



Inquiry Learning at UCFV

Linking Research and Teaching in a Teaching Intensive University

The Campus 2020 Report and the vision that is being proposed for the future of our institution cause us all to reflect on the role of research in a teaching intensive university. Does a teaching intensive university approach research differently? How does it integrate teaching and research? Is there something distinctive about how a teaching intensive institution integrates research and teaching?

The integration of teaching and research is often seen as one of the basic pillars of pedagogy for the 21st century. As such, it has been formally part of our institutional goals for several years. Yet, we have not quite pushed our own thinking very far in terms of how that integration is to be reflected concretely in both our teaching and our research activities.

Research, some have argued, is just another word for education (Wilson, Cramer, and Smith, 2004:1). Teaching and research are both concerned with learning. Strengthening the link between these two types of activity may be the best and most direct way to offer a genuine student-centred undergraduate education. It is possibly one of the best ways to prepare students for graduate school, career opportunities and active and responsible citizenship.

Broad strategies have been identified to increase the links between research and teaching (Freestone and Wood, 2006). The most popular ones include: (1) reviewing existing policies and practices to improve the linkages between research and teaching activities; (2) restructuring programs and reviewing curricula, as necessary, to expose students to research paradigms and to introduce inquiry-based or research-supported learning; (3) developing strategies for greater involvement of students in research and more multiplying the opportunities for students to participate in research.

At the heart of any initiative to strengthen the link between teaching and research, there must obviously be a concerted effort to create more opportunities for students to engage in inquiry-based and discovery-based learning as part of their overall learning experience. In principle, UCFV is committed to strengthening its various curricula by ensuring that all students have opportunities to learn through active involvement with the

scholarship of inquiry, discovery, integration and engagement. We now have to articulate some concrete ways to translate this commitment into action.

We can all pause to consider the nature of the links between teaching and research and the importance and benefits of research-based teaching and inquiry learning. We can perhaps then consider how we would go about creating an environment at UCFV that supports inquiry learning and students' involvement in research at every level and emphasizes the synergy between classroom learning and research activity. This should allow us to tentatively formulate some elements of a potential strategy to increase our students' opportunities to be involved in research and to engage in inquiry learning.

Multiplying the Opportunities for Students Direct Involvement in Research and Scholarly Activities

We must recognize that providing the opportunity for all of our students to participate in research and scholarly activities is an essential part of our fundamental pedagogical mission.

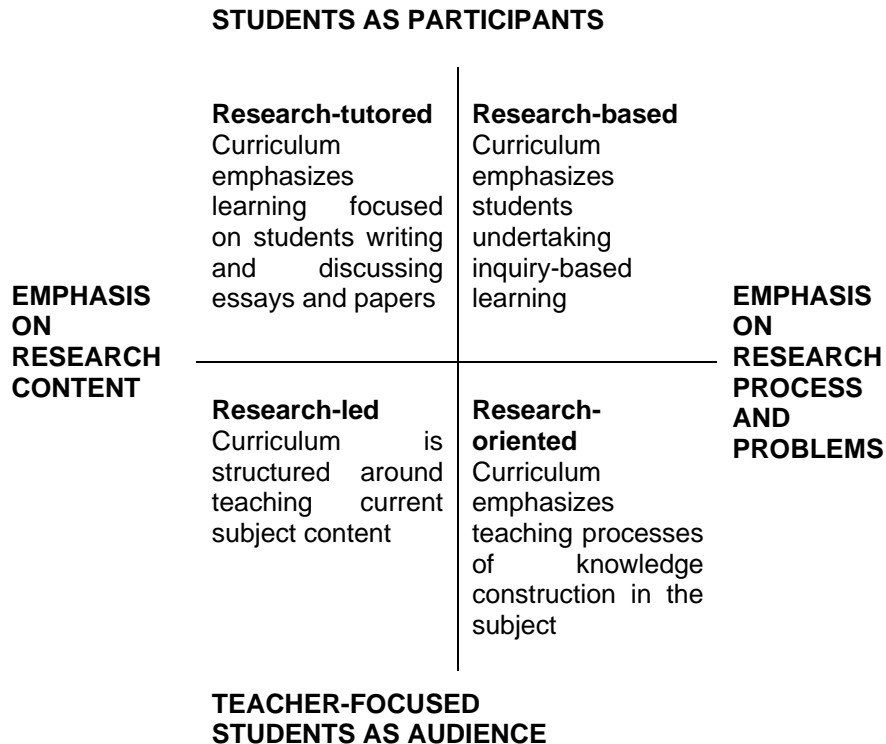
In the last several years, we have made substantial progress in the support we offer to faculty research and in developing a research infrastructure within our institution. While so doing, we have created more opportunities for our students to get involved in faculty-led research. We have established a number of centres and institutes which have also multiplied the opportunities for students to get involved in exciting research. These efforts will continue. Nevertheless, and however successful these initiatives were, our success was limited to creating for our students a few hundred research opportunities in a limited number of disciplines. This is no small achievement, but we must ask ourselves: "What about the other ten thousand or so students who would benefit from that kind of learning experience?"

