ASSESSMENT

Assessing an Iterative Method for Improving Undergraduate Student Literature Reviews

Karen M. Travis, Priscilla Cooke St. Clair,
Pacific Lutheran University

Abstract

Many undergraduate research capstones require research papers that include a literature review. This study assessed whether modifications made to teaching of a literature review resulted in significant changes to quantified measures of assessment. Literature reviews in the final economics capstone research papers of 212 students from the 2005–2016 period were examined. Results showed that a mandatory graded requirement of incorporating a summary first paragraph was significantly more effective than recommending that students write this paragraph. There was a statistically significant increase associated with both the number of references and total number of paragraphs with a minimum of two scholarly citations. Results demonstrated the general effectiveness of continuous updating of assignments and activities based on student feedback and instructor experience.

Keywords: *assessment, capstone, literature review, undergraduate research*

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Many disciplines have undergraduate research capstones that require research papers. Including a literature review in the final research paper is a common component, since it is an important part of the scholarly research process (Boote and Beile 2005, 3). As such, the literature review component provides a useful illustration of how a program can design aspects of its research capstone course to improve outcomes for specific learning objectives. A good literature review requires specific skills (e.g., searching literature databases) and higher order reasoning, which can be aided by structuring activities and providing specific guidance to improve areas where students are seen to struggle. This article presents a detailed example and assessment of how an undergraduate research capstone was adjusted over time to facilitate specific learning objectives related to the literature review component of students' final research papers.

Literature Review

Although specific goals of undergraduate research capstone courses may vary both across and within specific academic disciplines, a common feature is requiring students to engage substantively with discipline-specific scholarly literature related to their research projects. More specifically, research capstones and research methods courses from a variety of disciplines may require students to write a literature review as a component of a research paper or research proposal, e.g., chemistry (Schepmann and Hughes 2006); sociology, psychology, and anthropology (Hauhart and Grahe 2010, 2012; McKinney and Busher 2011; Orr 2014); economics (McGoldrick 2008a, 2008b); and criminology (Rudes et al. 2014; Portillo et al. 2013). These are usually similar in that they involve a process of identifying, obtaining, understanding, and synthesizing multiple research articles specifically as they relate to a student's research topic.

This literature review process is usually quite challenging for students. Schepmann and Hughes note that students "had difficulty searching the chemical literature, identifying key articles, and determining and interpreting the central ideas of the articles," prompting their department to institute two 1-credit courses before the capstone to help students with finding and interpreting appropriate

literature and writing a research proposal that includes a literature review (2006, 1024). Portillo and colleagues note that students needed substantial help distinguishing between the literature review and the findings section that analyzes evidence, and at the end of the course still had difficulty understanding how each of these sections fit into the research process (2013, 10). With regard to the final research paper in the capstone, McKinney and Busher find that the introduction/literature review and the discussion/conclusion sections scored the lowest on their evaluation of student final papers from multiple sociology capstone sections at two universities. They note that these sections required the most "individualized, original, and innovative thinking and writing" (2011, 299). The papers scored highest in areas that were the most structured, such as formatting (299).

Although it may be possible to help students with the challenging aspects of writing a good literature review by lengthening the capstone to two semesters or instituting a course students must take before their capstone research (Danowitz et al. 2016; Schepmann and Hughes 2006), many programs work within the confines of having one capstone research course (e.g., McKinney and Busher 2011; Portillo et al. 2013). In this case, programs may still structure assignments and class activities to help students with difficult aspects of the literature review. The aspects of the literature review production process with which students need the most structured guidance will likely vary depending on the program and students' prior coursework. It is hypothesized that even if a student can understand and summarize a particular research article, it is still a big step to understand multiple articles and synthesize them into a coherent literature review pertinent to an individual's particular research. The synthesis task is particularly challenging and may require pedagogical tools focused on this particular aspect of the literature review (e.g., Fitzpatrick, Mayer, and Sherman 2016, 3–4)

