Home Energy Assessments in a General Education First-Year Course
C. Wesley Walter, Denison University, walterc@denison.edu

In my course Renewable Energy and Sustainability, a general education first-year seminar at Denison University, the students do a research project in which they perform home energy assessments using volunteers’ homes as their “labs.” In teams of two or three, the students visit a particular house to visually assess the conditions and interview the homeowner about energy usage. Each team develops its own list of five factors that they will analyze to the specific situation at that house. Examples of factors that students have evaluated include lighting, space heating, “vacant electric power,” attic insulation, water heating, and thermostat settings. The students take relevant measurements at the house, such as electric power usage by appliance or hot water temperature. After analyzing the information they’ve gathered, together with the household’s utility bills, to evaluate the current energy usage and annual costs for the different aspects of energy usage. The students then develop specific recommendations for possible improvements in energy conservation, including the estimated potential cost savings.

The research project culminates in an energy-assessment report that is transmitted to the homeowner. The report includes discussion of the students’ findings about the current household energy usage and recommended improvements. This research project has worked well for students, helping them to put the course material to use in a meaningful, real-world context. As an added bonus, knowing that their reports will be read and possibly acted upon by the homeowners helps to motivate the students to work hard on their research and to do their best writing.

Bibliical Studies Research in Introduction to the New Testament
Amy Paehler, Wheaton College, amy.paehler@wheaton.edu

My introduction to the New Testament course includes an assignment to write an essay, an interpretive examination of a text, which is a task normally reserved for upper-level classes. This assignment asks students to engage deeply with the scriptures and other ancient texts, and on the entire testament. Students must consult an ancient source to learn more about the issue they have chosen. In addition, they must also pass a literature research on a socio-cultural issue that informs their scriptural theme. Each student finds her or his own sources, as opposed to writing a paper based on primary sources selected by anthologists or depository archivists, thus actually engaging in original research.

Robert P. Zaidel and Kate Kronschuh, University of Wisconsin-Stout, zaidelr@uwstout.edu

Research in the discipline of history necessitates access to primary sources, which complicates integration of such activity into introductory classes. Most students simply do not have access to major depositories of historical material, and those who do typically lack the requisite skills to find and use appropriate documents. Digitalization of historic newspapers and periodicals alleviates this problem, however. Using the databases to investigate the student’s “historical birthday” offers an original research opportunity. In our Modern U.S. History Survey assignment, students can investigate what occurred on the exact day they were born; in the Early U.S. Survey, students can investigate what happened on their birthday during a significant year—not the actual year they were born. They easily can locate materials for both assignments.

This research introduces students to a variety of sources and search strategies. They are taught to use digital databases to find primary sources—a newspaper article by date and a magazine or journal article by relevant topic. For example, in the Modern U.S. History Survey, students enter their birth date into Newseum, a subscription newspaper index, in order to find a pertinent article published that day. They are encouraged to choose an area of national significance. After finding it, students identify key words in the text, including names and events, and then use them to locate a related magazine or journal article in the Academic Search Complete database. Database features allow them to limit the dates to those near their birth. Students then use the sources to write a short interpretive and analytical narrative. Instructors provide guidance to help students understand what makes a particular piece of historical evidence important and show them how to connect it to a larger set. Each student finds his or her own sources, as opposed to writing a paper based on primary sources selected by anthologists or depository archivists, thus actually engaging in original research.

From the International Desk

Undergraduate Research in Scotland: An Enhancement-Approach Study
Ray Land, Durham University, United Kingdom

Scottish higher education increasingly finds itself, as do sectors elsewhere, having to cope with the complexities of a globalized and uncertain world. This manifests itself in the speed of knowledge generation and transfer, as well as the speed of digital communication. The seemingly ubiquitous intensification of risk, in relation to environment, health, security, finance and technology has only been exacerbated by the onset of economic austerity. At the same time, the pressing scientific, social and economic problems of our times—climate change, sustainability, security, international debt crises, public health, aging populations—require graduates with appropriate attributes to cope effectively and imaginatively in such environments.

Ideally, graduates are being prepared to view issues through more than one disciplinary lens, in order to bring these urgent issues more clearly into view. They also should be comfortable crossing epistemological, social, and ontological boundaries in pursuit of the solutions that policymakers and employers desire. Barnett (2000a, 257) has characterized the “supercomplex” nature of this environment as follows:

A complex world is one in which we are assailed by more facts, data, evidence, tasks and arguments than we can easily handle within the frameworks in which we have our being. By contrast, a supercomplex world is one in which the very frameworks by which we orient ourselves to the world are themselves contested.

