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Link Aloud: Making Interdisciplinary Learning Visible and Audible

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Abstract

Are there ways to document interdisciplinary learning, specifically the forms integration takes? This article reports on stage two of a Carnegie scholar project on interdisciplinary teaching and learning in learning communities at Holyoke Community College. In the first stage, the author used the Structure of the Observed Learning Outcome (SOLO) taxonomy as a course-level assessment rubric to document the strong relationship between learning community instruction and interdisciplinary learning. In this follow-up qualitative study to make interdisciplinary learning both visible and audible, the focus is on student writing, specifically the mechanisms students use to integrate their learning across learning community course levels and to develop integrative habits of mind. In-depth interviews were conducted with twelve learning community students or scholars using a Link Aloud method which preserves student voice in writing and conversation by drawing on two methods from cognitive psychology, concept mapping and verbal protocol analysis, where students "think aloud" while performing a task. After reviewing completed Link Alouds with the twelve student-scholars, twelve precise mechanisms of integration were identified.

Link Aloud: Making Interdisciplinary Learning Visible and Audible

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This is a report on stage two of my 2005 Carnegie scholar project on interdisciplinary teaching and learning in learning communities (LCs). Stage two, the heart of the project, involved a qualitative study of LC student writing using Link Aloud to make interdisciplinary learning both visible and audible. Thus far, 12 different linking mechanisms have been identified with most students using more than one in their writing. In the third stage of the project, I will scale up the Link Aloud research methodology using "Pedagogy of Guided Reflection" in an attempt to capture classroom conversations of connection and thus provide a multidimensional view of interdisciplinary learning in LCs.

Like the Sidney Harris cartoon depicting a complex mathematical proof punctuated by the words "then a miracle occurs," much of the process of teaching and assessing interdisciplinary learning remained undefined and undocumented, particularly as it occurred in developmental, college-level, and honors learning communities (LCs). The goals of my Carnegie scholar project were to describe the interdisciplinary nature of the so-called miracle and to identify and correlate the conditions that make it possible, such as course design, curriculum, pedagogy, and assessment. In the first stage, a correlational study, I used the Structure of the Observed Learning Outcome or SOLO taxonomy (Biggs & Collis, 1982) as a course-level assessment rubric, which confirmed what I already knew—there is a strong relationship between LC instruction and interdisciplinary learning.

How students integrated their learning in interdisciplinary LCs became my central research question in stage two, the focus of this paper, but with a sharper focus on student writing. In particular, I hoped to identify more precisely the mechanisms by which LC students integrated their learning across LC course levels and how they developed integrative habits of mind.

Literature Review

The literature on LCs and interdisciplinarity attests to the power of these reform initiatives to transform undergraduate general education and to provide multiple pathways to student success and faculty development. A review of both quantitative and qualitative research from national, regional, and local evaluation studies corroborates the effectiveness of LCs as a vehicle for improving student learning, student retention, curriculum reform, and faculty revitalization. Lenning and Ebbers (1999) summarize the research as follows:

> Extensive documentary evidence suggests that effective learning communities have important benefits for students and faculty. Benefits for students include higher academic achievement, better retention rates, greater satisfaction with college life, improved quality of thinking and communicating, a better understanding of self and others, and a greater ability to bridge the gap between the academic and social worlds. Faculty benefits include diminished isolation, a shared purpose and cooperation among faculty colleagues, increased curricular integration, a fresh approach to one's discipline, and increased satisfaction with their students' learning. (p. iv)