An Economics Research Capstone and Its Learning Objectives

The undergraduate research capstone course in the economics department at Pacific Lutheran University (PLU) is a one-semester course for fourth-year economics majors in which students choose their own individual research questions. The course is typically small, with anywhere from 4 to 24 students in a section. The department offers one or two sections per year. Student topic selection is only constrained by the requirements that the student has taken a relevant upper-level economics class and that a topic-appropriate economics faculty mentor is available. For example, a student wishing to research the effects of changes to the minimum wage on teenage unemployment should have had an upper-level class in labor economics and have a mentor who is a labor economist. The capstone course has a lead instructor who guides and evaluates student work. Students also work with their respective faculty mentors, particularly with regard to narrowing their research question, finding a theoretical approach, and finding relevant literature. This arrangement allows the capstone course to be taught by any faculty member of in the department. In this case, three instructors have taught the capstone since the course's inception in 2003. The products of the course are a full research paper that includes an introduction, literature review, theoretical and/or statistical model, results, discussion, and conclusion, as well as a research presentation to students and faculty. Assignments in the capstone are structured to build to the final complete research paper: introduction, literature review, theoretical model section, first full draft, and final draft. The literature review is a major assignment in this progression.

There are several learning objectives for the literature review:

(1) Find and collect scholarly articles pertinent to the research topic.
(2) Understand major questions and results within selected literature.
(3) Formulate several overriding themes relevant to the topic.
(4) Compare and contrast contributions of pertinent articles within each theme.
(5) Demonstrate higher order synthesis in the written form.
(6) Improve quality and integrity of writing through revision.

Learning objectives 1 and 2 relate to finding and understanding relevant scholarly literature. For scholarly literature, peer-reviewed academic journal articles are emphasized. Learning objectives 3 through 5 relate to synthesis of information from multiple articles. Learning objective 6 relates to grammar, writing skills, and proper citation.

Over many years of running this capstone, synthesis has been found to be the most challenging aspect of the literature review for students. Although the learning objectives for the literature review have not changed over time, activities and specific guidance to students have been designed to improve outcomes, particularly for learning objectives 3 through 5. These adjustments have occurred in an iterative fashion over time, allowing evaluation of their impact on student outcomes. This article focuses on methods for assessing learning objectives 1, 3, and 5.

Changes to Pedagogy and Requirements

The department's economic research capstone class began in 2003. Pedagogical methods related to the literature review have evolved incrementally over time. In-class exercises or detailed written descriptions of each individual graded component were added, such as requiring a

first paragraph that identified the themes of the student's literature review. In general, the adjustments have provided more suggestions, information, and examples; more hands-on practice in class; and more graded components of the literature review. Since 2003, the course instructor has explained how to do the literature review in class, met individually with students, and provided qualitative feedback on the first draft of the literature review component.

Prior to fall 2008, students were expected to include a literature review in their first draft and subsequent final draft. However, there was no separate literature-review assignment. Instruction on how to write the literature review was provided by the instructor in class and in meetings with students, and comments were given on the first draft to help students improve their final draft. In fall 2008, after the consistently poor quality of literature reviews was noted, a separate literature review assignment was added that provided specific written guidelines. This assignment has typically been worth 10 to 20 percent of the final course grade. Approximately three weeks of a 13-week semester is devoted to student work on the literature review. This includes in-class time and out-of-class time, when students are expected to work independently and meet with the course instructor. Also, students were explicitly warned in the literature review assignment and in class that they could at best receive a score of 50 percent on the assignment if they wrote the literature review describing the literature article by article rather than by organizing paragraphs by theme. This step was implemented after it was observed that students had difficulty understanding the development of themes and synthesizing literature; too many students were writing a "laundry list" of article-by-article paragraphs.

Subsequent to fall 2008, the literature review guidance provided in written form and discussed in class was updated iteratively to address particular problems such as emphasizing the use of multiple articles to support a particular point. Examples of past student literature reviews with instructor comments also were provided for student reference. These changes all provided further examples and information to students to assist in their understanding of expectations related to both form and quality.

Anew graded component to the literature review assignment also was added. In spring 2009, it was recommended in the "Literature Review Guidelines" that students include an initial paragraph in their literature review that summarized the themes identified. This was meant to encourage students to identify and use themes to organize their literature review. For example, for the research topic "Is student loan default rational?" themes included characteristics of borrowers, trends in debt levels, impact of loan modifications, factors associated with default for home loan borrowers, and rationality in economics. The summary first paragraph was made an official graded component in capstone courses taught fall 2011–fall 2013 and in 2016, but it was only recommended and not graded in course offerings at other times.