How graduates with such attributes might be developed, and how they can be encouraged to engage in such “re-invention” is a matter of pressing concern and is one in which the faculty in Scottish higher education is deeply involved. The National Survey of Student Engagement in the U.S. (Kuh 2008) probably the largest longitudinal study of student engagement in higher education, found that Barnett (2000a) identified “high-impact activities” correlated with increased student engagement. One such activity was undergraduate participation in collaborative, group work. Barnett has commented further (2000b, 163) that “being engaged in research of a frame-developing kind and projecting those frames to wider publics is a strong ... condition of teaching that is aimed at building about supercomplexity in the minds of students.”

Further, Baxter Magolda’s longitudinal study over the last twenty-five years (2009) has identified a process of student development through inquiry that leads to “contextual knowing or self-authorship.” She argues, “Moving away from unessential acceptance of knowledge to critically constructing one’s own perspective” is “more complex than learning a skill set. It is a transformation of how we think—a change in our assumptions about the certainty, source and limits of knowledge” (2006, 50).

This research introduces students to a variety of sources and search strategies. They are taught to use digital databases to find primary sources—a newspaper article by date and a magazine or journal article by relevant topic. For example, in the Modern U.S. History Survey, students enter their birth date into Newseum, a subscription newspaper index, in order to find a pertinent article published that day. They are encouraged to choose an area of national significance. After finding it, students identify key words in the text, including names and events, and then use them to locate a related magazine or journal article in the Academic Search Complete database. Database features allow them to limit the dates to those near their birth. Students then use the sources to write a short interpretive and analytical narrative. Instructors provide guidance to help students understand what makes a particular piece of historical evidence important and show them how to connect it to a larger set. Each student finds his or her own sources, as opposed to writing a paper based on primary sources selected by anthologists or depository archivists, thus actually engaging in original research.

The Scottish higher-education sector is a close-knit community, but one that contains a high degree of institutional variation. This variability and diversity is present despite the limited size of the sector—nineteen higher-education institutions—yet witnessed explicitly designed to establish an approach to enhancing the quality of higher education across a whole university system. This has been characterized as a “push for a new Scottish policy culture” (2009, 91) and certainly, politically and culturally, it arose at a significant juncture in recent Scottish history. The inception of this initiative, the Scottish Quality Enhancement Framework (QEF), took place in 2003, only four years after the establishment of the first Scottish government in nearly three hundred years. This bold move toward constructing a clear identity for the higher-education sector can be seen as part of the building of a broader and distinctive Scottish policy culture at that time. The imperative continues into the present as Scotland prepares for a major referendum in 2014 on possible national independence from the United Kingdom.

The QEF is coordinated by the Quality Assurance Agency on behalf of the Scottish Funding Council and is designed to provide an integrated approach that emphasizes undergraduate enhancement rather than solely assure the latter referring to judgments made against defined criteria to ensure the meeting of a standard. Quality enhancement (QE) is defined as “an enhancement by colleges, universities and other relevant bodies to...
continuously enhance the quality of provision that students enjoy.” Each institution is required to be evaluated every five years. (For a fuller explanation of the enhancement framework, see Land and Gordon 2013.) An important dimension of this complex and ambitious policy is a high degree of collaboration and partnership among stakeholders. Policy-makers aimed to achieve a sense of ownership and legitimation of the enhancement framework among all those with a vested interest. In particular, considerable emphasis has been placed on listening to the voices of students and encouraging their participation not just as consumers of a service but also, after appropriate training, as genuine partners in the review of quality.

There also has been a concerted attempt, at least in the early years of the initiative, to move away from an overly managerial and prescriptive approach—one sometimes characterized as “high fidelity”—to one that would be more consultative, pragmatic, and collegial, although perhaps less consistent or “low fidelity.” Grassroots participation was intended to replace top-down compliance, and judgments were designed to be less driven by metrics and rankings than derived from a more nuanced basis of evidence. Consensual rather than coercive decision-making—carrots rather than sticks—has been stressed. This model implies a strong awareness of the need for realistic and feasible measures that have a reasonable hope of implementation in a varied but compact sector. The overriding factor in this equation is the need for mutual trust. As Saunders suggests (2009, 59), “This enabled a familiarity, an ownership and a legitimation that other forms of implementation strategy might find hard to emulate. We term this a theory of ‘consensual development.’”

