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Inquiry Learning: Instructor Perspectives

Susan Vajoczki
McMaster University, vajoczki@mcmaster.ca
Susan Watt
McMaster University, wattms@mcmaster.ca
Michelle M. Vine
McMaster University, michelle.vine@oahpp.ca

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Inquiry Learning: Instructor Perspectives

Abstract
The rise of the research intensive university has led some critics to argue that teaching has been discounted in favour of research, and thus the academy has "failed...their undergraduate populations" (Boyer Commission, 1998, p .5). This paper examines instructor perceptions of inquiry at an institution with a significant history of providing inquiry learning opportunities to undergraduate students. Inquiry learning is typically seen as a pedagogical approach, both a method and a process, delivered in small class settings. Qualitative data were collected through interviews (n=16) with instructors who used inquiry in their teaching to elicit instructor perceptions of inquiry teaching. Content analysis was performed on the interviews to extract themes. Results suggest that instructors approached their inquiry teaching differently - some adopting an intentional and some an unintentional approach. There was general consensus that teaching and learning academic skills is valuable, inquiry instructors are facilitators, technology has only a modest place in the inquiry classroom, and larger classes inhibit inquiry. Responses were mixed about the importance of stand-alone inquiry courses. Teaching such courses appears to change the instructor's perspective about inquiry.

L'augmentation des universités qui sont de plus en plus axées sur la recherche a soulevé quelques critiques à l'effet que l'enseignement ait été délaissé au profit de la recherche et que, conséquemment, les institutions d'enseignement ont « laissé tomber… leurs étudiants de premier cycle » (Boyer Commission 1998, p. 5). Le présent article porte sur la perception des enseignants d'un établissement qui préconise depuis longtemps des pratiques pédagogiques notamment la - méthode d'enquête- pour favoriser l'apprentissage de leurs étudiants de premier cycle. Cette méthode est généralement considérée comme une approche pédagogique qui se préoccupe tant de l'objet que du procesus d'apprentissage. Des entrevues réalisées auprès d'enseignants qui utilisent cette méthode ont permis de recueillir des données qualitatives (n=16) afin de savoir ce qu'ils en pensaient. Les chercheurs ont analysé le contenu des entrevues pour en extraire des thèmes. Les résultats indiquent que les enseignants abordent la méthode d'enquête de manière différente : certains adoptant une approche intentionnelle et d'autres une approche non intentionnelle. Les enseignants s'entendent sur les éléments suivants : l'enseignement et l'apprentissage des stratégies pédagogiques sont utiles, les enseignants qui utilisent la méthode d'enquête ont un rôle de facilitateur, la technologie n'occupe qu'une faible place dans la classe où cette méthode est appliquée et les classes nombreuses nuisent à cette méthode. Les avis sont partagées quant à l'utilisation de cette méthode dans les cours sans préalables. Le fait de donner ce type de cours semble modifier l'opinion de l'enseignant quant à cette méthode.

Keywords
inquiry; teaching and learning; qualitative evaluation; instructor perceptions

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The rise of the research intensive university[1] has led some critics to argue that teaching has been discounted in favour of research, and thus the academy has "failed...their undergraduate populations" (Boyer Commission, 1998, p. 5). The scholarship of teaching and learning attempts to address this by highlighting the connection between pedagogical approaches and student learning styles (Prosser & Trigwell, 1999; Trigwell, Prosser, & Waterhouse, 1999; Trigwell & Shale, 2004). This paper examines one pedagogical approach - inquiry teaching and learning. In particular, the paper explores instructor perceptions of inquiry teaching and learning at the undergraduate level at an institution with a significant history of providing inquiry-learning opportunities for undergraduate students.

Concepts of Teaching and Learning

Two different learning approaches are identified in the literature: (a) a deep learning approach reflecting a genuine interest in the subject-matter and a conscious intention to understand and apply the content to everyday experiences, and (b) a surface learning approach addressing the course content in order to complete course requirements, while engaging in unreflective memorization (Entwistle & Waterston, 1988). In order to improve learning outcomes, the goal of many university instructors is to help facilitate deep learning strategies in support of critical thinking and knowledge application (Trigwell & Prosser, 2004).

Increased participation in post secondary education combined with increased public accountability has driven attention to exploring how we provide education to undergraduate students. This attention, in turn, has fostered interest in different approaches to teaching and learning and how they might be used with undergraduate students. No longer is an apprenticeship model possible or perhaps even the most desirable pedagogical approach.