Beginning in spring 2011, class activities designed to give students practice identifying themes and matching literature to themes were added. These activities varied by instructor. One example was a small-group class exercise in which students worked together to develop appropriate themes for each group member's topic. A sample of one in-class activity can be found in Table 1. In later periods, an initial discussion on the date the literature review was assigned as well as the opportunity for one-on-one appointments with the instructor were retained. The significant change was adding in-class activities to assist with theme development. Previously, students had met fewer times with the class and instead worked individually in the library with the instructor available as needed. By adding the in-class activity, students performed some of the individual work in the form of a group or partner activity with instructor assistance. Between spring 2011 and the fall 2016, there were either one, two, or three theme-related in-class activities, depending on the year and the individual teaching the course. Activities were added over time.

Quantitative Measures of Assessment

For the analysis, all students in the economics undergraduate research capstone between 2005 and 2016 were considered (n = 212). Analysis was performed of the literature reviews in their final draft, which had undergone one revision in response to the instructor's comments (for example, comments related to improving themes or article synthesis). To assess the effect of pedagogical adjustments in the capstone, four salient measures of student outcomes related to several literature review objectives were identified. These were quantitative measures that had the advantages of ease and low cost, an objective nature, and an ability to correlate with the outcomes of interest. Although other, more subjective qualitative measures were envisioned, these quantitative measures were less likely to be biased and more likely to be consistently replicable across time and across students with different research topics. Although qualitative feedback was important for the students, the goal was to identify simple, objective measures that allowed identification of valuable trends for assessment. The quantitative measures used, however, were clearly conditioned on the structure of the course, in which students were provided literature review instruction and guidance in a variety of ways, including qualitative feedback. The measures should not be interpreted as checklist items for students to achieve.

For the first measure, the number of economics peer-reviewed citations (JNL) within the student's literature

TABLE 1. Sample In-Class Exercise

Before class:
Bring to class a set of journal articles related to research topic to develop an appropriate list of literature review themes.
In class:
Work with your assigned partner to explain your topic/question. Use your abstracts to work through the following steps:
Generating a list of themes:
1. For each abstract, explain to your partner why you have chosen this paper and how you think it relates overall to your question/topic. The partner listening should record keywords or topics they are identifying that explain how the paper relates to your topic. 2. Do this for each paper (as time allows).
Reviewing the list of themes for refinement:
1. Once you have gone through the papers, **look over your partner's notes** to review the themes. Add any that you have already thought of but are unsure about. 2. After completing, discuss topics or ideas that are **"stragglers"** because they don't fit with the themes you've written so far but may not be enough for their own theme. For these stragglers, discuss whether they should be excluded or generate a new theme for which you need other papers to accompany this topic. 3. Examine the list of themes and discuss the ones that appear **too broad** because they are likely to yield too many unrelated papers. Discuss how to narrow these themes. 4. Identify (if you can) what themes might be **too narrow** and yield only one paper. Can you broaden this theme? 5. Consider the possibility of "holes" or **missing themes** that relate to the original question but don't seem to be showing up in any of the papers you've found so far. 6. For all themes without enough literature in hand, **identify the keyword searches** to do in EconLit to find relevant papers to include.
Organization of themes (if time allows):
1. Discuss the **possible arrangement** of your themes. Is there a good sequence? Should one theme actually be embedded into another? 2. Formulate the skeleton of an outline within which you may fill **"buckets"** with literature and sources.
Extracting background from the literature review:
1. Identify what information is background and should be placed into the introduction of your paper. Examples could include legal rulings or historical information. 2. Make notes on the ideas to exclude from the literature review.

review was counted. To be included in this count, the source cited also had to be accurately included in the references. This variable was a measure of learning objective 1, finding and collecting relevant scholarly sources. It also was related to learning objective 6, reflecting the integrity of student writing as only accurately cited references were counted.

Second, the number of paragraphs (PARA) within the literature review that contained a minimum of two peer-reviewed sources (from any discipline) with proper citation was totaled. This gave an objective measure of learning objective 5, demonstrating synthesis of the literature in written form. It was assumed that the content of the paragraph could not reflect any theme or synthesis of the literature if it only contained one citation. Although having at least two citations did not guarantee that a paragraph contained substantial synthesis, in the context of the course (particularly given qualitative feedback on the first literature review draft), this measure was positively correlated with more synthesis. It was found that students with more paragraphs with at least two citations tended to

have a more comprehensive discussion of the literature. A count also was performed on the final draft of the literature review. This meant that the student had received instructor comments regarding the removal of irrelevant citations prior to submission of the final draft. The proportion analysis of properly cited paragraphs was not used, as it was found that students with short and poorly written literature reviews might have a higher proportion of properly cited paragraphs, such as two of two paragraphs, or 100 percent. In contrast, a student with 10 total paragraphs and nine with multiple references properly cited would have a 90 percent score.