Institutional Collaboration in Enhancement
A further distinctive element of the Scottish framework is the periodic (roughly biennial) identification of an enhancement theme around which selected institutions gather to collaborate and share diverse solutions appropriate to their own institutional contexts. This work is coordinated by the Scottish Higher Education Enhancement Committee (SHEEC). Since 2003 a burgeoning repository of resources—publications, presentations, reports, and case studies—has been made freely available on the committee’s website. Two recent enhancement themes, titled “Research-Teaching Linkages: Enhancing Graduate Attributes” and “Graduates for the 21st Century,” drew increased attention to the need for and value of undergraduate research.

Both of these themes recognized and subsequently advanced the notion that encouraging students to participate in inquiry-based or “research-minded” activity could deliver a range of benefits. These included increased student academic engagement, as well as enhanced capacity of individuals as rigorous scholars, proactive employees, and ethical and responsible citizens—attributes envisioned by policy-makers as necessary for the success of modern Scottish society and economy. A rich array of valuable scholarship has grown out of the work done in connection with the enhancement themes, which addresses institutional, disciplinary, and pedagogical practices. This work, which merits wider dissemination, includes nine discipline-related national studies of undergraduate research, as well as studies exploring various dimensions of undergraduate research. Jenkins’ (2009) overview of the research-teaching linkages theme is a valuable gateway into this literature.

A number of conceptual tools were employed in addressing the themes. For example, Gunn (2011) helpfully discussed the notion of “research-mindedness” as one analytical lens. Another tool was Healey’s (2005) model of potential research-teaching linkages (after Griffiths 2004), shown in Figure 1 below. In terms of the Healey model, a shift from the “research-led” tendency (lower left-hand corner of the diagram) to a “research-based” tendency (upper right-hand corner) was deemed necessary in order to effect an active culture of undergraduate research that develops the desired attributes in graduates. All four approaches shown in the model were deemed important, but only the “research-based” approach was considered likely to lead to the capacities necessary for dealing with the “supercomplex” society described by Barnett.

The enhancement work in Scotland identified a polarization in approaches to the development of undergraduate research. At one end of the spectrum the approach might be characterized as a “junior model of the practitioner,” with the emphasis placed on research outcomes, the acquisitiveness of competence in research methods, and publication. Approaches that focus on research internships, undergraduate research publications, and undergraduates assisting faculty in their (faculty-led) research might fall into this category. The emphasis is on excellence and selectivity—engaging the best students who probably choose themselves to conduct research. It is an elite (and elitist) model in the positive sense of those terms. Activities in this narrative are often organized by an institution’s office of research.

The alternative approach is similar to what Jenkins and Healey (2009) have termed “mainstreaming.” This model embraces the development of important student attributes gained from research within the undergraduate curriculum and tends to be inclusive of all students. This approach might be characterized as fostering “research-mindedness” or skills of inquiry. It is informed by notions of graduates’ ultimate employability and is concerned primarily with educational outcomes. Activities in this framework are often organized by an institution’s office of teaching and learning, and it was this approach that groups working on the enhancement themes were seeking to develop.

These sector-wide enhancement projects encouraged the adoption of a broad and inclusive interpretation of research, encompassing Boyer’s (1990) four types of scholarship (discovery, integration, application, and teaching). The projects emphasized where appropriate:

• research formally evaluated and ranked by research councils, funding bodies, or government
• practice-led research
• consultancy-based research
• research of local economic significance,
• contributions to the work of associated research institutes or other universities
• various types of practice-based and applied research, including performances, creative works, industrial or professional “secondments” (the temporary transfer of a person from their normal duty to another assignment) and research internships
• inquiry-based or problem-based learning.