Inquiry is a pedagogical approach that is both a method and a process. The basic principles of inquiry are investigative in nature; exploration and discovery are fundamental to student learning. Inquiry is an innovative, institutionally supported teaching and learning approach, which was introduced in 1998 at McMaster University - a research-intensive university in Hamilton, Ontario, Canada. Inquiry operates in small, level 1 stand-alone courses in the Faculties of Social Sciences, Science, and Humanities. The introduction of inquiry learning in first year classes led to the infiltration of inquiry in all departments and at all levels in the Faculty of Social Sciences (Vajoczki, Watt, Vine, & Liao, 2011).

Now that there is a more than ten-year institutional history of inquiry teaching and learning at McMaster, an exploration of instructor understanding and application of inquiry is warranted. It is our assumption that by understanding how instructors perceive inquiry teaching and learning, we will be able to understand how this pedagogical approach shapes undergraduate education. The purpose of this paper is to examine instructors' perspectives on inquiry learning, conceptualize its pedagogical and methodological role, and illustrate distinctions between the perspectives of instructors who have both taught dedicated inquiry courses, and those who have not.

[1] The Boyer Commission (1998) defines a research (intensive) university as one in which a full range of undergraduate programs are offered, where there is a full commitment to graduate education, and where research is given a high priority, as evidenced by a federal investment of $40 million or more.

The relationship between subject matter (content) and pedagogical approaches (process), and pedagogical approaches and learning approaches has been conceptualized in recent higher education research (Prosser, Martin, Trigwell, & Ramsden, 2005; Ramsden, 2010; Trigwell, Prosser & Waterhouse, 1999; Trigwell et al., 2005). Trigwell (2011) found that "university teachers need to reflect upon their own ways of understanding subject matter and consider the implications of this for the ways in which they teach and bring their students into a relationship with that subject matter" (p. 5). Research has established a relationship between the approach that an instructor takes to teaching, and the approach students take to learning (Trigwell, 2011; Trigwell et al., 1999). Inquiry is a model that promotes a deep approach to both teaching and learning.

Inquiry is both a process that is a method, and a set of skills. The inquiry process is about exploring, discovering, and ultimately, reaching a higher level of understanding (Hudspith & Jenkins, 2001). This process has several steps including: actively identifying a topic or issue; generating a researchable question; investigating the problem by undertaking relevant research; critically thinking about the issue; answering the question(s); drawing conclusions; and reflecting on the inquiry process. Ultimately, inquiry is a form of research. Inquiry promotes student-directed learning and helps students to develop the skills necessary to acquire and reflect on new knowledge and understanding. According to Lee, Greene, Odom, Schechter, and Slatta (2004), inquiry-guided learning

> [r]efers to a range of strategies used to promote learning through students' active, and increasingly independent, investigation of questions, problems and issues, often for which there is no single answer. A range of teaching strategies is consistent with inquiry-guided learning including interactive lecture, discussion, problem-based learning, case studies, simulations, and independent study. (p. 5)

Justice, Rice, Warry, and Laurie (2007) identified several positive learning outcomes related to inquiry utilizing an earlier framework by Pettigrew (1985) on contextualist research that links theory and practice. These outcomes include: an increase in the rate of students earning passing grades; an increase in the rate of students achieving Honours standing; an increase in the percentage of students staying on the Dean's Honour list[2]; and, an increase in the number of students remaining in university until graduation.

Research has demonstrated that inquiry teaching and learning enhances students' critical thinking skills and their ability to undertake independent investigations of subject matter, while promoting responsibility for their own learning, intellectual growth, and maturity (Kinkead, 2003; Kirschner, Sweller, & Clark, 2006; Kuhn, Black, Keselman, & Kaplan, 2000). Throughout the inquiry process, the student remains relatively independent, with only a moderate amount of guidance from the instructor. Instructors do not act as knowledge dispensers or transmitters; rather they act as moderators. For example, instructors may raise important questions, help students to plan their research process, and guide students in formulating and justifying conclusions about what they have learned about the topic (Hudspith & Jenkins, 2001). Spronken-

[2] At McMaster University, students with a minimum average between 75-79% (B+) on at least 6 full courses (taking place over two consecutive terms), are named to the Deans' Honour List.

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Smith and Walker (2010) demonstrated that if faculty (staff in the UK) adopt an open, discovery-oriented, inquiry-learning approach including having the student develop a research question and complete the entire inquiry cycle, the ties between teaching and research become more firmly established. In a research-intensive university it is particularly important to teach students about the research process and to help students establish good pedagogical strategies early in their academic careers. Therefore it is helpful to understand how an inquiry approach might enhance this development. Although the authors share the view of Hudspith and Jenkins (2001) that all students studying in a post-secondary institution should have the opportunity to learn through inquiry because research has demonstrated its value as a learning tool (Kuhn et al., 2000), having a clear understanding of the competing points of view from students and faculty on this matter is essential from a planning and management perspective.