The third outcome variable was a binary variable indicating whether or not a student's literature review had a summary first paragraph that identified the student's literature review themes (SUMPARA). If a student's final paper had such a summary paragraph with identifiable themes, this variable equaled 1. If there was an introductory paragraph without identifiable themes or no introductory paragraph, the variable equaled 0. As previously discussed, this summary paragraph was intended to help students focus on organizing the literature review by theme and to achieve learning objective 3 (formulating several overriding themes). This binary variable did not measure the quality of the student's themes, but it did capture whether they had identified any.

The fourth outcome variable also was binary (NOART). In assessing the 212 literature reviews, papers received a score of 1 if the literature review was not organized in an article-by-article fashion. If the literature review included several paragraphs that each discussed only one specific study, it was scored as 0. Although some literature review assignments in other courses or institutions might have the format of an annotated bibliography, students were discouraged from following that particular format. As such, papers with 1 met a minimum standard of synthesis, whereas those receiving a 0 did not. NOART was used to assess learning objective 5 (demonstrating synthesis of the literature in written form). Although it did not give a qualitative indication of the degree of synthesis achieved by a student, it was positively correlated with achieving some amount of synthesis and allowed identification of an important trend.

Quantitative Measures of Pedagogical Changes

Although there were numerous small adjustments to the program over the years, as previously explained, three modifications allowed assessment of the impact of the change on the four literature outcome variables. To characterize these, the syllabus for each of the semesters in which the course was taught was carefully reviewed, so that the changes made in each semester could be quantified. These variables were used to test the statistical significance of the impact of these changes.

The first pedagogical change variable was a binary variable for the semesters in which the literature review was a separately graded assignment rather than part of a more complete draft. This began in fall 2008, along with the maximum 50-percent score penalty. Recall that this penalty was associated with the student presenting the literature in article-by-article format and failing to synthesize articles and organize the review around themes. Students before fall 2008 were assigned a 1, with all of those following assigned a 0 (NOART) to assess the impact of these changes, although it was not possible to ascertain whether the change in the assignment or the imposition of the penalty was the direct cause of a change in the quality of student papers.

A second measure of pedagogical change was made by documenting the semesters in which a summary paragraph that included clearly identifiable literature review themes was mandatory (2011–2013, spring 2014, and 2016) and those in which it was not (2005–2008, fall 2014, and fall 2015). In other semesters, it was found that a summary paragraph was encouraged by the instructor, although it was not an explicitly graded component (2009–2011).

Finally, the number of in-class activities pertaining to theme development was measured. The syllabi and curricular components were searched to determine the number of student activities during each semester. In some early semesters, the development of themes was addressed by the instructor in one class period and there were no theme-related class activities (2005–fall 2010). During later periods, class activities related to theme development were used. In some terms, one class activity was included (spring 2011–spring 2013, fall 2014, and spring 2015); in others, two activities were included (fall 2013 and spring 2014); and in one term three were included (fall 2016). For each possible number of activities, 0–1 indicator variables were used (e.g., if there was one activity, ACTIVITIES1 = 1, and 0 otherwise). These variables were used to investigate the relationship between the various levels of class time interaction and student outcomes. Notably, activities did not increase uniformly over time, allowing better discernment of their effectiveness.

Learning Outcome Measures

There is descriptive evidence that adjustments have improved student outcomes over time. Figure 1 plots semester course averages of the JNL and PARA variables over the span of capstone course offerings from 2005 to 2016. "Average Journal Articles" is the average number of economics peer-reviewed citations by students in each semester's capstone course. "Average Cited Paragraphs" is the average number of paragraphs with a minimum of two peer-reviewed article citations by students during each semester. Notably, the mean number of paragraphs with sufficient sources as well as the mean number of journal

articles per student trended upward, as can be seen in Figure 1. This generally corresponded positively with the cumulative addition of modifications meant to improve students' literature reviews.