Interdisciplinary Learning and Assessment

Armstrong (1980) writes, "a significant change occurs [in interdisciplinary courses], faculty members as well as students become participants in the process of synthesizing new knowledge" (p. 53). Newell (1990) reinforces Armstrong's claim, "faculty work with students in forging a new synthesis, which results in a larger, more holistic perspective" (p. 76). Echoing Klein and Newell, Dezure (1999) defines interdisciplinary learning as "a process to construct knowledge in which students and instructors come together to analyze differences in disciplinary approaches to a problem and to work toward a synthesis—a new, more comprehensive view than allowed by the vision of any one field" (p. 1). One of the stated goals shared by interdisciplinary studies and LCs is the development of students' integrative thinking skills. While we value the development of students' integrative thinking skills in general education, the means of teaching and accurately assessing interdisciplinary learning, or integrating knowledge across disciplines, remains undefined and undocumented in many LC courses. Davis (1995) examined a variety of interdisciplinary and LC course designs and recommends Bloom's taxonomy as a suitable model for developing and assessing interdisciplinary learning outcomes. Davis claims that applying the taxonomy does not change the categories, but the content of the tasks used becomes more complex in interdisciplinary courses. My experience in designing interdisciplinary assessments, writing prompts in particular, bears

this out.

Two approaches to interdisciplinary assessment seem especially useful. Mansilla (2005) examined samples of exemplary interdisciplinary writing and identified three generic assessment criteria for assessing "learning at disciplinary crossroads" (p. 20): disciplinary grounding, integrative leverage, and a critical stance. Wolfe and Haynes (2003) also studied interdisciplinary writing and constructed "Interdisciplinary Writing Assessment Profiles," the most comprehensive and detailed interdisciplinary assessment and scoring rubric to date. This scoring rubric for the assessment of expository, research-based, interdisciplinary writing was field tested primarily with year-long senior projects from the School of Interdisciplinary Studies at Miami University with projects about 60 pages in length. In applying and making the scoring rubric operational, Wolfe and Haynes identified four dimensions of interdisciplinary writing: (a) disciplinary sources, (b) critical argumentation, (c) multidisciplinary perspectives, and (d) interdisciplinary integration. Frankly, the depth and precision of this instrument is a bit overwhelming, but a rich resource for guiding further inquiry into assessing interdisciplinary writing.

For a more contextualized view of interdisciplinary assessment, three former Carnegie scholars provide snapshots of their interdisciplinary teaching and learning projects using the KEEP Toolkit, a set of Web-based tools that help faculty publish their research findings on the Web. To shed some light on how and in what contexts interdisciplinarity produces the positive effects discussed in the literature, Vess (1999) constructed two electronic course portfolios: IDST 2310, The Fine and Applied Arts in Civilization, and IDST 2205, Global Issues in Society. Her methodology was comprehensive, including videotaped classroom observations, transcriptions of course lectures, student surveys, interviews, focus groups, and standardized assessment instruments.

Linkon (1999) also constructed an electronic course portfolio featuring AMER 3701, Approaches to American Studies, and ENG 4864, Selected Topics in American Literature. Using observations, surveys and interviews of faculty and students, and analysis of student work, Linkon moved from asking general questions about how students understand interdisciplinarity, to identifying the obstacles students face in interdisciplinary courses, to exploring and testing strategies for helping them understand interdisciplinary theory and practice. Harnish (2003) conducted an assessment tour de force of the Coordinated Studies Program (CSP) at North Seattle Community College. After analyzing more than 600 student questionnaires from 23 different courses taught by 27 faculty from 11 disciplines over three years, Harnish found that in addition to confirming the national data on LC success, collaborative learning among students and faculty in interdisciplinary CSPs led to the creation of knowledge and connected or integrative learning.

The Local Campus Context

For more than a decade, Holyoke Community College (HCC) has been helping students pursue their learning in more intentional, connected ways using LCs. As a self-described "learner-centered institution," HCC's mission statement identifies LCs and interdisciplinary courses as two of the "contemporary assortment of instructional strategies" supported by the college. The campus mission of providing access, equity, and excellence in teaching and learning infuses the LC program's mission—to provide interdisciplinary learning communities to promote integrative learning across disciplines in the general education curriculum and career programs and affirm the value of community for increasing student involvement in learning. With their explicit valuing of relationship and community, emphasis on collaborative teaching and learning, shared epistemology, and integrative assessment, LCs engender competence in both students and faculty. Crosscutting texts, conceptual organizers, integrative reading, thinking-writing-discussion prompts, seminars on primary source texts, and collaborative-integrative projects are all examples of the instructional strategies LC faculty use to foster interdisciplinary learning. After three comprehensive evaluation efforts supported by grants from the National Endowment for the Humanities, National Science Foundation, and Fund for the Improvement of Postsecondary Education (FIPSE); a FIPSE Learning Communities Dissemination grant; and the most recent 2005–2006 LC Program Evaluation Study, a significant and reliable pattern of findings emerges—students and faculty learn more and better in LC courses. To borrow from the National Association of Developmental Education's motto, LCs help "underprepared students prepare, prepared students advance, and advanced students excel," while providing a transformational professional development opportunity for LC faculty.

