OFFICE FOR UNDERGRADUATE RESEARCH

Resources for Inquiry-based Learning

January 2014

Aditomo, A., Goodyear, P., Bliuc, A., & Ellis, R. A. (2011). **Inquiry-based learning in higher education: Principal forms, educational objectives, and disciplinary variations.** *Studies in Higher Education,* 1-20.
This study examined inquiry based learning at three Australian universities. They explored the learning tasks that were described by 224 teachers. The article summarized the forms of inquiry based learning (IBL) that the tasks represented in the variety of disciplines, class sizes, and levels of student (undergraduate and graduate students). They found that there were two common themes in the tasks were identified. The first theme was active learning while the second theme was that the tasks were problem/question driven as opposed to topic driven. Two other conclusions were discussed; practical/logistical issues in using IBL and concerns about the authenticity of the research activities in terms of building knowledge. The value of the article is not limited to the conclusions but in the sections that address definitions of IBL, forms and dimensions of IBL, and educational objectives of IBL.

Alkaher, I. & Dolan, E. (2011). **Instructors' decisions that integrate inquiry teaching into undergraduate courses: How do I make this fit?** *International Journal for the Scholarship of Teaching and Learning, 5*(2), 1-24. Retrieved from http://academics.georgiasouthern.edu/ijsotl/v5n2/articles/AlkaherDolan/index.html
This qualitative study describes the process of three faculty implementing inquiry-based learning (IBL) in their settings. The focus of the article is on how the instructors made decisions related to using IBL in their classes. They provide an interesting representation of their decisions and their perceptions of the efficacy of their decisions. Comments from the instructors provide a window into how they were thinking about using the IBL approach in their classrooms.

Atkinson, MP. & Hunt, MP. (2008). **Inquiry-Guided Learning in Sociology**. *Teaching Sociology, 36*: 1-7,
Sociologists often look for ways to facilitate their students' abilities to think like a sociologist. In this article, the authors describe inquiry based activities that were developed in a workshop to facilitate instructors' understanding of inquiry based learning.

Balaban, Marie T. **Implementing Inquiry- or Problem-Based Learning the Undergraduate Science Curriculum: Ideals, Examples, and Concerns**. *Developing & Sustaining a Research-Supportive Curriculum: A Compendium of Successful Practices*, eds. Kerry K. Karukstis and Timothy E. Elgren. Washington, DC: Council on Undergraduate Research. 2007. 41-59.
Balaban notes "the consensus on the importance of inquiry learning in the sciences" (41). She points out that although people may mean different things/practices when they refer to inquiry-based learning, there are crucial characteristics that need to be present, including an integrated curriculum across disciplines, a problem-based teaching approach, and attention to skills development.

Biermann, Mark L. **Fostering Recruitment, Retention, and Learning with a Research Course Designed for First-Year Students.** *Broadening Participation in Undergraduate Research: Fostering Excellence and Enhancing the Impact*. Eds. Mary K. Boyd and Jodi L. Weseman, eds. Washington, DC: Council on Undergraduate Research, 2009. 191-198.

Biermann describes the creation of a new introductory course in Physics to help counter attrition rates in the major. It includes three components: research techniques, faculty discussions of their own research, and completion of a research project. Biermann notes the importance of having students learning how to do science, not just learning about science.

Boyer Commission on Educating Undergraduates in the Research University. **Reinventing Undergraduate Education: A Blueprint for America's Research Universities**. Stanford, CA: Carnegie Foundation for the Advancement of Teaching. 1998.
This transformative call to action urges higher education, and research universities in particular, to create an integrated, inquiry- and research-based undergraduate learning experience and notes a number of ways undergraduate education needs to change.

Bruck, LB. & Towns, MH. (2009). **Preparing students to benefit from inquiry-based activities in the chemistry laboratory: Guidelines and suggestions**. *Journal of Chemical Education*, *86*(7), 820-822.
In this paper, the authors provide a definition for inquiry-based learning and use it to discuss how they made changes in their pedagogical approaches to make their curriculum more inquiry based. They conclude by discussing the new role for students in inquiry based learning and make suggestions for how to accomplish preparing the students.