Applying Inquiry at a Research Intensive University

Inquiry is an innovative award-winning teaching approach practiced at McMaster University, as evidenced by The Alan Blizzard Award - a national level teaching award that was awarded to the original team of first year Social Sciences Inquiry instructors at McMaster (Justice et al., 2002). At McMaster, inquiry provides an opportunity for undergraduates to work in teams to enhance critical thinking skills and to develop the attitudes and approaches necessary for lifelong learning. Using an inquiry approach, students are encouraged to develop a research question, to gather the evidence necessary to answer the question in order to undertake a critical assessment, and to engage in ongoing reflection on the learning process(es).

Inquiry-based learning was first formally used as a pedagogical approach at McMaster University in the Arts and Science program in the early 1980s (Jenkins, 2007). Given its success, McMaster's Faculties of Social Sciences, Science and Humanities introduced stand-alone, small-sized inquiry classes for first year students in the 1998-1999 academic year. Students were divided into a number of small classes within their own Faculty. Instructors within each Faculty worked as teams in planning the course, each facilitating their own class. The broad process-based learning outcomes for these courses are to enhance students' ability and proclivity to *learn deeply*, *think critically*, take *active* control of *learning*, be precise, accurate and clear in communicating, learn in a *participatory* fashion, be open to learning, and enjoy the pursuit of understanding (Justice et al., 2002). Thus,

> *Inquiry 1SS3* [the designated course for inquiry in Social Sciences] is based on the assumption that learning is the process of making sense of the world by abstracting meaning from experience and synthesizing these abstractions into deeper ways of understanding and interpreting the world. (Justice et al., 2002, p. 4)

Their research demonstrated that McMaster instructors were committed to providing practical knowledge of a process to heighten understanding and knowledge transmission, skill development, and a deep understanding of an area of social thought (Justice et al., 2002). The instructors reported observing developments in intellectual maturity, thus, heightening student awareness of social, cultural and ethnic diversity issues, and students' having a high regard for the course.

Justice, Rice, Warry, Inglis, et al., (2007) evaluated Inquiry 1SS3 and found that it achieved many of its underlying goals, and benefitted the students who took it. More recently, Justice et al. (2009) found that a tension existed between advocates for stand-alone inquiry courses, and those advocating for inquiry integration across the curriculum. Philosophical and pedagogical beliefs surrounding a stand-alone inquiry course had resulted in varied levels of support by Faculties. Justice et al. (2009) found that some faculty members resisted teaching inquiry because they saw inquiry as a threat to their role and responsibilities within their Faculty. Sometimes instructors perceived inquiry teaching as additional work or as a threat to their performance reviews (Justice et al., 2009)[3]. Although inquiry learning had been practiced at McMaster for more than fifteen years, there appeared to be a limited understanding within the university community about what is meant by inquiry as a pedagogical approach (Justice et al., 2009).

Vajoczki et al. (2011), building on the work of Justice and colleagues (2002, 2007, 2009), examined the level of inquiry infiltration across the Social Sciences curriculum at McMaster through a content analysis of 545 course outlines. Findings demonstrated that the amount of inquiry varied greatly by level, department, and class size. All departments within the Faculty exhibited some level of inquiry learning. The greatest levels were exhibited in the departments of Social Work, Labour Studies and Political Science. Health, Aging and Society, Anthropology and Geography displayed the least amount of inquiry learning. Inquiry learning was more prevalent in small, upper year courses but there were examples where instructors in large (> 200 students), lower level classes (years 1 and 2) utilized inquiry as a pedagogical approach. In order to understand the variation in inquiry prevalence, it is useful to explore instructor perceptions of inquiry teaching and learning.

Research Objectives

The focus of this research is to understand instructors' perspectives about inquiry teaching and learning. The current research is part of a larger study examining inquiry learning in the Faculty of Social Sciences at McMaster University. This aspect of the research addresses two objectives:

1) to investigate the perceived objectives of undergraduate inquiry teaching and learning at McMaster University; and,
2) to explore the perceptions of course instructors of the key factors influencing inquiry teaching and learning, including course delivery and undergraduate student uptake.

Research Methods

To achieve these research objectives, a qualitative research design was employed (Crabtree & Miller, 1999). In-depth interviews were undertaken with key stakeholders in the spring of 2010. Participants (n=16) were purposefully selected from previous work that involved the analysis of more than 500 course outlines in the Faculty of Social Sciences at McMaster in order to identify the presence of and value placed on inquiry learning (Vajoczki et al., 2011). A cross-departmental sample was developed from the Faculty of Social Sciences.