Qualities Sought in Graduates
The steering group studying research-teaching linkages, which included faculty and students, considered how to develop the desirable student attributes through the taught programs. It focused on how, at level of the institution and the academic program, links among research strategies, activities, outputs, and processes could support student learning and enable the development of key research-oriented attributes in graduates. At the undergraduate level, such potential attributes included:

• critical understanding
• awareness of the provisional nature of knowledge
• awareness of how knowledge is created, advanced, and renewed

Figure 1. Healey’s Model of Undergraduate Research and Inquiry

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• inquiry-based or problem-based learning.
Research-oriented undergraduate research is described as a high degree of collaboration and partnership among stakeholders. Policy-makers aimed to achieve a sense of ownership and legitimation of the enhancement framework among all those with a vested interest. In particular, considerable emphasis has been placed on listening to the voices of students and encouraging their participation not just as consumers of a service but also as appropriate gatekeepers, as genuine partners in the review of quality.

There has also been a concerted attempt, at least in the early years of the initiative, to move away from an overly managerial and prescriptive audit approach—one sometimes characterized as "high fidelity"—to one that would be more consultative, pragmatic, and collegial, although perhaps less consistent or "low fidelity." Grassroots participation was intended to replace top-down compliance, and judgments were designed to be less driven by metrics and rankings than derived from a more nuanced basis of evidence. Consensual rather than coercive decision-making—carrots rather than sticks—has been stressed. This model implies a strong awareness of the need for realistic and feasible measures that have a proven capacity to improve performance in a varied but compact sector. The overriding factor in this equation is the need for mutual trust. As Saunders suggests (2009, 59), "This enabled a new phase of the enhancement of undergraduate research that would develop the desired outcomes." There is a need for dealing with the "supercomplex" society described by policy-makers as necessary for success in the modern Scottish society and economy. A number of conceptual tools were employed in addressing the enhancement themes. For example, Gunn (2011) helpfully discussed the notion of "research-mindedness" as one analytical lens. Another tool was Healey's (2005) model of potential research-teaching linkages (after Griffiths 2004), shown in Figure 1 below. In terms of the Healey model, a shift from the "research-led" tendency (lower left-hand corner of the diagram) to a "research-based" tendency (upper right-hand corner) was deemed necessary in order to effect an active culture of research among undergraduate students. A rich array of valuable scholarship has grown out of this work done in connection with the enhancement themes, which addresses institutional, disciplinary, and pedagogical practices. This work, which merits wider dissemination, includes nine discipline-related national studies of undergraduate research, as well as studies exploring various dimensions of undergraduate research. Activities in this framework are often organized by an institution's office of teaching and learning, and it was this approach that groups working on the enhancement themes were seeking to emulate.

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The steering group studying research-teaching linkages, which included faculty and students, considered how to develop the desirable student attributes through the taught programs. It focused on how, at level of the institution and the academic program, links among research strategies, activities, outputs, and processes could support student learning and enable the development of key research-oriented attributes in graduates. At the undergraduate level, such potential attributes included:

- critical understanding
- awareness of the provisional nature of knowledge
- awareness of how knowledge is created, advanced, and renewed
- ability for effective communication and dissemination of findings
- an ability to analyze problems and issues and to formulate, evaluate, and apply evidence-based solutions and arguments
- an ability to apply a systematic and critical assessment of complex problems and issues
- an ability to deploy appropriate techniques of analysis and inquiry
- familiarity with advanced techniques and skills
- inventiveness and creativity in formulating, evaluating, and applying evidence-based solutions and arguments
- effective project management of time, resources, operations, and teams
- an understanding of the need for a high level of ethical, social, cultural, environmental, and professional conduct.

An important emphasis for this steering group was provided by recent Australian work. Krause’s (2007) “knowledge transfer conceptual framework” warns against the dangers of polarizing between research and teaching. She argues the need to acknowledge emerging conceptions of knowledge transfer, notions of “public scholarship,” and “third stream” activities (i.e., revenue-raising activities undertaken by academics over and above their first two streams of activity teaching and research). These could take the form of collaborations with commercial companies, such as providing professional development programs, one-off consultancies, or knowledge transfer partnerships (KTPs) in which research posts would be funded as a joint enterprise between private companies and universities. This is in keeping with the influential work by Gibbons et al. (1994) on changing modes of research, including a contemporary shift to publicly commissioned, team-based, applied, and shorter duration "mode 2" research, e.g., a university working with a local engineering firm to test the durability of a new material. In contrast, the concept of “public scholarship” has received less debate in the UK. Krause refers to public scholarship as occurring when universities engage “in reciprocally beneficial ways with communities at [the] local, national and international level.” It is more commonly discussed in the United States, where it has grown out of "service learning" and is related to Boyer’s (1996) concept of “the scholarship of engagement.”