The fall 2006 LC program evaluation data from LC surveys, faculty reflective interviews, and self-assessment reports suggest that students are most likely to develop integrative "habits of mind" when engaged in interdisciplinary coursework. One survey said, "I liked it best when you could stop thinking about it as one subject or another—I mean, the whole point is to bring various subjects together." Approximately 75% of the students surveyed ($N = 325$, 68% return) reported that their LC helped them "a great deal" in achieving the full range of interdisciplinary learning outcomes reported in the literature, such as critical thinking; ability to synthesize or integrate diverse perspectives; problem solving; integrative writing; empathy for ethical, social, and other issues; ability to tolerate diverse perspectives; greater humility; increased listening skills; and more sensitivity to bias (Klein, 1990; Klein & Newell, 1996).

When asked whether their LC provided opportunities for students to create new knowledge, one student replied: "Always in an LC, never in a stand-alone course. In a regular class you can't create new knowledge because first, you have no input. And second, you don't get anyone else's input. You only get one source, the professor." Having multiple and sometimes competing points of view in an

LC added to the complexity of the topic and challenged students to make sense of things for themselves. One student explained: "My own understanding emerged when I tried applying a theory to the literature and found holes in it. Examining a topic or theme using more than one discipline allowed me to see the connections as well as the separations between them."

Much of what I know about interdisciplinary learning has been gained from more than a decade of teaching LCs and from the LC program evaluations I have conducted over the years. Both have been limited for different reasons. The material taught in an LC is often too content specific to generalize beyond the course level, while LC program evaluation data is mostly limited to student and faculty self-reports. Even the data on student achievement and retention tells me little about the "precise mechanisms" by which LC students integrate knowledge across disciplines (Vess & Linkon, 2002, p. 96). My Carnegie and Washington Center colleagues concur, particularly in regard to local studies. "Much of the research needs to extend beyond the traditional measurement of retention and academic success to fully understand what makes a difference in learning communities" (Smith et al., 2006, p. 10).

Method

The Link Aloud Method

Link Aloud provided a visual and auditory representation of interdisciplinary learning—preserving the student voice in writing and conversation by combining two signature methods from cognitive psychology, concept mapping, and verbal protocol analysis. By verbally describing what is going through their minds while performing a task, students can provide information about what they are thinking, that is, they are thinking aloud. This type of data is referred to as a verbal protocol (Ericsson & Simon, 1984). Consistent with the relational philosophy and practice of learning communities, I treated Link Aloud as a conversation about an interdisciplinary object—a sample of LC student writing. In this way Link Aloud is not just a data retrieval procedure, but a collaborative reflection on interdisciplinary learning, and thus, an opportunity for discovery. Using a simplified close-reading procedure, I asked students to select a sample written assignment that demonstrated interdisciplinary learning, that is, links or connections made between disciplines, subject matters, or multiple sources of material. Students then read the assignment, paragraph by paragraph, discussing what, where, and how they made connections between the subject matters. I then used their written work (e.g., specific word choices, operative phrases, interpretations) to probe and sometimes provoke the students' thinking, particularly as it related to integration of material. In closing, I asked the students to consider what, if any, new knowledge or understanding they discovered, uncovered, or constructed as a result of doing this assignment.

I interviewed 12 LC students, or LC scholars, across three course levels for

a total of 20 interviews. Some students participated in only one Link Aloud, while others participated in a sequence (including both completed assignments and assignments in progress). I also connected faculty close readings with the student Link Alouds and created a "talking back" opportunity for students. For example, first, faculty close read a student essay; second, the student did a Link Aloud of the same essay; third, the student "talks back" as he or she listened and responded to the audiotape of the faculty member close reading the essay. Finally, I asked students to reflect on their Link Aloud experience and discuss what they learned.