[3] Justice et al. (2009) report that inquiry instructor ratings of effectiveness typically dropped during the first two or three years they taught using this pedagogical approach.

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Respondents had taught a formal inquiry course and/or had some level of general knowledge of inquiry courses. The tenure status of instructors varied and includes individuals with a contractually limited appointment (CLA), assistant professors, associate professors and full professors. Respondents were initially contacted by way of an introductory letter, which provided information about the study and details related to follow-up. The response rate was 33%. Both full-and-part-time instructors participated. Respondents had been involved in inquiry teaching for up to four years.

The sample includes seven male and nine female respondents. Interviews lasted between 25 and 90 minutes. Interviews were tape-recorded (with permission) and transcribed verbatim for subsequent thematic analysis. Respondents were asked to select the interview location. Interviews took place either in-person in the office of the respondent (eleven), or via telephone (five). The development of an interview checklist was informed by the research objectives and questions, and background knowledge obtained from previous stages of the research project (see the Appendix). Respondent quotations were taken directly from the transcripts and have been used, verbatim, to illustrate key themes. Respondents received a copy of the interview checklist prior to the interview, as well as a letter of information and a consent form, which was signed prior to the start of the interview. This research received clearance from the McMaster University Research Ethics Board.

Findings

Research findings provide evidence of inconsistencies among instructors' perceptions of inquiry. The inconsistencies include intentional (i.e., explicit) and unintentional (i.e., implicit) approaches to teaching inquiry. Perceptions also vary within the instructors who had taught stand-alone inquiry, and within those who had not. The instructors are also not aligned in their perceptions about the most appropriate curricular level for inquiry learning, and about the impact of class-size on the viability of an inquiry approach to teaching and learning. Instructors are aligned in their perceptions that skill development is a crucial component of inquiry learning, the instructor's role is that of a facilitator, and, that there is a need for appropriate use of technology to enhance student learning. In this paper we report on the (lack of) alignment of perceptions of inquiry in relation to the pedagogical approach of the instructor, the type of exposure of the instructor to inquiry teaching, their views on the level at which inquiry teaching should be provided, and the practices used in inquiry teaching.

Pedagogical Approach

Perception misalignment. Findings reflect two different types of approaches to teaching inquiry: (a) intentional/explicit, and (b) unintentional/implicit. Using an intentional approach, inquiry instructors explicitly try to increase student engagement and interaction through the acquisition of defined skills. Respondents using this type of teaching approach have a common understanding of inquiry, agreeing that there are several components to inquiry learning. These components include critical reflection of learning and critical thinking, interactions with peers, an independent, self-directed approach to learning, knowledge and question generation, the ability to evaluate data and information, and the creation of a regular feedback loop (between students, and between student and instructor). For example, "There is also a structure whereby they will get critical feedback to enable them on the way. There is also a structure whereby there

are expectations in terms of paper lengths. Discussions of what constitutes appropriate critical feedback" (ID 11). One instructor who had just implemented mandatory meetings outside of class time with each student said, "This one [this course] requires a lot more, and you are a little more intense in giving feedback, because you want them to grow from it, and change" (ID 6). Instructor expectations appear to be high and include a high level of one-on-one feedback and instruction.

Respondent perceptions illustrate the way in which instructor feedback acts as an important structural component of the inquiry course as it encourages students to participate in a process of reflexive engagement with course content through critical thinking and self reflection. In this way, students act as agents in their own learning, reproducing and re-evaluating epistemological claims through their social interactions with instructors and other students.

The ability of a student to select the topic and then evaluate related information was another key component of an inquiry approach to teaching. One instructor said,

> I think it is trying to hit a number of different goals. Certainly, one is engagement is my guess, because I think people are more interested in their own questions than in questions that are imposed upon them sometimes. The other thing is it tends to promote research skills just sort of broadly, and in particular a sort of critical approach to sources of information to evaluate sources of information. (ID 7)

Critical thinking involves a process of posing good questions, student engagement, and self-reflection. One instructor clearly articulated this practice:

> For people to understand, the critiquing above and beyond… [Asking such questions as] Did you understand that? What did you get out of it? What didn't you like about it? What questions didn't they ask? You know, to what extent was a product of their time? What would you like to know about the author? (ID 7)

Inquiry learning also appeared to be student-driven. "Inquiry learning to me is the process of students…formulating questions, finding research into questions, finding information, synthesizing and analyzing that information, and then communicating that information, or the results of their work or findings" (ID 13). Another instructor acknowledged the importance of skill-development – not just course content: "It is not just about the content of your classes, but that it is about learning writing, it is about learning critical thinking, including critical reading, and research skills, and information literacy" (ID 12). A feedback loop, the ability of students to evaluate published information and the work of others, and engagement in critical thinking exercises, represent an explicit/intentional approach to inquiry learning.

