

Measuring the Impact of Information Literacy Instruction on Assignment-Level Learning Outcomes

Principal Investigator:

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Year/Semester Awarded:

2017/Spring

Number of undergraduate students in this study:

147

Number of graduate students in this study:

0

Estimated number of student records used in this study:

3,841 for the calculations presented in this report (many more records were used in the preliminary analysis phase)

Please indicate the type(s) of data you are using to conduct your research, placing an X next to each category? Select as many categories as needed to describe your research.

Student Demographics - which includes characteristics such as ethnicity, race, and class standing

Student Preparation - such as transfer credits, prerequisites, curriculum requirements, pre-college classes and remedial educational programs

Student Performance - as understood by course grades, GPA, persistence, retention, engagement indicators and graduation rates

Student Choice - as understood by selection of major, inflection points and pathways toward graduation

Please select the level(s) that your research addresses, placing an X next to each level that applies. Select as many levels as needed to describe your research.

Course Level

Program Level

Institutional Level

Executive Summary

This study uses a rubric-based analysis to evaluate the impact of information literacy instruction on assignment-level learning outcomes. Student assignments were rated on how well they demonstrated four areas of information literacy skill development. These ratings were then used to compare the skill levels of students that had participated in information literacy instruction during their course of study to those that had not. The results of these comparisons demonstrated statistically significant positive differences with large effect sizes in the rubric scores for students who participated in instruction. However, regression models suggested that much of the observed differences were associated principally with student experience (measured by accumulated credits) rather than library instruction.

Narrative

Initial Findings

In 2016, the IUB Libraries conducted a study¹ examining the impact of library information literacy² instruction on in-course grade outcomes. While this study uncovered findings that pointed toward a positive effect of library instruction on student achievement, its analysis was ultimately limited by the difficulty of using grades as a proxy variable for assessing information literacy skill acquisition and by problems with instructor effects acting as a confounding variable.

Because of these problems, this follow-up study utilized a rubric-based research design that assessed the information literacy skills demonstrated by students on course assignments independently of course grades and instructors' evaluations.

Instructors of 9 courses in SPEA, Biology, and Business agreed to participate in this study, and consent to obtain and analyze course assignments was obtained from 318 students. However, only 6 of these courses (BIOL-L319, BIOL-S318, BIOT-T322, SPEA-S161 (2 Sections), & SPEA-V-160) ultimately included assignments that were appropriate for a rubric-based approach to information literacy evaluation, yielding 147 assignment artifacts. 5 courses were taught in Fall 2016 and one in Spring 2017.

A rubric was developed to evaluate the information literacy skills demonstrated in student assignments in four areas: support of problem analysis (criterion A), evidence-based solution or recommendation (criterion B), appropriate sources (criterion C), and multiple perspectives (criterion D) (See Appendix A). The rubric was normed by a team of instructional librarians using 5 example artifacts. 4 raters then individually scored the assignment artifacts in each of the information literacy skill criteria using a 3-point scale.

The internal consistency of the rubric was evaluated using Cronbach's alpha calculated with the sum of the ratings in each of four criteria. This result ($\alpha = .878$) indicated a good level consistency across the

¹ This study was conducted as part of the 2016 Student Learning Analytic Fellows program. The final report is available at <https://scholarworks.iu.edu/dspace/handle/2022/21277>

² Information literacy is defined as the set of abilities required for individuals to recognize when information is needed, and to locate, evaluate, and effectively use the required information.

criteria, providing a fairly high level of confidence that the rubric criteria measure a common information literacy construct.

Interrater reliability measures (Table 1) were calculated for scores in each criterion for the full dataset and for each course using interclass correlation (ICC (2,4) (two-way random, consistency)). While the raters achieved good (defined as above 0.60) scoring consistency overall, consistency within individual course assignments was no higher than fair, and often indicated poor or no agreement (below .40; negative values). These ICC results indicate that the rubric scores are most useful for making aggregate comparisons across the study population rather than course-by-course comparisons. However, the low ICC scores at the course level also suggest that the rubric’s current evaluation criteria may be difficult to apply appropriately to some assignments and may need revision. This problem is intensified by the relatively small number of assignment artifacts available for evaluation in several of the courses.