So far, research opportunities for our students tend to consist of a limited number of research assistantships or apprenticeships with a faculty on his or her research, or a student-led project required for completing the requirements of a course or program of studies (term paper, lab experiment, major thesis). It is probably fair to say that, at this point, our efforts to involve our students in research-based or inquiry-based learning are, for the most part, scattered, limited to some academic disciplines, and largely dependent on the initiatives of individual faculty members.

Many believe that a faculty-mentored research experience is the ideal way for students to learn and use science knowledge, but this opportunity is rarely available to most students. We must therefore look at additional ways to create research and inquiry-based learning opportunities for our students.

Linking Research and Teaching

There are different ways to link teaching and research. Several authors have tried to categorize these linkages (Griffiths, 2004; Jenkins and Healey, 2005; Healey, 2005). The students' learning experience may be based on learning about other people's research, learning to do research (research methods), and on conducting research (inquiry-based learning). A diagram developed by Mick Healey (2005) and reproduced below represents the relationship between research and teaching along two axes.



Source: Curriculum Design and the Research Teaching Nexus, Healey, 2005, p. 70.

An effective strategy to strengthen the link between research and teaching can contribute to enhancing both types of activities. The experience of institutions that have taken steps to enhance the links between teaching and research has shown that: "For those departments with limited access to external research funds, developing the teaching-research link can help the department develop a research profile. For strong research departments, ensuring the link can help students appreciate the value to them of this departmental research focus" (Jenkins, Healey, and Zetter, 2007: 13).

The strength of that link can be expected to vary among departments and disciplines. Based on a review of the literature, Jenkins concluded that "variations are shaped by how disciplinary communities conceive the nature of knowledge, research and teaching, the forms of pedagogy and curricula in different disciplines, and for some disciplines, the impact of

professional organizations and student interests on the content and practice of the disciplines” (Jenkins, 2004: 19). For various reasons, it is sometimes more difficult to create student research opportunities in some disciplines than in others. For example, mathematics is often cited as a difficult area, but some programs have successfully been developed in that area (e.g. at Lafayette College; Gordon, 2007). We must therefore expect variations in the capacity of our various departments at UCFV to deliver research-based and research linked teaching. We can expect that our efforts to increase the linkages between research and teaching will play out differently among the departments and will be filtered by the various disciplines’ approaches and traditions.

It is not sufficient, as a matter of strategy, to simply increase the research outputs of faculties or departments. Effective teaching research links are not automatic. They have to be constructed (Jenkins, Healey, and Zetter, 2007; Jenkins and Healy, 2005). Even when there are a lot of solid research activities taking place in a department or faculty, the link often still has to be built into the curriculum, the departmental procedures and practices, and the education plan. In fact, it is important to make the desired linkages between research and teaching explicit, something which is seldom done in most institutions.

What is Inquiry Learning?

Inquiry learning, also referred to as “inquiry-based learning”, “discovery learning”, “investigative learning”, encompasses a variety of approaches, including what is called “problem-based learning” (PBL). Inquiry learning is used as an umbrella concept to describe approaches to learning that are driven by a process of inquiry (Kahn and O’Rourke, 2005).