Instructors who adopt an unintentional/implicit approach to teaching inquiry have a much less well-defined understanding of inquiry. These types of respondents are less likely to identify key components of inquiry. Although they recognize that they have taught inquiry they are not able to definitively articulate the underlying principles of inquiry. In this way, inquiry learning is a "taken-for-granted" pedagogical approach. For example, one instructor stated, "Well the only thing there that is different, perhaps different from other kinds of learning is the fact that the student is almost entirely independent. Otherwise it is the same as anything else that I have

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taught" (ID 2). One respondent who taught a stand-alone inquiry course on four different occasions expressed similar uncertainty about the underlying purpose of inquiry:

> I don't know how to answer that question actually. I think it looks like the students are making an effort. It looks like they sometimes get frustrated, and sometimes for some students, it is very boring, and on the other hand, it is like if you can see some light bulbs going on. I am not quite sure how to answer that question. (ID 6)

Inquiry and non-inquiry instructors. Findings illustrate a clear link between the *teaching experiences* of instructors and their *perceptions* of inquiry teaching and learning. There is a marked relationship between whether instructors had taught a formal course in inquiry, and their perception and understanding of inquiry as an approach to learning. For example, instructors who *had not* taught a formal inquiry course are more inclined to view these skills as innate and naturally occurring, not requiring explicit examination and/or instruction. One instructor reported,

> I am not sure I understand for myself the difference between inquiry learning and any other kind of learning. If you look up the meaning of the words inquiry learning in the dictionary, it says things like, "search for knowledge". I just think all learning is that…So all learning is inquiry learning as far as I can see. What would the alternative be? (ID 2)

Conversely, stand-alone inquiry course instructors indicate that these skills need to be an explicit part of the course curriculum, requiring systematic, strategic instruction and evaluation. One instructor stated,

> I think because you are teaching them the skill set, and you are more focused on the skill, rather than the topic that you are using as a vehicle for developing those skills. I think you become a little bit more conscious about the steps you need to follow, and how you go about developing a set of research questions, and then how you go about searching the literature to find the correct answers, and then writing skills as well. (ID 3)

All instructors who participated in this study acknowledged that the skill-set related to inquiry learning is predicated on the students' willingness to learn. One instructor commented that inquiry

> works well for the people who sit in the front of the class…and it is relatively difficult to engage people to that level when they are not that interested in being engaged, right and so I think the inquiry model is great, but it really presumes that, it presumes that the students are interested in being there. (ID 14)

Student motivation, self-direction and an element of discretion are critically important factors.

> I want the students to be able to learn how to assess the literature, think about it critically, not accept things published in the scientific literature as fact, but to realize that there are always flaws and limitations to research, and the interpretations published are always sort of presented through the light of the researcher's own theoretical viewpoint. (ID 15)

Designing the curriculum. Although all instructors identified inquiry skills (e.g., independent research, critical thinking and evaluation) as important foundational components of learning in university, they were mixed in their attitudes about when students should be exposed to inquiry pedagogy. Some respondents identified level one as the most appropriate time to introduce this form of learning, whereas others acknowledged the upper levels as most appropriate.

> I am a little bit skeptical about these kinds of courses at the earlier levels…They have got a certain basis in order to engage in meaningful research, in the narrower way that you define it, and in a more independent spirit. But without that I can't see how you could do it for the average student in first or second year. (ID 2)

Other respondents argue that inquiry courses benefit students at *all* levels.

> At each level then you are really laying the foundation…when they get into second year, I think they are really starting to kind of really understand what is going on here. By the time they are in third year, I think they are at a good level to really grasp the inquiry method…and then obviously by fourth year, you want them really using it. (ID 3)

Although responses vary about the place of inquiry courses in undergraduate education, all respondents, except one, indicate that such a course, or elements of such a course, should be mandatory for undergraduate education. Nearly two-thirds of respondents believe that first year students should be exposed to inquiry, though not necessarily in a stand-alone course format.

Inquiry Teaching Practice

In this section we describe several components of inquiry pedagogy, as defined by instructors. These include academic skills, instructor role, technology, and class size.

