of information literacy concepts. The baseline of 55.157 in the spring was lower than the 60.542 of the fall but was within the projected variance. Interestingly, the post-test results were exceedingly close, with only a 2.21 difference, and perhaps demonstrates that there is a limit to the growth that can be expected of students in a 10-week information literacy lab.

Hypothesis 2 was also found to be false. The expansion of UDL concepts in the fall of 2018 and spring 2019 showed increased growth in student information literacy knowledge compared to previous semesters (see Table 3). However, it should be noted that the authors cannot conclusively say that the UDL implementation was the sole cause of this increase in growth between the pre- and post-tests. While there was anecdotal evidence from instructors suggesting that students find the inclusion of UDL elements beneficial to their learning, those elements or variables could not be tested in isolation. Students were able to achieve a higher average score on the test after UDL was implemented compared to before. Judging by the anecdotal evidence and the test scores, at minimum, UDL has enhanced iLab.

Discussion

As a result of the fall 2017 through fall 2018 experimentation phase for the design, delivery, and assessment of iLab, piloting was first done in a limited number of sections. The realigned pre-post tests were deployed in two sections of the course initially to test validity and reliability. The instrument was considered reliable when a similar spread in both pre- and post-test scores was observed, including the growth from one to the other. This was fully confirmed over the next year when 281 individuals took the test with similar results. The content validity of the instrument was built into the design of the test as the lesson plans with learning objectives had already been created. This helped align the instrument with the overall course objectives and allowed the creators to build a reliable test using those learning objectives. Considering the results of the post-test, we further believe this adds weight to the test instrument being valid and reliable for our purposes.

Standardized lesson plans were followed by the entire team, hoping to control for the instructor variable. Instructor as a variable was not tested for this study but the CI indicates comparable results across classes. Specifically accounting for instructor variables could be undertaken in the future.

Recent survey findings have shown some academic libraries "are not adequately planning to meet accessibility needs for users of library collections" (Peacock & Vecchione, 2020, p. 5). Libraries can begin to address accessibility and inclusion issues through small, stepped changes by employing universal design frameworks (Kirsch, 2024; Pionke & Rutledge, 2021). By dispersing efforts across the services offered by an academic library to include those instruction librarians responsible for building instructional tools, content and development of embedded courses, and intentional use of frameworks such as UDL Guidelines, progress can be made to lower the gates to the information and skills students need to progress.

Chodock and Dolinger (2009) assert that "one-size-fits-all approach will not work for the wide variety of circumstances in which instruction librarians teach" (p. 30) and UDL can serve as a framework for guiding more inclusive teaching practices. Incorporating flexibility and multimodality from the onset is ideal; however, when faced with existing courses and

working arrangements, it is still possible to target areas to improve accessibility and inclusivity to the benefit of students.

When accessibility and inclusion are the priority for serving a diverse population of students, such a framework to guide course design is an asset. It becomes even more valuable when the framework is intuitive and offers practical options and when paired with assessment and intentional iteration.

While international students were the trigger for this work, Generation 1.5—as well as the recognition of unknown, invisible, or otherwise not predicted barriers and learning preferences—motivate continued progress in this area. Broadening the way students can engage with instructional content may increase the likelihood of impactful interactions and growth in information literacy.

The results demonstrated that the effort undertaken by the Education Services Team to incorporate UDL principles into their course design had the desired effect on learning. Students were the beneficiaries, and the assessment shows their knowledge gains were better after UDL was implemented. Considering how many students and instructors were involved, the lack of significant variance in the results and the consistent nature of the improvement gives the Education Services Team hope for continuing to improve the delivery and to hold this baseline of improvement.

Multimodal methodology for delivering this type of content paired underpinned learning and application by providing students with flexibility to meet their needs. The resulting impact was shown in the assessment data. Allowing students to access and engage with content via accessible text, audio and video available in their native languages whenever possible in the LMS, followed by facilitated practice during class allowed for NNEs to navigate the ideas and skills with a wider range of support. A potential future improvement would be to extend this multimodality to assessment methods for the pre- and post-tests, the scaffolded group assignments, and the final research deliverable, while also balancing the scale for the effort this type of instruction and grading requires of a librarian who has multiple sections. Still the employ of UDL as a guiding framework and the multimodal methods used allowed students to access and apply content in ways that increased their learning.

Limitations

Though testing of the assessment proved it to be reliable as described, a test longer than ten questions would further help to improve the validity of the instrument.