	Overall	BIOL-L319	BIOL-S318	BIOT-T322	SPEA-V160	SPEA-V161-13685	SPEA-V161-14466
Criterion A	0.724	-0.724	0.429	0.315	0.575	-1.2	0.732
Criterion B	0.64	0.415	0.446	-0.275	0.482	0.519	0.356
Criterion C	0.605	0.407	0.511	0.748	0.568	0.462	0.605
Criterion D	0.592	0.09	0.234	0.553	0.48	N/A	0.45

Table 1: Interclass correlation results (ICC (2,4)) for rubric ratings in the four information literacy criteria.

In order to evaluate the effect of library instruction on information literacy skills, Independent samples t-tests comparing the mean scores for students who were enrolled in previous or concurrent courses that included library instruction (none of the courses analyzed had library instruction) (Table 2). These tests showed a statistically significant increase in the mean score in criteria A, B, and C ($p < .001$) and all criteria combined ($p = .001$) with large effect sizes (measured by Cohen’s D).

		N	Mean	Std. Deviation	t-test	Cohen's D
Criterion A	Had library instruction	37	2.4865	0.29431	p < .001	1.049252
	Did not have library instruction	107	2.0280	0.54332		
Criterion B	Had library instruction	37	2.4662	0.32894	p < .001	0.872922
	Did not have library instruction	107	2.1379	0.41810		
Criterion C	Had library instruction	37	2.7432	0.23926	p < .001	0.907314
	Did not have library instruction	107	2.4393	0.40898		
Criterion D	Had library instruction	37	2.2500	0.40397	p = .144	0.289664
	Did not have library instruction	107	2.1238	0.46502		
Total of all scores	Had library instruction	37	9.9459	0.91122	p < .001	0.9324
	Did not have library instruction	107	8.7290	1.60524		

Table 2: Independent samples t-test results and effect sizes comparing the results of students who had instruction to those who did not in each information literacy criterion.

A stepwise linear regression was next conducted (Table 3) to assess the contribution of library instruction to the observed variation in the rubric scores. Using total accumulated credits, cumulative GPA, and participation in library instruction sessions as input variables, the regression model showed that credit hours were most predictive of the total information literacy rubric score. While GPA and participation in library instruction were positively correlated to the total rubric score, their contribution to the variability explained by the regression model was negligible.

Table 3: Results of regression models evaluating the contributions of cumulative GPA, and participation in library instruction sessions to the observed variation in rubric scores.

Regression Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.581 ^a	0.338	0.324	1.27516
2	.580 ^b	0.337	0.327	1.27168
3	.577 ^c	0.333	0.328	1.27078
a. Predictors: (Constant), Credit Hours, GPA, Library Instruction				
b. Predictors: (Constant), Credit Hours, Library Instruction				
c. Predictors: (Constant), Credit Hours				

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.623	0.395		19.298	0.000
	Library Instruction	0.283	0.290	0.080	0.978	0.330
	GPA	-0.070	0.146	-0.035	-0.482	0.631
	Credit Hours	0.019	0.003	0.545	6.806	0.000
2	(Constant)	7.466	0.223		33.550	0.000
	Library Instruction	0.251	0.281	0.071	0.893	0.373
	Credit Hours	0.019	0.003	0.541	6.811	0.000
3	(Constant)	7.430	0.219		33.963	0.000
	Credit Hours	0.020	0.002	0.577	8.418	0.000

a. Dependent Variable: Total Rubric Score

Correlations					
		Library Instruction	GPA	Credit Hours	Total Rubric Score
Library Instruction	Pearson Correlation	1	.317**	.505**	.344**
	Sig. (2-tailed)		0.000	0.000	0.000
	N	144	144	144	144
GPA	Pearson Correlation	.317**	1	.244**	0.123
	Sig. (2-tailed)	0.000		0.003	0.141
	N	144	144	144	144
Credit Hours	Pearson Correlation	.505**	.244**	1	.577**
	Sig. (2-tailed)	0.000	0.003		0.000
	N	144	144	144	144
Total Rubric Score	Pearson Correlation	.344**	0.123	.577**	1
	Sig. (2-tailed)	0.000	0.141	0.000	
	N	144	144	144	144

** . Correlation is significant at the 0.01 level (2-tailed).

Based on these analyses, it appears that while participation in library instruction contributes to information literacy acquisition, students' overall level of academic experience is a much greater predictor of these skills. This is perhaps not a surprising finding given that library instructional interventions are often relatively brief and focused, and that the wide range of skills necessary to information literacy development are addressed by courses throughout the curriculum. The relatively weak association observed between GPA and the information literacy rubric scores further supports the argument that grade-based measures are a poor proxy for assessing skill development, and indicates that further refinement of artifact-based methods similar to this study design will improve this approach to information literacy evaluation and may be more broadly applicable to other skill-focused assessments.