The proportion of students in each class that had included a first summary paragraph with themes in the literature review was calculated (% first paragraph). In addition, the proportion of the class overall in each semester that had successfully organized the literature review in a thematic fashion was determined (% No Article-by-Article). A plot of these data over time is shown in Figure 2.

Figure 2 shows that in later years, a larger proportion of the class was writing the literature review in the proper form, without an article-by-article format. In addition, with the exception of 2014 and 2015, the proportion of the class including a summary paragraph also was higher in later periods. A formal test of the changes to these outcome variables is discussed later; however, it appears

FIGURE 1. Average Number of Journal Articles and Properly Cited Paragraphs per Student

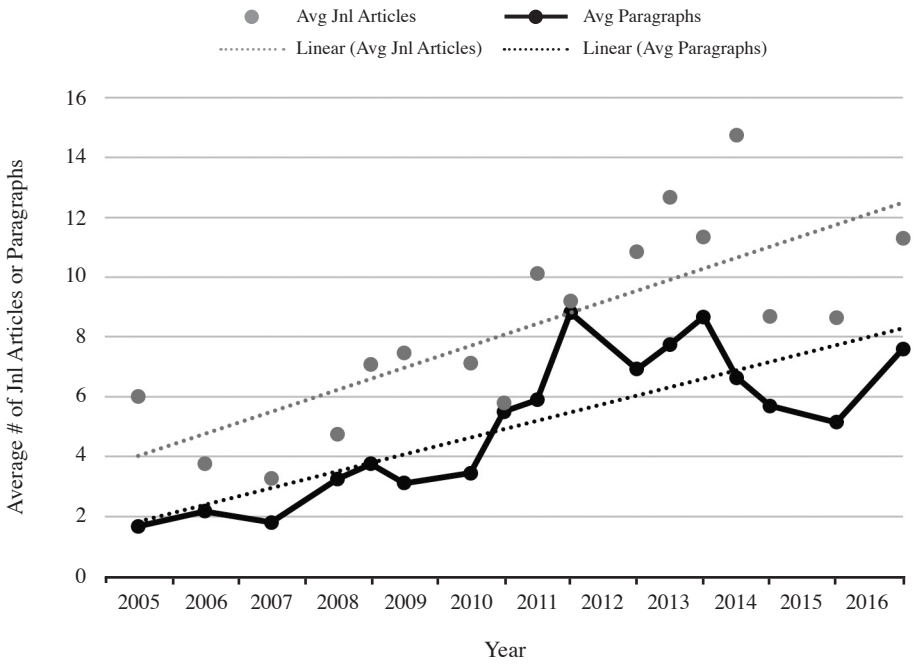
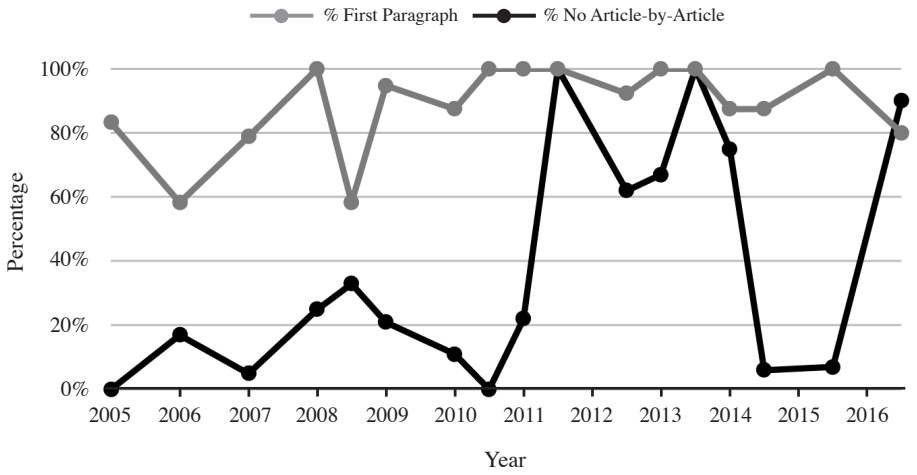


FIGURE 2. Percentage of the Class Achieving Benchmarks



that recommending but not requiring a first paragraph that identifies themes is generally ineffective.