Source: Healey and Jenkins (2009, 7), based on Healey (2005, 70)
In terms of defining attributes desired in graduates, the steering group readily acknowledged that the language used to describe student development is fraught with inconsistencies in terms of use and meanings. Indeed, terms such as attributes, skills, competencies, and abilities are often used interchangeably. A fellow Australian, Barrie (2004, 262), defines desirable attributes as being “the skills, knowledge and abilities of university graduates, beyond disciplinary content knowledge, which are applicable to a range of roles and contexts.” A significant amount of research has been undertaken, predominantly in Australia, to look at how institutions can use the concept of graduates’ attributes to be more transparent and explicit about how students can expect to develop throughout their higher education. An important dimension of defining needed attributes, which arguably is less obvious when talking about skills, is the extent to which the definition enables inclusion of values and behaviors, as well as technical abilities. Introducing graduate attributes in this way enriches the debate and begins to capture the transformational elements of the higher-education experience. This, in turn, raises more fundamental questions about the role of a university education in today’s society.

Vignettes of Undergraduate Research

Comprehensive information on all the Scottish enhancement themes can be obtained from a dedicated website at: http://www.enhancementscotland.ac.uk. Publications

A full account of the variety of undergraduate research in Scottish universities is available from Land and Gordon (2008a, 2008b). The following is a brief selection of vignettes from their work (2008b) showing the range of research undertaken.

University of Strathclyde Mechanical Engineering: First-Year Design Through Research

Students are aware that they will undertake a “mechanical dissection” of a car before enrolling at university; the exercise is highlighted in the degree prospectus and “open days” when students have the opportunity to visit a university and find out more about the subjects they are interested in before they apply. At the beginning of the students’ first year, the structure of this class is explained so that students know what will be happening during the year they will be working on the car dissection. It is also emphasized that the tasks they must undertake are related to the development of research skills for use later in their course. Students are divided into groups and each group spends a couple of hours selecting a part of the car (for example, the front or rear suspension, or a part of the braking system) and understand the distinction between the ethics of personal exploitation, and sedimentary bio-geochemistry. During all four years, students undertake fieldwork aboard the vessels and work in the specialized laboratories. Modules are led by experts in the disciplinary fields, so the students are exposed to the latest conceptual and technological developments and range of pedagogical approaches that are directly tied to students’ acquisition and development of higher-level research skills. These include, for example, techniques of experimental design in the first year; and writing in experimental design in the second year; reviewing of academic papers and writing abstracts in the third year; writing research proposals and undertaking research projects in the third and fourth years; and deconstructing the certainty of science and communicating science in the fourth year. Although not a systematic approach to embedding research-teaching linkages at the core of the curriculum, this occurs because of the nature of the students’ environment at the laboratory.

Conclusion: A Future Agenda

A number of issues arise from the foregoing discussion of undergraduate research practice in Scotland. A particular implication of the mainstreaming approach discussed above is the need for appropriate faculty development. Such an approach for all students in undergraduate curricula requires a degree of scaffolding for students. Faculty require an awareness of curriculum design and are obliged to negotiate a learning threshold that places emphasis on student activity and student learning, as opposed to faculty research expertise.

An interesting future research agenda also arises from such undergraduate research. How do undergraduates perceive their own development and academic identity through their experiences of research? How do research-based projects relate to shifts in a student’s disciplinary understanding and identity, as well as developments in their practical capacities and perceptions of whether the experience has increased their employability? Given the interdisciplinary nature of many of the intricate issues facing societies in the 21st century, what learning gains have students experienced from intercultural encounters and border crossings? What are the identifiable factors in the design of research-based curricula and co-curricula that are most likely to optimize student engagement? Scottish institutions continue to explore such issues. One hopes that similar issues might also emerge in the papers at future CUR conferences and issues of the CUR Quarterly.