Spring 2019 variance is probably related to teacher learning curve and the first full semester rollout. In many ways it was a pilot phase in which instructors delivered new lesson plans designed for the UDL materials. With the need for scalability due to the large population size, some of the lessons needed to be tweaked or modified to accommodate UDL appropriately. It should also be noted that, while the increase in student growth from pre- to post-test could be attributed to the changes made, the authors cannot rule out outside influences such as other classes covering information literacy topics.

Fall 2019 instructors had settled in and were able to go from pilot testing materials to understanding and iterating ways to teach it. While the lesson plans stayed the same, how those lessons were delivered solidified around some best practices. This improvement should be examined in the future to understand how instructor knowledge and comfort with course materials plays a role in pre- and post-test scores. It is also possible that the improvement in the

growth between the pre- and post-test scores were a result of simple variance in the population being studied. A new cohort of ESL students may have had previous knowledge of subject materials, studied more or differently, or had less difficulty adapting to the university setting.

The original intent was to include spring 2020 in the review; however, the COVID-19 pandemic and resulting emergency shift to remote instruction interrupted instruction and was particularly difficult for international students, resulting in unusable data. Changes made to iLab for fully remote ENG 105Z for the fall 2020 and spring 2021 semesters represent another significant stage in the evolution of this embedded information literacy course.

Implications for Future Research

The findings of this case study have implications for academic librarianship not only in the context of IL instruction for NNES undergraduates, but more broadly in improving accessibility and inclusivity in IL instruction and information services to all populations. In practice, the UDL Guidelines are a valuable resource for IL instruction, both in embedded and one-shot contexts, to newly frame or reimagine more inclusive and accessible instruction. Evidence-based methods have the potential to balance the deficits time and knowledge of individual student needs in any classroom into which a librarian is invited. Lowering language and cultural barriers between early undergraduates and IL content—while also creating a more engaging and thereby inviting environment—have the potential to improve not only their research and information use behaviors, but also relationships between the librarian, students and faculty involved. However, with a broader interpretation, other interactions and services academic libraries offer could be opened to students, faculty, and staff alike. Further research into the long-term impact of improved early interactions with international students would provide evidence on retention and continued development semester-to-semester and year-to-year for this demographic. Additionally, with the requisite changes in deployment of the course to fully remote due to the COVID-19 pandemic, an analysis of UDL in entirely online IL instruction would provide guidance for preference and effectiveness in mode of instruction (Fullmer & Strand, 2024; Hays & Handler, 2020). To make progress toward meeting individual, institutional, and professional standards (Association of College & Research Libraries, 2012) and goals, a framework such as UDL is a valuable, evidence-based tool warranting further investigation.

Conclusion

Information literacy is a key component to the UB undergraduate curriculum and provided an opportunity for librarians to develop a semester long lab. For NNES students, it was important to stop and consider if the standard ways of teaching IL were appropriate or if there were opportunities to better assist these students and, in the end all students, with their knowledge and skill acquisition. Using UDL as a guiding principle, the librarians set out to create a learning environment that allowed for increased and varied pathways students could take to learn. Using a pre- and post-test model of evaluation that was built into the course structure, iLab was evaluated before and after the UDL principles were implemented. The results indicated that students could improve their knowledge of information literacy during a 10-week course, and that when UDL was implemented there was a marked improvement in post-test scores. This study's results indicate librarians who work with diverse populations should consider UDL as a possible framework to guide instruction that can positively impact

their students' outcomes. Because the needs of students change, there is value in continuing to evaluate instruction to identify barriers and find new ways to lower them, allowing more students to find their own unique ways to succeed.

Acknowledgment

The authors would like to thank the members of the former Education Services Team at the University at Buffalo: Cindy Ehlers, Bryan Sajecki, Jocelyn Swick-Jemison, Nicole Thomas, Cynthia Tysick, and Tiffany Walsh.

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APPENDIX A

Fall 2017 iLab Assignments and Weighting

Pre Quiz (10%): A brief, mandatory assessment of your knowledge of information skills prior to taking iLab.

Post Quiz (10%): A brief, mandatory assessment of your knowledge of information skills after taking iLab.

8- PreWork Quizzes (10%): After viewing items in indicated weekly folders, you will be quizzed on your knowledge of the content. Submit the day before your iLab class by 11:59pm in Blackboard LMS.

7- Class Participation Assessments/Attendance (CPA) (10%): Assessments of how well you've mastered the material and count as attendance for class that day. Submit by the end of class that day or 11:59pm in Blackboard LMS. Please refer to course schedule for details.