Kahn and O’Rourke, summarize the main characteristics of inquiry-based learning as follows:

- “Engagement with a complex problem or scenario, that is sufficiently open-ended to allow a variety of responses or solutions;
- Students direct the lines of inquiry and the methods employed;
- The inquiry requires students to draw on existing knowledge and identify their required learning needs;
- Tasks stimulate curiosity in the students, encouraging them to actively explore and seek out new evidence;
- Responsibility falls to the student for analysing and presenting that evidence in an appropriate ways and in support of their own response to the problem”. (Kahn and O’Rourke, 2005: 2).

By opposition to a traditional lecture/expository approach, as Balaban explains, “an inquiry approach would likely have (a) greater emphasis on students assuming an active than a passive role in learning; (b) greater emphasis on students developing conceptual understanding and reasoning skills rather than rote knowledge, and (c) greater emphasis on students

tackling the complexity, creativity, and discovery involved in science, rather than assuming the existence of absolute knowledge” (Balaban, 2007: 42).

The hands-on, practical experience students acquire through inquiry learning and service learning helps them get clarity about their own career or professional goals and illuminates for them some career possibilities. It helps students learn most intimately the skills they need for academic and professional success.

Promoting inquiry learning is about helping students acquire the confidence to know that they are able to approach any kind of problem given the right circumstances and the right tools. They learn to trust their own intuition and judgment, as well as to follow their own curiosity, and trust their ability to ask the right questions. This is invaluable as a foundation for their future career.

The Value and Benefits of “Inquiry Learning”

Research-based or research-led teaching is a great motivator of students. It helps students take ownership over their own education. Numerous studies have established that students generally value learning in a research-based environment (Jenkins, 2004: 29). Students involved in research see themselves as participants in the research community and stakeholders in the research function at the university. Students who take part in research become more confident as learners and more capable of thinking independently (Blackmore and Cousin, 2003). Learning applied research skills may also enhance graduate employability and provides them with the confidence to operate in the world of professional practice.

In fact, there are dozens of ways in which students’ involvement in research and inquiry-based learning in general benefits the students. Inquiry learning and involvement in research create unique opportunities for students to develop some crucial and tangible skills, including their **analytical thinking skills** (analyzing, classifying, sorting, prioritizing, synthesizing, correlating data and information, and reaching sound, logical conclusions); their **communication skills** (writing persuasively, creatively, and technically, arguing convincingly, organizing and presenting complex information, etc.); their **ability to relate practice to theory** (ability to apply various research methodologies and understand their relative usefulness and limitations); and, their **ability to work in a team**.

Inquiry learning and direct participation in research also helps students develop **critical thinking skills**, including: an appreciation for the social and professional contexts of their discipline; an ability to formulate problems and questions and an understanding of how problems and questions are formulated in studies within their own field; and, an ability to critically read research reports and connect their own work with others in the field. Inquiry learning will also often naturally expose students to new opportunities for cross-disciplinary collaboration and thinking.

Furthermore, there is evidence that another benefit of a research-based curriculum is that it can contribute to the acquisition of **information skills** by the students (information technology skills, information literacy, or library research skills) (Smith, 2007).

Organizing students along **learning communities** is one of the strongest predictors of student success. This applies especially to learning communities organized around an inquiry, a case study, or a problem to be solved. Cooperative learning in the classroom around project-based or problem-based assignments creates opportunities for inquiry-based learning (Wenzel, 2007).

Inquiry learning is often used in conjunction with **student-led seminars**. The seminars encourage students to assume responsibility for their learning and that of other members of their learning community. In an inquiry-based learning model, the student-led seminar can also be used as a method of assessment and can help ensure that students work individually and independently in the preparation of their own part of the presentation (Palmer, 2002:82).

In terms of developing future researchers, it is clear also that an early involvement in undergraduate research can help students develop the **professional research skills** that they will need as researchers within or outside of academia. Canada's three major research agencies (NSERC, SSHRC, CIHR), in consultation with several academic organizations, have been developing a statement of principles on key professional research skills for new researchers. The identified skills are grouped under ten clusters: (1) communication and inter-personal skills; (2) thinking and intellectual skills; (3) creativity and imagination; (4) personal effectiveness; (5) integrity/ethical conduct; (6) teaching competence; (7) leadership; (8) research management; (9) knowledge translation; and, (10) societal/civic responsibilities. The students' research experience at UCFV should provide several opportunities for them to acquire and practice these important professional skills.