The Scottish research-teaching linkages work offers much that is valuable to institutions in the United States at departmental, institutional, national, discipline, and accreditation-agency levels. It offers a practical framing tool (Land and Gordon 2008a, 68-72) and an audit tool (audit 72-73) to analyze curricular, extra-curricular, and all the resources already mentioned above, all freely available online.
In terms of defining attributes desired in graduates, the steering group readily acknowledged that the language used to describe student development is fraught with inconsistencies in terms of use and meanings. Indeed, terms such as attributes, skills, competences are often used interchangeably. A fellow Australian, Barrie (2004, 262), defines desirable attributes as being “the skills, knowledge and abilities of university graduates, beyond disciplinary control knowledge, which are applicable to a range of careers.” A comprehensive amount of research has been undertaken, predominantly in Australia, to look at how institutions can use the concept of graduates’ attributes to be more transparent and explicit about how students can expect to develop throughout their higher education. An important dimension of defining needed attributes, which arguably is less obvious when talking about skills, is the context. An important dimension of defining needed attributes, which arguably is less obvious when talking about skills, is the context.

**Poster Explanation**

Poster explaining these characteristics.

**Under a Microscope**

under a microscope to ascertain the materials and processes of parts for further examination. These parts are examined behind the component’s function and then selects a couple of components and removes that part. The following day each group has to field a couple of questions from one of the other groups of students. In preparing the poster and presentation, students will need to explain topics not covered elsewhere in their first-year course.

The overall aim in developing this class was to show students how the research work they covered in their research is correct and that they understand that “expands on so many skills,” and that “it allows you to see how an engineer would think.”

**University of Aberdeen School of Divinity**

University of Aberdeen School of Divinity, History and Philosophy: Temporary Ordination in Second Life

This initiative is seeking to build a simple “virtual monastery” loosely modelled on its environmental, with appropriate dress and activities so that students in the Encountering Buddhism course can experience the challenges and responsibilities of being members of a religious order dependent on patrons for food, clothing, and other resources. (The monastery is developed using the online virtual world Second Life http://www.secondlife.com/.) The outcome is a research-informed teaching environment for second-year and fourth-year students that uses role-playing to convey the ritualization, ethical constraints, internal cohesion, and responsibility of the Buddhist monastic way of life. This allows them to understand the ritualization of everyday life that is a part of monastic behavioural experience, the challenges and responsibilities of being members of a religious order dependent on patrons for food, clothing, and other resources. The monastery is developed using the online virtual world Second Life (http://www.secondlife.com/).

**University of Strathclyde Mechanical Engineering: First-Year Summer Course**

University of Strathclyde Mechanical Engineering: First-Year Summer Course (2008a, 2008b). The following is a brief selection of vignettes which arguably is less obvious when talking about skills, is the context. An important dimension of defining needed attributes, which arguably is less obvious when talking about skills, is the context.

**Vignettes of Undergraduate Research**

Vignettes of Undergraduate Research: University of Strathclyde Mechanical Engineering: First-Year Summer Course (2008a, 2008b). The following is a brief selection of vignettes which arguably is less obvious when talking about skills, is the context. An important dimension of defining needed attributes, which arguably is less obvious when talking about skills, is the context.

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For a list of references, see the end of this article. Reference.


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Ray Land is professor of higher education at Durham University in the United Kingdom and director of Durham's Centre for Academic Practice. He previously held similar positions at the Universities of Strathclyde, Coventry, and Edinburgh. He has been a higher-education consultant for the Organisation for Economic Co-operation and Development and the European Commission and is currently involved in two higher-education projects in Europe and Latin America sponsored by the European Commission. He has published widely in the field of educational research, including work on educational development, learning technology, and quality enhancement. He is best known for his theory (with Jan Meyer) of threshold concepts and troubleshooting knowledge.

Introduction
As faculty members in academic institutions, our primary instructional responsibilities are to equip and empower our students. By making effective teaching and learning a priority, a faculty member ensures that students will obtain the skills needed to succeed as they move on from the college or university. During a student's time with us we must be proficient in capturing and then demonstrating the excitement of the sciences and, at the same time, equip that student with the fundamental principles of his or her field, in this case, organic chemistry.

Stice showed in a 1987 study that college-level students retain only 25 percent of what they hear and 30 percent of what they see, compared to 90 percent of what they say (Stice 1987). These remarkable numbers show that learning is not a spectator sport regardless of the instructor's abilities. The interactive approach to teaching is a necessary tool to ensure that students leave a classroom having understood and remembered the material presented to them. This is similar to the Gutenberg method of teaching in which textbook and lecturer together provide the fundamental concepts to the students and involve the students in the classroom on a regular basis (Morrison 1986).