Group Outline (20%): First component of the Group Project. As a group you will outline your chosen topic using the assigned formula in preparation for the Infographic & Works Cited. Submitted by ONE member on behalf of the group in Blackboard LMS.

Group Infographic & Works Cited (20%): Final component of the Group Project. As a group you will create an infographic and accompanying works cited page using information compiled from Group Outline. Submitted by ONE member on behalf of the group in Blackboard LMS.

Individual Outline (20%): You will be crafting a research outline related to one of your final assignments in ENG 105.

APPENDIX B
Fall 2019 iLab Assignments and Weighting

Pre-Test (5%): A brief, mandatory assessment of your knowledge of information skills prior to taking iLab.

Post-Test (5%): A brief, mandatory assessment of your knowledge of information skills after taking iLab.

Quizzes (30%): A brief quiz will be given at the start of each class to see how well you've mastered the material from the videos assigned for the week. (6 total)

Assignments (15%): 3 assignments that tell us how well you've mastered the material and build on the previous week's lesson. Due by 11:59 pm the day of iLab. Please refer to course schedule for details.

Group Project Draft (15%): Draft of the Group Project. Submitted by ONE member on behalf of the group in Blackboard LMS.

Group Project Final (30%): Final component of the Group Project. Submitted by ONE member on behalf of the group in Blackboard LMS.

APPENDIX C
Fall 2019 iLab Schedule

Week	Before Class	Topic(s)	In-class	After Class
3	Go to ENG 105 in Blackboard LMS. Open the iLab tab, click the Week Three folder to watch the videos and get instructions to navigate Group page.	<ul style="list-style-type: none"> The Scholarly Conversation Finding a Known Item 	<ul style="list-style-type: none"> Pre-Test Get into groups Create a shared Google Folder Understand Scholarly Conversation 	<p>Review Group Page Starter Pack. Click the link to your group's TED Talk. Watch this video. Select the appropriate option for Closed Captions and Transcript language. Review your group's Popular and Scholarly sources in the Starter Pack.</p>
4	Go to ENG 105 in Blackboard LMS. Open the iLab tab, click the Week Four folder and watch the weekly videos.	<ul style="list-style-type: none"> Narrow topic using brainstorming Citation styles 	<ul style="list-style-type: none"> Quiz Groups brainstorm Peer review brainstorms Reflect and refine topic Citing sources 	<p>iLab Week 4 Assignment Due in Blackboard LMS by 11:59pm the day of iLab</p>
5	Go to ENG 105 in Blackboard LMS. Open the iLab tab, click the Week Five folder and watch the weekly videos. Review feedback on iLab Week 4 Assignment in Blackboard LMS.	<ul style="list-style-type: none"> Creating search terms What is a database? Identify types of sources 	<ul style="list-style-type: none"> Quiz Keyword practice Basic search <i>Everything</i> Types of sources (popular) Citation practice (newspaper article) 	

APPENDIX C				
Fall 2019 iLab Schedule				
Week	Before Class	Topic(s)	In-class	After Class
6	Go to ENG 105 in Blackboard LMS. Open the iLab tab, click the Week Six folder, and watch the weekly videos.	<ul style="list-style-type: none"> • Creating search strategies using Boolean, truncation, and phrases • Advanced searching in <i>Everything</i> • Revising keywords based on search results 	<ul style="list-style-type: none"> • Quiz • Search strategies • Advanced search <i>Everything</i> using filters • Types of sources (scholarly) • Skimming records • Citation practice (journal article) 	iLab Week 6 Assignment Due in Blackboard LMS by 11:59pm the day of iLab
7	Go to ENG 105 in Blackboard LMS. Open the iLab tab, click the Week Seven folder and watch the weekly videos. Review feedback on iLab Week 6 Assignment in Blackboard LMS.	<ul style="list-style-type: none"> • Advanced searching in <i>Academic Search Complete</i> • Identifying scholarly articles (skimming) • Record parts (title, source, author, volume, year, pages, subjects, abstract) 	<ul style="list-style-type: none"> • Quiz • Basic and advanced search in <i>Academic Search Complete</i> • Identify citation parts of scholarly articles • Skim articles • Citation practice (journal article) 	iLab Week 7 Assignment Due in Blackboard LMS by 11:59pm the day of iLab
8	Go to ENG 105 in Blackboard LMS. Open the iLab tab, click the Week Eight folder and watch the weekly videos. Review feedback on iLab Week 7 Assignment in Blackboard LMS.	<ul style="list-style-type: none"> • Indirect source citations and how to avoid them • Synthesis of information 	<ul style="list-style-type: none"> • Quiz • Identify and read in-text citations • Identify relevant and concise evidence • Revise evidence for each student and the group as a whole 	
9	Go to ENG 105 in Blackboard LMS. Open the iLab tab, click the Week Nine folder and watch the weekly videos.	<ul style="list-style-type: none"> • Copyright and image use • Citing images and 3-point attribution • Group project draft 	<ul style="list-style-type: none"> • Quiz • Review iLab citation Guide (image) • Citation activity (image) • Find an image related to group topic • Work on draft of group project 	iLab Group Project Draft Due in Blackboard LMS as a group submission by one team member by 11:59pm on day of iLab
10	Review feedback on iLab Group Project Draft in Blackboard LMS.	<ul style="list-style-type: none"> • Final group project • Post-test 	<ul style="list-style-type: none"> • Post-test • iLab group project workshop 	iLab Group Project Final Due in Blackboard LMS as a group submission by one team member by 11:59pm on day of iLab