Finally, there is evidence that inquiry learning and involvement in research can help **student retention**. For example, the University of Michigan has evaluated the impact of its strategy to involve undergraduate students in collaborative research with faculty, particularly during the first two years of college, the time when the heaviest attrition occurs. The evaluation suggested a definite positive effect on retention rates, particularly for some students from under-represented minorities. The undergraduate research program has been a success, especially for students from underrepresented minorities. Students from these groups who participate in the research program had an attrition rate about 56 percent lower than that of underrepresented students in general (10.3 percent versus 23.3 percent). When minority program participants were compared to matched minority controls, participants in the program had an attrition rate 35 percent lower than the controls (10.3 percent versus 15.9 percent) (University of Michigan, 1996).

Elements of a Strategy

Jennings and Healey have offered suggestions concerning a comprehensive strategy for developing the link between research and teaching. It is based on four major components: (1) developing institutional awareness and institution mission; (2) developing pedagogy and curricula to support the nexus; (3) developing research policies and strategies to support the nexus; and, (4) developing staff and university structures to support the nexus. However, they also argue that focusing on the curriculum is, perhaps, the key strategy for institutions (Jenkins and Healey, 2005: 33).

Curriculum development: Infusing the curriculum with research and research-like experiences has the benefit of making the opportunity available to a greater number of students. A research-supported curriculum provides more opportunities for student to develop the broader learning outcomes that are fostered through participation in research (Wenzel, 2007). Karukstis and Elgren (2007) have produced a useful compendium of successful practices in developing and sustaining a research-supportive curriculum.

Within each discipline, the curriculum can be reviewed to ensure that it links research and teaching by focusing on: (1) developing students' understanding of the role of research in their discipline; (2) developing students' abilities to carry out research; (3) progressively developing the students' understanding of research and offering them an opportunity to participate in research; and, (4) managing the students' experience of research (Jenkins, Healey, and Zetter, 2007: 45-6).

Implementing PBL: Many universities have favoured a strategy based on the promotion of Problem Based Learning (PBL) to provide a foundation in the processes of discovery and scholarship for all students. Students are offered opportunities to discover by themselves some important concepts and their interconnections. To implement PBL within the curriculum, suitable problems must be developed. In fact, PBL frequently requires changes in course material, the role of the instructor, evaluation methods, and even the classroom and its furnishings.

Teaching of research methodology: We could make a commitment to include an appropriate research methodology component in all programs and every aspect of the curriculum.

Curricularizing some research activities: Research must not be perceived as an extra-curriculum activity. As long as it is, it remains marginal both in the definition of the students' learning experience and in the definition of the faculties' role, responsibilities, and workload. A number of methods can be explored: credit hours must be offered within each program/curriculum to advance the students' research skills and methods; credit hours must be offered for research projects; credit hours can be offered for research related to students' research experience while participating in faculty-led research.

Senior theses: senior theses or the equivalents can be introduced in many programs (Akim, 2000: 28-29). At UCFV the Major thesis (mini-thesis) is used in many departments to enhance the students' opportunity to engage in independent inquiry learning. It may be opportune to review our curricula to determine whether that opportunity should be offered as part of more programs. Departments could be encouraged to develop models that fit their discipline, circumstances and resources.

Encouraging student-led research: Independent student research can and should be encouraged, particularly in the humanities. Some institutions have made independent studies a requirement for all undergraduate students and have adjusted their curriculum to support development toward the independent study experience (Bettison-Varga, 2007). Another possible method may consist of developing a computer-assisted scholarship portfolio system to encourage, support, guide, supervise and evaluate student-led enquiries, creative work, or service learning experiences over his/her undergraduate experience. This work can then be credited.