Academic skills. Instructors identified a number of academic skills including posing good questions, critical thinking, and student independence. The skill of posing good questions is seen as a valuable component of critical reflection. One inquiry-instructor illustrated the extent to which learning to ask a good question is integral to the inquiry process:

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> Their goal was, "I am going to give you a topic, and you should be able to tell me questions that will allow you to further the research of this topic." So I personally wasn't giving them the answers to anything, I was giving them the ability to build questions. (ID 5)

Asking key questions, sometimes within small group discussion, was linked to critical thinking and reflection. "After I talk about the readings I have a list of questions, and I ask them to break into small discussion groups, and they can choose one of the questions to discuss amongst themselves" (ID 4). Group interactions enhance student engagement, group dialogue and projects are perceived as an appropriate space within which to develop and hone research skills.

> You are teaching them the skill set, and you are more focused on skill, rather than the topic that you are using as a vehicle for developing those skills. I think they become a little bit more conscious about the steps that you need to follow, and how you go about developing a set of research questions, and then how you go about searching the literature to find the correct answers. (ID 3)

Student independence is also viewed as an integral part of inquiry learning, and one to which students respond well.

> Most of them respect being treated as being intellectually mature, and capable of thinking about things on their own. So when you pose the questions, you are posing challenging questions deliberately because you want them to be thinking at this particular level about the issue, and I think most students would prefer to be treated that way, as opposed to being treated at a much lower level, in which you are going to given them in essence all of the answers, and tell them what questions to ask and so on. So I think for that reason, the tendency is for them to respond positively. (ID 10)

One respondent illustrated the nature of this type of student-driven learning: "I am under the impression they don't like the unidirectional approach. I am under the impression they want to be involved in their own learning. They just don't know how" (ID 8).

Active learning is also a key component of inquiry-based teaching and learning, which is similar to the deep learning process developed by Entwistle & Waterston (1988). Active learning provides students with individual autonomy, heightening their awareness of and capacity for research. In the context of inquiry teaching methods, instructors balance course content and curriculum with the development of inquiry skills:

> I think what we have to do is sacrifice some content for some interaction to increase retention, and [what] the inquiry projects do in a really nice way is somehow maintain that active learning, but they bring so much content back into the course. You end up with research skills, and you end up with engagement, and you end up with some sort of critical evaluation of information sources. (ID 7)

Instructor role as facilitator. As part of an active pedagogical approach, many instructors perceive their role as that of facilitator and, therefore, responsible for leading and guiding class discussion. In this way, students are encouraged to participate in class discussion by communicating, debating and analyzing topics related to course content:

> I tried to speak at them very little. I just had to be more like a facilitator at the front. You would have a few slides, and then you would try to break them off into groups to explore the question. (ID 5)

In this way, the instructor is seen as a guide or a mentor, and classes are: "Student driven, so I don't lecture at all. I am just one of a community of learners, and I facilitate the discussion. That is how I see myself" (ID 8). The role of instructor becomes challenged as instructors assess the extent to which they are able to give up a sense of control:

> I think as instructors we are used to going into a classroom, say for a lecture period, and we control the pace, we control what is going on, and that is what we are used to. With this inquiry type of approach…it is very much a case of having the confidence to say, "I am not in control". (ID 13)

In addition, pre-defined expectations are kept to a minimum, as students are encouraged to identify and develop their own method of learning, guided by self-direction and independence:

> I think inquiry tries to accomplish more or less through a stated set of things…trying to get people to be self-directed. To figure out, sort of learn how to learn. To learn a set of skills, whereby people can and sort of solve their problems, and teach themselves how to solve their own problems…I think inquiry tries to teach people to be, to think more critically but to also do that in terms of being able to frame questions as well. (ID 14)

The ability to think critically about ideas and evaluate evidence is vital, and helps to increase student motivation and independence. For example:

> The other part I think of inquiry is this sort of critical reading, critical thinking, and so we cover that explicitly as a topic in class. We talk about methods and quality of evidence as part of intro…The idea is that they have to not only find it, and synthesize it, but then they have to evaluate it somehow, and have their own voice. (ID 12)

Knowledge translation exercises appear to be an outcome of inquiry teaching:

> Last year they did posters, and they also came up with a survey question, so the idea was they came up with a strategy. They defend the strategy, that is why I think it would work, and then they come up with a question to test whether the public would be willing to accept it or not. (ID 7)

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These student-learning approaches are linked to heightened student engagement, and the long-term goals of students.