Regression Results

To assess more formally whether student performance had improved because of the pedagogical changes, two multiple regressions were done. For the first, individual student data on the number of economics journal articles included in the literature review (JNL) was used as the dependent variable. For explanatory variables, a student's individual cumulative GPA at graduation was used to control for student quality. Also included were indicator variables for sex and white versus nonwhite to control for potential differences unrelated to the pedagogical changes. Due to very small numbers of nonwhite students, they were not separated into smaller categories by race/ethnicity. Measures of various pedagogical changes also were incorporated, such as indicator variables for whether there were zero, one, two, or three in-class activities for theme development. A time-trend was included to control for any average annual change not attributed to other factors. Also included was an indicator variable beginning the year the 50- percent maximum score penalty and the separately graded literature review were added. Two indicator variables were included to control for the three different instructors. Finally, the same explanatory variables were used when the dependent variable was the individual number of paragraphs with sufficient citations (PARA). The regression results are summarized in Table 2.

As expected, those students with higher academic ability as captured by cumulative GPA had significantly higher numbers of journal articles and sufficiently cited paragraphs (p-value < 0.01). In the case of journal articles, for each increase in the GPA the student had an average of 2.54 more journal articles and 2.24 more sufficiently cited paragraphs in the literature review. The time-trend (YEAR) was not statistically significant in either regression. Other control variables for sex and white/nonwhite were not significant in either regression. Indicator variables to control for instructor were insignificant in the regression for journal articles. In the regression for the number of sufficiently cited paragraphs, one indicator variable for an instructor was slightly statistically significant (p-value < 0.10).

TABLE 2. Regression Results

	Expected sign	No. of journal articles per student	No. of cited paragraphs per student
Student GPA	+	2.54 (0.001)	2.24 (0.000)
Year	+	-0.234 (0.488)	-0.108 (0.611)
1 class activity	+	3.63 (0.037)	2.39 (0.030)
2 class activities	+	6.27 (0.008)	2.53 (0.089)
3 class activities	+	4.78 (0.123)	3.83 (0.051)
50% max/separate assignment	+	3.32 (.017)	2.29 (0.009)
Female student		-0.452 (.508)	-0.489 (0.257)
Nonwhite student		0.739 (0.466)	0.053 (0.935)
Instructor no. 1		1.65 (0.123)	-1.42 (0.062)
Instructor no. 2		0.031 (0.979)	-0.973 (0.15)
Number of observations		212	212
Adjusted R-squared		0.281	0.371
F-stat		9.26	13.42

Note: Each cell entry is the unstandardized regression coefficient with the p-value in parentheses.

The indicator variables were used to assess the impact of adding in-class activities designed to teach theme development. For each semester, students were assigned an indicator variable for having one, two, or three in-class activities. The semesters with no in-class activity were measured by the constant. For example, a coefficient of 3.63 (p = 0.037) indicates that, when compared to no activities, adding one activity increased the number of economics journal articles included by 3.63 on average. Similarly, having two activities increased it by 6.27 (p = 0.008), and three activities increased it by 4.78 (p = 0.123). The exact reasons for the size of the coefficients could not be distinguished, since these exercises were not always identical. However, the first two of these indicators show a statistically significant positive impact of more in-class exercises on the overall number of economics journals cited. The indicator for the third activity was not statistically significant. The indicator for the time period after the 50-percent score and separate assignment were imposed also was highly significant (p = 0.017). The improvement associated with this change was 3.32 more economics journals included with references than previously.

In the regression with the number of sufficiently cited paragraphs as the dependent variable, the same explanatory variables were incorporated. The student GPA was positive and highly significant (p = 0.000), whereas the time-trend was not (p = 0.611). Indicator variables showed that, for one in-class activity, the number of sufficiently cited paragraphs increased by 2.39 (p = 0.030). For two activities, an improvement of 2.53 sufficiently cited paragraphs was estimated (p = 0.089), and three activities showed an increase of 3.83 (p = 0.051). Each of these indicators showed a statistically significant positive impact of more in-class exercises on the overall number of paragraphs with at least two citations. The indicator for the time period following institution of the 50-percent score and separate assignment also was highly significant (p = 0.009). The improvement associated with this was 2.29 more sufficiently cited paragraphs than previously.