Eagan, M. Kevin; Hurtado, Sylvia; Chang, Mitchell J.; Garcia, Gina A.; Herrera, Felisha A.; Garibay, Juan C. **Making a Difference in Science Education: The Impact of Undergraduate Research Programs.** *American Educational Research Journal*. 50.4 (2013): 683-713.
The authors affirm the benefits of undergraduate research and reiterate that participation in undergraduate research correlates positively with intentions to enroll in STEM graduate students. They also find that STEM students who had research experiences were more likely than other STEM students to indicate their interest in pursuing a graduate degree. Being mentored by graduate students and teaching assistants also increases stated intention to pursue graduate STEM degree.

Elrod, Susan, Diane Husic, and Jillian Kinzie. **Research and discovery across the curriculum.** *Peer Review* 12.2 (2010): 4-8.
This article recommends we "infuse a pedagogy of research and discovery into courses across the curriculum" (4). It rehearses the findings of the benefits of undergraduate research – increased learning, increased persistence to degree, increased retention of historically underrepresented students, and higher likelihood of graduate/professional school enrollment. The most effective characteristics of a pedagogy focused on discovery and inquiry are to have students engaged in original research, help students understand the importance of research for solving real-life problems, provide adequate time for students to engage in research, provide appropriate feedback, and provide opportunities for students and faculty to interact.

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Friedman, D., Crews, T., Caicedo, J., Besley, J., Weinberg, J., & Freeman, M. (2010). **An exploration into inquiry-based learning by a multidisciplinary group of higher education faculty**. Higher Education, 59(6), 765-783.
This article describes the use of inquiry based learning in several disciplines by faculty who were using it for the first time in the following disciplines; philosophy, journalism and mass communications, business and technology education, public health, civil engineering, and social work. They describe the fundamental of inquiry based learning (IBL) as they understood it, strategies and implementation of IBL, student responses to IBL, and what they see as the implications of IBL for higher education.

Golding, L. & Wood, J. (2009). **A guide to the facilitation of enquiry-based learning for graduate students**
http://www.ceebl.manchester.ac.uk/resources/guides/guide_to_fac_v6.pdf
This guide provides an overview of inquiry/enquiry-based learning and some of the frameworks that this perspective uses in their conceptualization of inquiry-based learning. The guide includes an example of an inquiry-based approach in Literary Studies class.

Gregerman, Sandra R. **Filling the Gap: The Role of Undergraduate Research in Student Retention and Academic Success**. *Broadening Participation in Undergraduate Research: Fostering Excellence and Enhancing the Impact*. Eds. Mary K. Boyd and Jodi L. Weseman, eds. Washington, DC: Council on Undergraduate Research, 2009. 245-256.
Gregerman is a significant assessment scholar. Her research notes the importance of undergraduate research opportunities in retaining diverse (and traditionally underrepresented) students and finds that participation in undergraduate research decreases attrition, increases retention, and increases completion of degree.

Hanson, DM. (2006). **Instructor's Guide to Process-Oriented Guided-Inquiry Learning**. Retrieved from
http://www.pogil.org/uploads/media_items/pogil-instructor-s-guide-1.original.pdf
In this instructor guide, Dr. Hanson describes the perspective of the Process-Oriented Guided Inquiry Learning (POGIL) approach for the chemistry classroom. The guide provides a good discussion on why this approach is useful for student learning. Multiple examples of tools and explanations of strategies to use in the POGIL classroom. An extensive reference list is provided.

Journal of Inquiry-Based Learning in Mathematics
http://www.jiblm.org/index.aspx
This journal offers examples of course materials that have been developed by instructors placing students at the center of the instruction one of the key principles in inquiry-based learning. Detailed course notes are provided. In some of the examples, there are student notes available so that students can work through the content independently.

Kuh, George D. **High-Impact Educational Practices: What They Are, Who Has Access To Them, And Why They Matter**. Washington, DC: Association of American Colleges and Universities. 2008.