Technology. All respondents reported that they used technology (e.g., Power Point slide presentations, overheads, electronic poster boards, blogs, and clicker[4] technology) to varying degrees as a way of making inquiry course material accessible to students. Instructors report the link between student engagement and the use of technology in large class sizes:

> You need to keep students engaged. That is not always an easy thing to do. So I think the clickers have really worked for me this term…And if there is something else that can also promote that kind of engagement in a large classroom, and then obviously I would go for it. (ID 3)

Other respondents use technology as a tool for student-led dissemination activities.

> We are going to have a mini-conference when they have to submit an abstract of 150 words, and key words, and all those sorts of ideas. We are going to have judges to judge the best poster prize, and they have to speak about their work. (ID 5)

Instructors reported their use of podcasting to improve the accessibility of course content and increase student and instructor control over the management of information. Clickers are utilized by several instructors to measure attendance and participation rates. Instructors identify ELM (campus learning management system) as being helpful in facilitating group work: "I think there are ways that you could do group work using ELM that would be pretty useful" (ID 9).

Other respondents were less enthusiastic about technology use. "I am just very cautious about the way it is going, so the simple answer to your question: I try and do more with less tech" (ID 1). Time and resources are cited as barriers to technology: "The university has not invested enough in the stuff that is needed to ensure that the technology in every classroom is always in working order" (ID 9). Stand-alone technologies are seen as less advantageous than combined methods for teaching and learning:

> I don't think that either the method or the technology is a guarantee of successful teaching and learning. So there are three parts to it -- the person, the technology, and the method. And those three things work together. I really believe that the person has a lot to do with the extent to which you get success from the method and technology (ID 10).

The use of technology varies among participants in this study. While some instructors actively seek out technological learning opportunities, others are less interested, citing time and resources as barriers. Many respondents adopt technology as a way of integrating course material into large classes, through podcasting or the use of clickers. In order to facilitate a continuous

[4] Clickers are a type of classroom personal response system technology that help facilitate discussion among students and provides instructors with a mechanism to track student understanding of course material, course attendance and participation.

feedback process, driven by question formulation and investigation, instructors believe they can draw on technology as a way to facilitate in-class discussion and feedback.

Class sizes. Most respondents agreed that large class sizes act as a barrier to inquiry teaching and learning. Small group work helps to alleviate some of these barriers by creating opportunities for students to communicate with one another, and engage in critical thinking exercises. In addition, small group work provides opportunities for the development of a feedback loop between instructors and students, and among students. It is within this context that student motivation is highlighted:

> I think it motivates. The big benefit is it motivates the better students, and that in turn creates a sort of I guess hopefully a snowball effect and the other students may or may not pick up on it… It probably gets more students to think differently about the issues that you are dealing with on the basis of what they find out themselves, and also on the basis of what they hear other students say. (ID 10)

This type of feedback loop is seen as critically important in advancing student development.

> They need at least to bounce ideas off you on a very regular basis, so that you can direct them away from things that are fruitless or give them the support they need when they have an idea and they are not sure it is a good one. (ID 4)

Along with a feedback loop, instructors believe that students appreciate and value the relationship building that takes place within small groups. For example, as one respondent indicated

> Often times they talk about how much they like the fact that they feel connected with their classmates, and the sense of belonging…It allows that interaction with a family member, with their peers, and to pursue a topic that they are interested in. (ID 6)

Even in large class sizes, instructors are cognizant of the importance of integrating elements of inquiry teaching and learning. The issue of content is balanced by a clear need for inquiry elements:

> It is not just about the content of your classes, but that it is about learning writing, it is about critical thinking, including critical reading, and research skills, and information literacy…I have been thinking about this, and I do plan my classes with these kinds of ideas in mind, even though my intro level has 469 students in it. (ID 12)

Although some respondents are optimistic about integrating these skills into larger sized classes, others are less so, citing resources as a clear barrier:

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> I suspect to get first year students to the point where they can ask their own research question, and figure out how to answer it, and critically evaluate the information along the way, requires a lot of support, and that is resources. (ID 7)

The facilitation of small groups often occurs through tutorial sessions. There was a concern among instructors, however, that tutorials themselves are becoming too large.

> The tutorials are getting really too large, and you know we need to be able to facilitate some kind of process. We don't even have enough TAs right now to manage a peer review of each other's work, where they do writing for each other, and we are just short and so that is the number one thing that we are working on an absolute bare bones kind of budget for the intro classes. (ID 12)

Discussion

This research demonstrates a high level of agreement that inquiry learning skills are an important component of an undergraduate education. This level of agreement is evidenced among instructors from all ranks, among those who had taught stand-alone inquiry and those instructors who had not, among those with an intentional or those with an unintentional approach, and among instructors teaching at all undergraduate levels. This level of agreement is shared, specifically around the role of technology in the classroom, the role of the instructor as a facilitator, and the perception that a large class would be a barrier to using an inquiry approach.