Other Outcome Variables

Difference in proportion tests were performed on the requirement of a summary first paragraph. Using student level data, all semesters in which the summary was recommended only were compared to those semesters in which it was explicitly required and graded. The proportion of literature reviews that included a summary first paragraph when it was a graded requirement (n = 65) was 81.5 percent. When it was recommended, only 11.9 percent included one (n = 42). Assessment was not done of periods when the summary paragraph was neither required nor suggested. In this case, 14.8 percent of literature reviews included one (n = 96). The difference in proportions comparison indicated that when it was required rather than merely recommended significantly more reviews included the summary paragraph (p = 0.000, Z = 5.82). However, performing the same test to compare recommending the summary paragraph with no recommendation or encouragement revealed no statistically significant difference (p = 0.4437, Z = 0.142). Students generally did not include this first paragraph with identified themes unless it was a graded requirement.

Also examined was the proportion of the students who successfully complied with an organizational structure built on themes rather than presenting their review in an article-by-article format. In particular, the goal was to determine whether a significant shift occurred in fall 2008, when both separate grading of the literature review and the 50-percent maximum score penalty were implemented. Using the outcome variable NOART from the review of final papers, it was found that, despite faculty explanations in class, prior to fall 2008 23.8 percent of students continued to write the final drafts of their literature reviews in an article-by-article fashion (n = 42). After implementation of these two changes, only 10.7 percent of students continued to write their literature reviews in this way (n = 169). Using a difference in proportions test, the proportion abiding by the thematic approach was statistically significantly higher after these changes (p = 0.0122).

Discussion

This analysis sought to discern the answers to two important questions: (1) Have the changes made gradually over time to guide students in writing better literature reviews been effective? and (2) Can we detect significant effects of particular changes on student learning outcomes? It is evident from this sample of economics majors that the answer to both of these questions is yes. These results provide several useful takeaways.

The results support that students respond to focused and graded assignments (summary paragraph and 50-percent grading). It appears that modifying graded assignments can induce students to improve, with the graded component providing an incentive. These, of course, should not simply be standalone, checklist items but part of the overall pedagogical structure of the course. Importantly, it has been shown that it is possible to incorporate an incentive into particular components even if the ultimate learning objective involves higher order reasoning (i.e., a summary paragraph that requires students to articulate identifiable themes for a literature review). Such a graded assignment may require thoughtful crafting in an effort to achieve a particular learning objective, but its implementation does not have to be complicated.

These results also show that focused, outcome-specific in-class activities are a good way to improve student achievement of targeted learning objectives. This is true even if verbal explanations by the instructor, one-on-one

appointments, written guidelines, and posted examples have already been provided. The evidence suggests that repetition provides additional improvement even when activities are not identical within or across courses. Findings show that having two in-class activities provides a bigger improvement in outcomes than having only one, but it is clearly better to provide one than none.

Although the pedagogical components of this example may be useful to others, there is a broader usefulness in the overarching method employed to improve student outcomes over time. This method may be applied to many majors and other assignments with synthesis as a learning objective. This study's results demonstrate the usefulness of a trial-and-error approach with response to feedback when creating curricular requirements. Each change made, including of additional handouts, more class activities, imposing a significant penalty for a one–by-one format, was formed in response to examination of assignments that were below expectations during prior semesters. Input also was provided through discussions with students about how and why they were struggling. By incorporating this feedback into the next class's curriculum, teaching was refined and improved in measurable ways. Those attempting to teach other types of research writing may engage in a similar process of modification, evaluation, and refinement that includes explicit repetition and engagement with expectations to improve student outcomes.

Over the span of these years, it has become clear that expectations assumed to be "obvious" were in fact not at all obvious to students. The assumption that explaining something once or even twice in a lecture format would make expectations clear had to be set aside. Instead, it was ensured that students had seen it, heard it, read it, and discussed it numerous times. This lesson may be useful in addressing myriad research writing courses and assignments.

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Karen M. Travis
Pacific Lutheran University, traviskm@plu.edu

Karen Travis is an associate professor and chair of economics at Pacific Lutheran University where she has taught for 19 years. She has taught the economics undergraduate research capstone 10 times since initiating the course at Pacific Lutheran University in 2003. Her research focus is health economics; she received her PhD from the University of Washington in 1995.

Priscilla Cooke St. Clair is an associate professor of economics and chair of global studies at Pacific Lutheran University. Her research focus includes development and environmental economics with an expertise in community forest management and household energy use. She received her PhD from the University of Washington in 1995.