Precise Mechanisms of Integration

Each Link Aloud provides a visual and auditory representation of interdisciplinary learning, thus preserving the student voice in writing and conversation. Student essays are represented using an electronic concept map in an attempt to make visible what links students made between subject matters, such as content links, and how they made them (i.e., instrumental links). In addition, each concept map contains a number of highlighted words and phrases that activate relevant audio links, providing a more detailed explanation in the student's own voice. For example, in the Link Aloud "Epistemological Critique," Candace, a student, critiques the epistemological constraints of both psychology and English literature as she applies psychological theories of identity development to characters in a variety of novels and films featured in her second-year LC, "Bring the Noise: Teen Angst and Anthems."

Results

After reviewing the completed Link Alouds with the LC scholars, we discovered approximately 12 precise mechanisms of integration. The following is a description of each (seven samples, created using KEEP Toolkit, are available in an electronic Link Aloud Gallery at http://sakai.cfkeep.org/html /gallery. php?id=79906730055722):

- Embedded quotes: student writes a sentence and seamlessly integrates a quotation from the text.

- Metaphor: student uses or creates a metaphor to link disciplines or different sources.

- Personal experience: student uses personal experience as a critical incident that links disciplines or different sources.

- Integrative question: student poses a question that can only be addressed by a synthesis of different sources.

- Feedback loop link: student returns to the primary thesis or theme, but with a variation or elaboration.

- Theory application: student applies a theory from one discipline to describe, analyze, explain, or evaluate something in another discipline.

- Method of inquiry: student uses a (field-based) research method to investigate a question or test a construct or theory.

- Epigraph: student uses prose, poetry, and even song lyrics as a distillation of their thesis, a construct, or a theory.

- Epistemological critique: student evaluates the validity of an element, concept, construct, or theory by identifying the epistemological constraints or limitations of the discipline.

- Personal beliefs and values: student uses personal beliefs or values to link disciplines or different sources.

- Using or creating a construct: student uses or creates a construct from one discipline or source to analyze or evaluate something in another discipline or source.

- Comparison and contrast: student compares or contrasts different disciplines or sources.

Although linking mechanisms, such as embedded quotes, feedback loop link, method of inquiry, and the use of multiple sources, are not interdisciplinary per se, they can act as functional equivalents due to their integrative character. For example, student Kamil Peters's method of inquiry, the teen ethnography, provided him the means and the material to make the move from integrative to interdisciplinary learning. The Holyoke Latino Mural gets its power from its interdisciplinary center, merging art and psychology to showcase answers to Erickson's twin questions motivating the adolescent identity crisis—who am I, and where do I belong?

Discussion

LC scholars reported that the Link Aloud interview itself was an integrative learning experience punctuated by significant moments of personal discovery. Here is one representative comment: "I think the best term for the [Link Aloud] experience was revelatory. I came to see my entire project in a new light and obtained a clearer understanding of what worked and did not work in my writing.

Some of this came not from your responses, but just from the active rereading of the work."

Three things stand out for me as I reflect on the quality of intellectual work submitted for review by the LC scholars. First, I did not expect the students to be so intellectually playful in their writing. For example, when applying the uncertainty principle to the social sciences, Candace reverses the observer effect, or the subject's tendency to change behavior when observed, and asks, "Are subatomic particles conscious then?" Similarly, Dan flips the crucible metaphor and suggests that perhaps the elements in a laboratory chemistry experiment (e.g., magnesium) are undergoing a "trial or test of their character."

Second, students seemed to exhibit a kind of "unconscious intentionality" in their writing, claiming that they were unaware of the so-called linking mechanisms they used to make connections between disciplines. It is clear from even a cursory review of the Link Aloud Gallery that the integrative structure of these interdisciplinary essays is not unintentional. A related metafinding perhaps is the observation that a number of the LC scholars integrated their learning across disciplines with little or no prompting or classroom instruction. This may indicate an unexpected predisposition for interdisciplinary learning or possibly a predisciplinary learning orientation.