Kuh uses the learning outcomes developed in the 2007 LEAP report to identify 10 high-impact educational practices, including learning communities, collaborative assignments and projects, and undergraduate research, that help to achieve those outcomes. These practices positively correlate with increased retention and persistence as well as gains in deep learning. Kuh recommends that institutions should insure students participate in at least two high-impact activities during their undergraduate career.

--- and Ken O'Donnell. **Ensuring Quality & Taking High-Impact Practices to Scale**. Washington, DC: Association of American Colleges and Universities. 2013.
Research continues to demonstrate the positive results when students participate in/have access to high-impact practices and notes that historically underrepresented groups in higher education in general are underrepresented in terms of participation in these high-impact practices as well. Kuh notes some of the features that make HIPs effective, including engaged teaching and learning, and structuring projects and assignments in ways that encourage students to synthesize and integrate information and material across courses.

Lopatto, David. **Undergraduate research as a high-impact student experience**. *Peer Review* 12.2 (2010): 2-30.
In this article, Lopatto offers a succinct version of the research he discusses in his book [Science in Solution: The Impact of Undergraduate Research on Student Learning (2010)]. One interesting finding is that students who experience undergraduate research in a course setting report similar learning gains to students in focused summer research programs.

Pukkila, Patricia J., Martha S. Arnold, Aijun Anna Li, and Donna M. Bickford. **The Graduate Research Consultant Program: Embedding Undergraduate Research Across the Curriculum.** *Council on Undergraduate Research Quarterly* 33.4 (2013): 28-33.
This article describes UNC's Graduate Research Consultant (GRC) Program, which embeds a research experience into a course. Assessment data indicates that faculty, GRCs and undergraduates have positive reactions to this program/strategy. Most faculty who have used a GRC indicate that they would use a GRC again and feel that the GRC program had a significant or transformative influence on their students' learning and that students became active learners.

Spronken-Smith, Rachel and Rebecca Ealker, Julie Batchelor, Billy O'Steen and Tom Angela. **Enablers and constraints to the use of inquiry-based learning in undergraduate education**. *Teaching in Higher Education*. 16.1 (2011) 15-28.
This article draws on a meta-analysis of institutions of higher education in New Zealand to identify factors that make IBL effective, including learner-centered teaching focused on helping students learn, rather than conveying information, scaffolding inquiry skills throughout a degree program, institutional support for an inquiry-based curriculum. They note the need for institutional support for instructors as they move to an engaged learning model and also note that students often resist being expected to take ownership of their learning.

Van Oostrum, D., Steadman-Jones, R., & Carson, Z. (2007). **Taking the imaginative leap: Creative writing and inquiry-based learning**. *Pedagogy, 7*(3), 556-566.
Another example of how inquiry-based learning (IBL) is implemented in a Creative Writing course. For these faculty, using IBL was a way to embed their research in their teaching. They participated in a campus wide initiative to use IBL in their courses. They describe their process and insights gained as they put students in the role of writers.

Wenzel, Thomas J. **Cooperative Learning and Project-Based Laboratories as a Way to Broaden Learning Outcomes**. *Developing & Sustaining a Research-Supportive Curriculum: A Compendium of Successful Practices*, eds. Kerry K. Karukstis and Timothy E. Elgren. Washington, DC: Council on Undergraduate Research. 2007. 21-39.
Wenzel describes changing his chemistry classes (both introductory and advanced) to include cooperative learning and project-based experiences and finds that students learned more.

White, Harold B. **Stimulating Attitudes of Inquiry with Problem-Based Learning.** *Developing & Sustaining a Research-Supportive Curriculum: A Compendium of Successful Practices*, eds. Kerry K. Karukstis and Timothy E. Elgren. Washington, DC: Council on Undergraduate Research. 2007. 9-19.
White discusses the importance of embedding inquiry throughout the curriculum and recommends problem-based learning (PBL) as one pedagogical strategy. He has had success using peer facilitators in the classroom.