Concurrent with one's instructional responsibilities is the pursuit of one's scholarly activities—research. Accordingly, the introduction of research to students in organic chemistry—the direct interaction with the unknown and unexplored—provides a unique and valuable experience rarely available outside the walls of an institution of higher education. Research offers the student an individualized, hands-on experience that, when paired with an effective classroom experience, offers a truly enriched educational environment.

Research provides a unique opportunity for students to develop their own scholarly activities. That is, students in the lecture setting are presented on the first day of classes with predetermined dates for their quizzes/exams/final. The lecture material is scheduled and organized on a grid format with little input from the class. Research is open-ended, and the data generated are never predetermined. Using research as a vehicle for learning, the overall experience allows for added benefits. The professor now takes on the role of mentor, in addition to that of teacher, as he or she interacts one-on-one with students, while at the same time assuming an important role in the student's professional development.

Outlined below are the responsibilities with which each of us has been charged as a faculty member. The items are specifically focused for those in organic chemistry, but we hope they will benefit all entering academe.

Guidance for Entering Academics in Organic Chemistry

Nothing more effectively demonstrates the value of undergraduate research than the words and stories of the student participants themselves. In spring 2014, the Council on Undergraduate Research (CUR) will host its annual undergraduate poster session on Capitol Hill. This event will help members of Congress understand the importance of undergraduate research by allowing them to talk directly with the students involved in such studies.

CUR invites undergraduates to submit an abstract of their research that represents any of CUR’s divisions (Arts and Humanities, Biology, Chemistry, Geosciences, Health Sciences, Mathematics/Computer Science, Physics/Astronomy, Psychology, and Social Sciences). To ensure proper review of applications, the above are the only disciplines in which students may apply. In the case of research that is interdisciplinary, students should select the division that most closely describes the research.

Directors of undergraduate research, faculty members, and other involved administrators are urged to encourage their students to submit posters. This is a highly competitive program and a very exciting experience for both students and their faculty advisors.


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Ray Land is professor of higher education at Durham University in the United Kingdom and director of Durham's Centre for Academic Practice. He previously held similar positions at the Universities of Strathclyde, Coventry, and Edinburgh. He has been a higher-education consultant for the Organisation for Economic Co-operation and Development and the European Commission and is currently involved in two higher-education projects in Europe and Latin America sponsored by the European Commission. He has published widely in the field of educational research, including work on educational development, learning technology, and quality enhancement. He is best known for his theory (with Jan Meyer) of threshold concepts and troubleshooting knowledge.

Introduction
As faculty members in academic institutions, our primary instructional responsibilities are to equip and empower our students. By making effective teaching and learning a priority, a faculty member ensures that students will obtain the skills needed to succeed as they move on from the college or university. During a student's time with us we must be proficient in capturing and then demonstrating the excitement of the sciences and, at the same time, equip that student with the fundamental principles of his or her field, in this case, organic chemistry.

Stice showed in a 1987 study that college-level students retain only 25 percent of what they hear and 30 percent of what they see, compared to 90 percent of what they say (Stice 1987). These remarkable numbers show that learning is not a spectator sport regardless of the instructor's abilities. The interactive approach to teaching is a necessary tool to ensure that students leave a classroom having understood and remembered the material presented to them. This is similar to the Gutenberg method of teaching in which textbook and lecturer together provide the fundamental concepts to the students and involve the students in the classroom on a regular basis (Morrison 1986).

Concurrent with one's instructional responsibilities is the pursuit of one's scholarly activities—research. Accordingly, the introduction of research to students in organic chemistry—the direct interaction with the unknown and unexplored—provides a unique and valuable experience rarely available outside the walls of an institution of higher education. Research offers the student an individualized, hands-on experience that, when paired with an effective classroom experience, offers a truly enriched educational environment.

Research provides a unique opportunity for students to develop their own scholarly activities. That is, students in the lecture setting are presented on the first day of classes with predetermined dates for their quizzes/exams/final. The lecture material is scheduled and organized on a grid format with little input from the class. Research is open-ended, and the data generated are never predetermined. Using research as a vehicle for learning, the overall experience allows for added benefits. The professor now takes on the role of mentor, in addition to that of teacher, as he or she interacts one-on-one with students, while at the same time assuming an important role in the student's professional development.

Outlined below are the responsibilities with which each of us has been charged as a faculty member. The items are specifically focused for those in organic chemistry, but we hope they will benefit all entering academe.

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