APPENDIX D				
Pre- and Post-Test Questions, 2019				
Question	Answer A	Answer B	Answer C	Answer D
301: The Cycle of Information refers to the order of progression of media coverage of an event in the news. What is the correct order of the Cycle of Information?	Magazine, Newspaper, Books, Scholarly Journals	Newspapers, Magazines, Scholarly Journal, Books	Books, Newspaper, Scholarly Journals, Magazines	Newspapers, Scholarly Journals, Magazines, Books
303: You have been given the following citation: Profen, Ian B. "The Impact of Alcohol on University Students' Ability to Concentrate During Exams." College Students, vol. 38, no. 3, 2004, pp. 30–45. What type of source are you looking for?	a Magazine Article	a Newspaper	a Book Chapter	a Journal article
302: You need to find information on what the current U.S. President said in reaction to a meeting with a foreign prime minister yesterday. The best source for this type of information is:	an academic journal	a book	a newspaper	a magazine
304: Generally speaking, the best place to find a scholarly article is:	Within a library database	The library catalog	In a Google search	Going to the library
305: You are researching the topic of urban decay and stress on communities. Which of the following would help you evaluate the validity of a website you found?	Number of page visits	Graphs and charts	Numbers and statistics	References for the information
901: You are looking up information about college students and their understanding of how to use the library and you find an article. You see that the author provided the following subject headings: What can you use these subject headings for as your further your research?	In expanding your search by using the new words provided	In limiting the search by avoiding all of those words	There is no use for the subject headings; it is required by the author to submit them in order for the article to be published	You can see what the author is interested in

APPENDIX D				
Pre- and Post-Test Questions, 2019				
Question	Answer A	Answer B	Answer C	Answer D
902: When searching in a library database, what words would the keyword stress* find, in addition to just the word stress?	distressed AND distressful AND stressful	stressed AND stressing AND stress-related	tension AND pressure AND strain	stress AND pain AND tension
903: Your professor tells you that you need to include at least three (3) images in your end of the semester presentation. Due to copyright laws, what kinds of images are you able to use?	You can freely use any images you find in a Google image search	You can only use images you take yourself with a camera or other device	You must purchase any images that you wish to use due to copyright	You may use public domain or creative commons licensed images for sharing and reproduction
904: You are writing a paper on a controversial topic and find strong evidence that changes your mind from your original stance. What do you do?	Ignore the evidence and try to support your original stance	Keep your stance and use your personal experience to disprove the evidence	Keep your stance and use your personal experience to disprove the evidence	Compare and contrast each side in a list
905: Can you use all material found on the internet for educational purposes?	Yes. If it's used for education, it's fair game.	No. There may be copyright restrictions.	Yes. As long as I cite the source, I can use anything.	No. I should also pay for the material I need.
401: What is a periodical that has little to no advertising and is peer-reviewed:	An encyclopedia	A dissertation	A scholarly journal	A newspaper
403: The record below is for a scholarly journal article. Where should you look to find a summary of the article's contents?	The Author affiliations	The Abstract	The Subject terms and keywords supplied by the author	The Source information
404: The record below is for a scholarly, peer-reviewed journal article. What is the volume and issue number for this article represented in MLA 8th format?	17 (3)	Vol 17, Issue 3	volume 3, number 17	vol. 17, no. 3