Linking inquiry learning to service learning: Creating opportunities for students to get involved in community-based research activities offers a way to link inquiry learning to service learning. UCFV's work-study and co-op education programs can be put to contribution to create a significant number of research opportunities for students, within UCFV and with community agencies and private industries.

Policies: Our policies and practices may have to be reviewed. The reward systems (inside and outside the institution, or within a discipline) may or may not be supportive of the integration of research and teaching. Our research policies, in particular, must reflect our determination to link the student research experience and opportunities very closely to our research enterprise.

Faculty development: Encouraging faculty to consider that their research can include teaching-related research in addition to advanced research, including measures to ensure that different forms of scholarship and research are effectively rewarded within the institution. Increasing the relationship between teaching and research and promoting inquiry learning may also require increasing the skills of faculty to teach emphasizing the construction of knowledge by students rather than the imparting of knowledge by instructors. Faculty may need support to develop assignments and examinations that reward deep, rather than surface, learning.

Accountability: It may be necessary to review the ways in which we define and promote accountability for teaching in terms of student learning, evaluation of teaching, and the impact of teaching on learning.

Encouraging student publications: Finding ways to encourage the dissemination of student research within and outside the institution. This could include using the UCFV Research Review, or UCFV Press, as well

as international journals open to undergraduate students such as: *Young Scholars in Writing*; the *Pittsburgh Undergraduate Review*; or *The Oswald review*, an international journal of undergraduate research and criticism in the discipline of English.

Rethinking the "term paper": It has been argued that the term paper, as it has long been conceived and taught, has lost its educational function (Grobman, 2007: 26). We may need to progressively and fundamentally transform our students' learning experience with respect to the research paper or the term paper. Changing our mindset around this exercise and renewing its meaning is one way to strengthen the link between research and teaching.

Creating a centralised infrastructure for promoting student research: In 2005 McGill University's Faculty of Science created an office of Undergraduate Research in Science. In the 2006-07 academic year, there were almost 2,000 undergraduate researchers at McGill and the number is growing rapidly (Martin, 2007: 10). Many American universities have created a centralized undergraduate research program that helped change the culture of the university (Stocks, Ramey and Lazarus, 2004: 7). At UCFV, the Research and Industry Liaison should further develop its student research support activities.

Developing a greater capacity to mentor the students' research experience: Undergraduate students learn and grow significantly from their research experiences, but require a strong mentor relationship to do so (Guterman, 2007: 13). Mentoring is extremely important in helping undergraduate students make the most of their research experience (Merkel and Baker, 2002). Mentors play a significant role in providing intellectual stimulation and support for undergraduate student researchers, teaching through example and coaching, asking questions and providing constructive feedback to the learners.

Mentoring undergraduate students can be very time-consuming. Undergraduate students place varying levels of demands on their supervisor/mentor because they themselves vary in their level of preparation, skills and abilities. Providing the required mentoring to all students at UCFV will no doubt raise a number of issues concerning resources, faculty workload, and infrastructure. Using peer-mentors is a great way to multiply the opportunities for students to become involved in research (Russel *et al.*, 2004). Other institutions typically make use of graduate students to help support and mentor undergraduate student researchers. This is not currently an option at UCFV. Once more, we may have to be creative. In that respect, we should note that some institutions have made use of peer or near-peer mentors and reviewers.

Making use of summer programs: Some universities have focused on developing summer programs during which students participate in research (often in groups, with a faculty mentor, for credits, etc.). Some institutions hold a series of seminars and workshops during the summer to increase the students' understanding of the research process, enhance their skills

and foster a sense of intellectual community (Joyce, 2004: 3). Some institutions are using the summer program as a kind of head start program to involve gifted students early in their undergraduate studies.

Making use of international opportunities: A student research opportunity can take the form of a semester abroad program or exchanges between universities (Jianping, 2007, Werner and Sorum, 2004). For instance, some institutions have collaborated with universities abroad to create a “mini-term” abroad with a research component. UCFV’s newly developed semester abroad program can be structured in part to support inquiry learning and create new research opportunities for students.

Preparing high school students for inquiry learning: It may be worthwhile to consider different ways to work with high-schools and involve university students in projects involving high-school students, thereby supporting student recruitment and preparing future students for post-secondary studies.