Third, the great power of this method is also its greatest challenge—time. Given the busy lives of community college students who are commuting between work, school, and family life, and the intense workload of community college faculty (e.g., five courses per semester, committee work, college service, and advising), it was a monumental task to schedule and complete a succession of related interviews.

Implications for Interdisciplinary Teaching and Learning

Link Aloud not only provides an electronic document of interdisciplinary learning, but it also enables students and faculty to revisit writing assignments through close reading and even closer conversation. The result can be a deep learning experience via guided reflection. As a faculty resource, the Link Aloud Gallery can provide interdisciplinary models of student writing and thinking that faculty can use to design their own interdisciplinary writing assessments. The Link Aloud Gallery can also function as a resource for students, providing them with an electronic archive of sample papers to review. However, as one LC scholar observed, going public with model student work can sometimes result in classroom rivalries, or worse, duplication without true understanding or mastery. The challenge for the instructor is to build a classroom community that supports and affirms academic accomplishment as a collaborative achievement. In addition, the instructor needs to provide multiple but different samples of the same assignment.

While the Link Aloud Gallery showcases exemplary samples of interdisciplinary writing, much can be learned from the difficulties students

experience when attempting to make connections between disciplines and different source materials. Embracing difficulty by examining so-called bad links (i.e., superficial, inaccurate, or missing links) can transform confusion into "gateways rather than barriers to understanding" according to Salvatori and Donahue (2005, xi). Linkon (1999) exemplifies this approach when she reports that "part of the difficulty, it seems, lay not in finding the links but in articulating them, as suggested by the fact that the second most common response to the question about difficulty and confusion focused on the challenge of articulating the student's ideas in the papers." Given the particularly burdensome workload demands placed on community college faculty, a more integrative approach to scholarship is required, one that avoids the more typical add-on approach. What originally began as a research method can now be transformed into classroom pedagogy. This more integrative approach to scholarship hinges on embedding the research method into classroom instruction using documentation as a product and process of research and reflection. By incorporating explicit occasions for reflection, the research project can be transformed into instruction. Turning from description to prescription, or turning from what is to what works, not only helps make the move from research to pedagogy but from pedagogy to assessment. Consequently, "the action of instruction, assessment, documentation, and research come to contain each other" (Giudici, Krechevsky, & Rinaldi, 2001, p. 333).

The Link Aloud research method can be readily translated into a classroom context in a variety of ways. Using audio or video recordings of individual students via conferencing, small groups via team presentations, or the class via large group discussions, interdisciplinary conversations can be captured, documented, and then revisited through guided reflection. Students then become co-investigators as they inquire into the epistemology of the interdisciplinary classroom and ask: What constitutes collective interdisciplinary knowledge? What kinds of linking mechanisms do students use in interdisciplinary conversations? How does collective knowledge (of an interdisciplinary kind) develop? This, however, will be the focus of the third stage of my Carnegie scholar project on interdisciplinary learning in LCs.

It is worth noting how crucial the KEEP Toolkit was to going public with my research project. Not only did it provide the ways and means for analyzing, documenting, reflecting on, and disseminating project work, but it also made the "how" as well as the "what" of learning visible. What I find most compelling about the KEEP Toolkit is its multimedia capacities—enabling users to combine images, audio, and video with text and hyperlinks to build multidimensional, digital, research documents on teaching and learning. In this way, the documentation itself becomes the "stuff" of understanding, or the object being documented becomes a product and process of research. I found both the audio-link function and the gallery tool essential to attaining my research goal—to make interdisciplinary learning visible with the added benefit of making it audible as well. In fact, it was the multimedia "mixing" capability of the KEEP Toolkit that provided me the

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opportunity to create the audio-image structure of Link Aloud. For me, the KEEP Toolkit has become an invaluable assessment tool in the classroom by extending students and faculty the opportunity to integrate their learning and teaching using a versatile multidimensional Web-based tool.

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