APPENDIX D				
Pre- and Post-Test Questions, 2019				
Question	Answer A	Answer B	Answer C	Answer D
405: Your professor requires you to use at least one scholarly source for your research paper in psychology. Which one of these is a scholarly journal article?	Witt, Joseph C., et al. <i>Assessment of Special Children: Tests and the Problem-Solving Process.</i> Scott/Foresman, 1988.	Smith, T. Recent Studies of Parents' Perceptions of Deceptive Children. <i>Psychology Today</i> , vol. 43, no.5, 2010, pp. 13–16.	Roos af Hjelmsäter, Emma, et al. "Mapping' Deception in Adolescents: Eliciting Cues to Deceit Through an Unanticipated Spatial Drawing Task." <i>Legal & Criminological Psychology</i> , vol. 19, no. 1, Feb. 2014, pp. 179-188. <i>Academic Search Complete</i> , doi:10.1111/j.2044-8333.2012.02068.x. Accessed 10 May 2018.	Jacoby, Jeff. "Right-to-Work Laws Free Workers from Coercive Union Control." <i>Are Unions Still Relevant?</i> , edited by Noah Berlatsky, Greenhaven Press, 2013. At Issue. <i>Opposing Viewpoints In Context</i> . Accessed 10 May 2018. Originally published as "Right-to-Work Laws Stand for Choice," Boston.com , 1 Feb. 2012
406: You find a scholarly journal article that is useful for your research. Where could you look within the article to find a list of resources potentially related to your topic?	the Abstract of the article	the References or works cited the author(s) of the article used	the Article's introduction section	the Subheadings within the article
501: You have been assigned a paper on alternatives to fossil fuels used in North America. You have decided to focus on the use of nuclear power as a possible alternative energy source in Canada. What keywords best describe this particular topic?	Canada AND "alternative energy" AND "nuclear power"	climate AND limitations AND "nuclear power"	effects AND limitations AND "nuclear power"	nuclear power as a possible alternative energy source in Canada

APPENDIX D				
Pre- and Post-Test Questions, 2019				
Question	Answer A	Answer B	Answer C	Answer D
503: You are searching for articles on gender discrimination in the workplace. You searched a library database using the keywords gender, discrimination, and workplace, but got too many results. How would you refine your keywords to get fewer results?	Add more keywords with AND between them	Use broader terms for workplace	Use synonyms for gender	Remove one of your keywords
505: You are using a psychology database to find information about the effect of family relations on teen dating violence. Which combination of keywords should you use in your search?	effect AND family AND "teen dating"	"family relations" AND "dating violence" AND teens	effect AND "dating violence" AND family	teenagers AND dating AND problems
506: Your research question is "How have recent natural disasters in the Philippines affected the mortality rate of infants?"	The database may not have any resources on the topic	This type of information is unavailable because the topic is too recent	There must be an error with your student access to the database articles	The question has not been broken down into searchable keywords
509: While doing research in a database, you search for "body image" AND "eating disorder" and find some great articles about your topic; however, you would like to find more information. What is a good strategy to expand your search within the database?	Use synonyms for your original keywords and add them to your search using OR	Start your search over with new keywords	Filter your results by year	Use synonyms for your original keywords and add them to your search using AND
203: You find a 15-page journal article. Which section of the journal article contains all of the authors' evidence or findings?	Abstract	Discussion/ Results	Methods	Subject headings

APPENDIX D				
Pre- and Post-Test Questions, 2019				
Question	Answer A	Answer B	Answer C	Answer D
204: What can you use to locate specific words in an article, webpage, or document open on a computer?	The Find tool	Google	Bookmark tool	Copy and paste
207: You are researching drug use to see if it leads to depression in adolescents. What resource below is the most authoritative?	An article in Popular Psychology	An article published in The New England Journal of Medicine	The Wikipedia article about Addiction	The website www.drugrehab.com
208: You read some background information on your topic and come up with 3-4 keywords. What should you do with those 3-4 keywords before you begin searching for articles?	Brainstorm possible synonyms for those 3-4 keywords you can use for your search	Pick 1 or 2 keywords that you like best and only use those keywords	You should not be using keywords when searching in a library database	Google each keyword separately to see what kind of results you get and if any of them will work for your research project
209: You are researching stereotypes and television. You search Google using the two topic keywords, where would be the first place you should go to get an overview and background information on the topic?	Wikipedia article about the topic	Journal article in Google scholar about the topic	Book about the topic	A video on YouTube about the topic