Developing and funding an undergraduate research opportunity program: The initial success of many American universities’ undergraduate research programs was due in large part to their access to federal funding to launch institution-wide initiatives. Securing funds to further support undergraduate research at UCFV will continue to be a challenge. Several alternatives should be considered, including the possibility of fundamentally restructuring our work-study program and of developing a new component of the student co-op studies program to provide the backbone support for an undergraduate student research opportunities program at UCFV.

Role of research centres and institutes: Policies could be developed for all of our research centres and institutes relating to their responsibility to provide meaningful research opportunities for our students.

Reward excellence in student research: UCFV already has a modest undergraduate research excellence award program. The program could be further strengthened and developed, perhaps in cooperation with the Development Office.

Next Steps

Five years ago, we adopted a strategic plan for research and saw it integrated fully into the institution’s overall strategic plan. Since then, UCFV has pursued five main strategies to enhance its research and scholarly activities. The focus was on: (1) increasing support internally for research, scholarly, and creative activities; (2) integrating research and teaching activities and enhancing the research training of students; (3) obtaining external funding for research; (4) encouraging interdisciplinary approaches and developing strategic research alliances with other institutions and with community organizations; and, (5) increasing our knowledge transfer and technology development activities. We have achieved some substantial progress in all of these areas except perhaps the last one.

The research and scholarly production of faculty and students has increased fivefold during that period. Our faculty have successfully sought and obtained funding from the major Canadian granting councils as well as from non-traditional sources of research funding. More than a dozen research centres and institutes have been created and many of them are now reaching the point where their research production and their relevance to the community are becoming very noticeable.

We have developed a supportive Research Services and Industry Liaison office. We now have a Research Advisory Council that brings together researchers from all disciplines and is helping us map out the future of research at UCFV. We developed and adopted policies in the areas of research ethics, integrity in research, intellectual property, and research contracts. We have developed efficient and fair internal mechanisms for supporting and funding research and scholarly activities. We have established a well functioning and very credible Research Ethics Board. We have established regular liaison with our colleagues at the AUCC, ACCC, and in other universities and university colleges in the province. We have encouraged international faculty exchanges and research partnerships with other institutions. We have gained official recognition from the major granting council and have developed some important working relationship with them as well as with other funding agencies.

There are more of us involved in research and scholarly activities than ever before and this is reflected in the volume of scholarly work that our faculty and students are publishing every year. Our increased research capacity is the result of our faculty's commitment to research, the institution's efforts to facilitate research, as well as our efforts to recruit faculty members with a commitment to research and scholarly activities.

Our objectives, with respect to the promotion of research and scholarly work at UCFV, will remain those stated in the Strategic Research Plan approved by the Board of Governors. We have made some significant progress upon which we can continue to build.

Given the rapid pace of change in the knowledge-based economy, every region must be able to rely on science-based education and training to meet the challenges of change and remain competitive. In virtually all sectors of the economy, including the public sector, repeated calls for evidence-based and science-based practices have found an echo in the university's ability to support local communities in their efforts to develop the tools and applications they require. UCFV produces research that directly engages local partners and responds to local challenges. In the coming years, as a regional institution, we will be expected to engage even more deeply in that type of research and to focus on some of the difficult issues to which the community attaches great importance.

As a teaching-intensive institution, our biggest challenges will be to build our ability to engage more of our students, and hopefully one day all of our students, in inquiry-based learning and thus strengthen the link that we

make between teaching and research. UCFV is committed to offering its students a full range of opportunities to engage, together with their professors and fellow students, in scientific and scholarly enquiries and to actively participate in the process of discovery. Research allows students and faculty to learn together, to wrestle with the questions of their time, and to expand their own knowledge. We must find creative ways to integrate research and teaching and to place research and scholarly activities at the heart of the learning experience of our students, our faculty and our community.

This paper was prepared to generate some discussions and suggestions about how best to promote inquiry-based learning and create more opportunities for our students to become engaged in research and scholarly activities. The goal is to develop an institutional strategy that can soon be reflected in our education plan and in our educational and research policies.

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