Reflections about the LAF Process

This study was the first attempt by the IUB libraries to assess the impact of information literacy instruction independently from course grades and using evidence provided directly from student assignment outcomes. While the difficulties in achieving sufficiently high interrater reliability levels suggest that additional procedural and methodological work is necessary to improve the rubric evaluation tools, the significantly higher scores achieved by students who participated in library instruction demonstrate the efficacy of the approach, in particular the use of assignment-level artifacts rather than more general measures of student success (such as in-course or overall GPA) in measuring information literacy skills. This study therefore provides a useful proof-of-concept and research model

for incorporating rubric-based information literacy analyses into the Libraries' learning analytics investigations.

Because of the large number of courses that participate in the Libraries' information literacy instruction programs and the need to consider a student's entire course enrollment to determine if they received instruction, the dataset required to compute the instruction and GPA variables amounts to essentially IUB's entire enrollment records over approximately 4 years. Combined with the multiple table structure of the learning analytics datasets, this volume of data made the process of disaggregating students and writing calculation formulas more difficult and time consuming than expected. This data structure also makes evaluations based on the point during a student's course of study when they received instruction quite difficult, and resulted in this study not completing an analysis of the effectiveness of instructional timing as originally planned.

An additional problem with the data format used in this study is a lack of specificity or differentiation in the library instruction variable. This study treated all library instruction as the same, while in practice there is a fairly wide range of instructional interventions and intensities. Future studies should consider developing a rating system that allows more fine-grained evaluation of different types or approaches to instructional interventions or limiting the analysis to curricula in which the specifics of instructional interventions are known.

Changes Undertaken, Connections to the Field, and Disseminating the Findings

Given the problematic ICC results for the scoring rubric at the course level and the lack of predictive power of the library instruction variable in the regression models, it is likely premature to recommend specific curricular changes at this time. However, the large differences in information literacy performance observed between the instruction and non-instruction student groups support the efficacy of the Libraries' information literacy instruction and further development in the methods and models used in this study may yield more conclusive results in this area. The Libraries' assessment department will continue to track instruction and collect examples of student assignment artifacts on an ongoing basis in order to expand this dataset, and these analyses will be updated as additional data becomes available. Building multi-year datasets will also enable a more rigorous evaluation of the potential effect of library instruction over time and at different points in a student's course of study.

In addition to expanding the dataset used in this study, I plan to conduct a study in collaboration with the English Department in AY 2017-2018 that uses a similar methodological approach to examine information literacy development of students enrolled in English W131 multilingual.

The results of this study will be shared with instructional librarians and with IUB Libraries' administration, and will also be used in outreach to faculty members while planning library course instruction and setting instructional goals.

The full dataset and SPSS syntax files of this analysis can be made available for reuse by other Learning Analytics Fellows.

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Appendix A

Information Literacy Skills Evaluation Rubric

Criterion:	[Unsatisfactory]=1	[Needs Work]=2	[Satisfactory]=3
A. Support of Problem Analysis	(Case data and) background research is missing; absence of citations.	With a few exceptions, analysis is informed by (case data and) background research as indicated by the presence of citations.	Analysis is clearly and consistently informed by (case data and) background research as indicated by the presence of citations.
B. Evidence-based Solution or Recommendation	Solution or recommendation is not explicitly stated and/or evidence from problem analysis and secondary sources is not relevant or is missing.	Solution or recommendation is stated but not consistently supported by evidence from the problem analysis and secondary sources.	Solution or recommendation is stated and consistently supported by evidence from problem analysis and secondary sources.
C. Appropriate sources	Sources are not appropriate for the assignment.	Some sources are appropriate (authority, purpose, currency, bias, and/or audience)	All sources are appropriate (authority, purpose, currency, bias, and/or audience)
D. Multiple Perspectives	Does not include counterarguments, criticisms, or alternate hypotheses.	Includes counterarguments, criticisms, or alternate hypotheses but they are not clearly and consistently supported by appropriate sources.	Includes counterarguments, criticisms, or alternate hypotheses and they are clearly and consistently supported by appropriate sources.