In this research it has become apparent that the use of inquiry pedagogy is a learning experience for both students and instructors. Instructors who demonstrate a critically reflective approach to teaching also demonstrate an intentional approach to inquiry teaching. At this point, it is unclear if instructors who elect to teach inquiry do so because they are already critically reflective teachers, or if they develop the skill of being a critically reflective teacher as a result of teaching inquiry. Whatever the direction of the association may be, Brookfield (1995) argues that a critically reflective teacher enhances the learning experience of students.

One might expect at an institution with a ten-year history of implementing a pedagogical approach that there might be more consistency in instructor understanding of inquiry. However, we found a wide range of perceptions about what is meant by inquiry, how inquiry skills should be taught, and at what level inquiry skills should be taught. This may be explained by the fact that there is no single best place for inquiry teaching and learning within curricula, and it has been demonstrated to work in both stand-alone courses and embedded within courses (Hudspith & Jenkins, 2001). At an institution with a high level of departmental autonomy, and in the absence of centrally mandated curriculum guidelines, it is not surprising to encounter this diversity. What remains unknown is whether in the long run students benefit from this diversity, or find it confusing.

Conclusion

This research demonstrates that inquiry instructors do not have a uniform approach to their teaching. Some instructors approach inquiry teaching using an explicit, intentional approach; whereas, others teach inquiry using an implicit, unintentional approach. Instructors that used an explicit/intentional approach had a common understanding of inquiry, which

includes: critical reflection of learning and critical thinking; interaction with peers; an independent, self-directed approach to learning, knowledge and question generation; the ability to evaluate data and information; and regular feedback between students and between students and instructors. Instructors who adopted an unintentional approach to teaching inquiry have a much less well-defined understanding of inquiry.

In addition, the research demonstrates that instructors are conflicted about the place within the curriculum where inquiry learning should occur. They view this as a continuum - from stand-alone inquiry courses to inquiry embedded within the curriculum.

Both intentional and unintentional approaches create a unique landscape of inquiry teaching and learning at McMaster. Instructor perceptions have some bearing on the way curriculum is developed, how courses are designed and delivered, how students engage with course content, and how learning outcomes develop.

One of the things that remains to be understood is how the diversity of instructor understanding and approach impacts student learning - at different levels, with different content, and in relation to students' approaches to learning. A second area of research focus, as yet relatively unexplored in the literature, might be to develop an understanding of the effect of locating inquiry within a curriculum. Does the insertion of the inquiry skills into discipline-specific courses act as a content-shaping driver for curriculum? If it does, is this a desirable outcome?

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Appendix

Interview Guide for Semi-structured Interviews with Instructors

Questions for Interviews of Teaching Staff

May we digitally record this conversation? (please ensure that you re-ask this question on tape if consent is provided)

1. When you think of Inquiry learning in your discipline,
    a. How do you view it?
    b. What does it try to accomplish?
    c. What does it look like in action in the classroom?

2. Do your students in xxx engage in inquiry learning?
    a. If yes, would you describe one of the inquiry learning experiences in this course?
    b. If no, could you tell us how this experience differences from inquiry learning?

3. Inquiry is a different approach to learning in the classroom, what do find particularly challenging in adapting to an inquiry approach?

4. Are there benefits to having Inquiry as an approach in your course/s and if so what are they?

5. Have the students in your course responded in the same way to inquiry elements as to other aspects of the course (e.g. same level of disinterest, excitement, level of participation)? If not, how has it been different and why do you attribute the difference to inquiry learning?

6a. Do you think that demonstrated the ability to inquire is a necessary requirement for university graduation?

6b. Do you think that a formal course in inquiry learning should be required of students in university?
    i. If yes, at what Level of study Level I, II, III, IV, or postgraduate?
    ii. If no, how would you evaluate a student's ability to undertake inquiry?

7. Do you think that independent learning is an essential component of learning inquiry skills?
    a. If no, why not?
    b. If yes, how is it demonstrated at different university levels?

8. How do you encourage critical thinking and reflection of learning in your class?

9. For large class sizes, how do you ensure that each student is learning the skills of inquiry?

10. How do you use technology in your teaching?
    a. How did you decide to use which technology?
    b. Have you tried technologies that you subsequently abandoned?

11. Do you see ways in which technology could enhance your students' inquiry learning experience?
    a. Are you interested in learning more about these technologies
    b. What keeps you from using them?

12. Please add any other comments about inquiry learning or teaching with technology that you would like to include.

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