

SECTION D

Embedding Inquiry-Based Learning Activities to Create a Research-Supportive Culture

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ABSTRACT

Research, in its most elemental form, is the process of asking a question and searching systematically for an answer. Thus, it is inquiry-based. Embedding inquiry-based activities throughout the curriculum facilitates the creation of a research-supportive culture, the stated purpose of Embry-Riddle Aeronautical University's Quality Enhancement Program. Inquiry-based activities range from confirmation of known principles following an instructor-specified procedure, to independent formulation of questions and investigative procedures by the students themselves. They follow inductive methods and constructivist principles. Instructor preparation requires careful planning, with attention to learning objectives, resources required, and student resistance factors. Instructors must possess deep content knowledge and a variety of pedagogical strategies. Often the greatest challenges are embracing cognitive dissonance and handling unexpected or nonexistent student responses.

Introduction

Why is the sky blue?

What happens when we die?

How come the other kids don't like me?

Probably most people would not instinctively recognize these as research questions, and yet they are. In its most elemental form, research is the process of asking a question and then searching for an answer. From this standpoint, research activities are inquiry-based; everything starts with a question, and questions continue to guide the work throughout the research process.

To define research as fundamentally inquiry-based leads to an important clarification: There are many ways to search for answers to the research question; however, the method used does not determine whether or not research is being conducted.

Of course, children just ask the question and wait for someone to provide an answer; however, from an academic perspective, research is a bit more organized than that. Embry-Riddle Aeronautical University's Quality Enhancement Plan (QEP) *Ignite* (Embry-Riddle Aeronautical University, 2012) defines research as "a systematic inquiry or investigation" (p. 7). Inquiry-based learning meets the systematic criterion; it utilizes inductive teaching methods. It is with this understanding of research as beginning with and guided by questions and conducted in a systematic way, that inquiry-based learning is presented as a potent means of accomplishing the stated purpose of *Ignite*: to establish "a research-supportive culture in the undergraduate community" (p. 7).

Inductive vs. Deductive Teaching Methods

Inductive teaching methods begin with a specific problem or question and students learn, as they work along, the general principles and skills they need to know in order to solve the

problem or answer the question. In traditional deductive teaching methods, by contrast, learning proceeds from the general to the specific. Students first learn relevant theories and processes and then apply them to solve particular problems or answer specific questions.

To present a simple example of the differences, Table 1 shows the contrast between inductive and deductive teaching approaches when the objective is to produce an effective oral presentation, a common assignment in many courses. In the deductive approach, the instructor would provide a list of the general characteristics of an effective oral presentation; for example, it is organized and focused; employs clear, precise language; and is supported by appropriate visual aids. Students and instructor would discuss each of these in turn, ensuring that the characteristics were effectively defined. Students might then expand their understanding by viewing oral presentations and analyzing them. Finally, students would be given the task of producing their own oral presentations, to demonstrate that they can apply the general principles to a particular task.

In contrast, using the inductive approach, the instructor would assign the task at the beginning and send the students off to prepare their oral presentations. In the process, students would discover on their own the characteristics that they believe are necessary in an effective presentation and incorporate them into their plans. There are many possible ways that they might make these discoveries: through brainstorming, by recalling presentations they enjoyed and those they didn't, or by doing research. When the students make their presentations, the instructor would guide the discussion and analysis, so that students could draw out from their own experiences the general characteristics of an effective presentation.

Table 1

Contrasts in Deductive and Inductive Approaches to Teaching

Objective: Produce an Effective Oral Presentation

Deductive Approach	Inductive Approach
1. The instructor provides information (general characteristics of an effective presentation) and ensures that students understand each characteristic	1. Instructor provides basic information (time limit, for example) and gives the assignment (produce an effective oral presentation).
2. Students expand their understanding (write reports about famous presentations; analyze examples of effective and ineffective presentations; complete textbook exercises such as quizzes).	2. Students prepare their presentations. In the process, they discover that they need information that was not given in the assignment; they don't know what the characteristics of an effective oral presentation are. They determine how to get the necessary information; they get it and apply it.
3. Instructor gives the assignment: students apply their general conceptual knowledge to demonstrate mastery (produce an effective oral presentation).	3. Students make their presentations; they and the instructor discuss their experiences. The instructor has students describe their processes, including any problems they had and how they solved them. During the discussion, the instructor encourages students to recognize the general concepts at work, using their particular experiences as reference points.

In "The Many Faces of Inductive Teaching and Learning," Prince and Felder (2007) offer this definition of inquiry-based learning:

Any instruction that begins with a challenge for which the required knowledge has not been previously provided technically qualifies as inquiry-based learning, and the scope of

the inquiry may vary from a portion of a single lecture to a major term project. In this sense, all inductive methods are variants of inquiry, differing essentially in the nature of the challenge and the type and degree of support provided by the instructor. (p. 15)

Prince and Felder (2007) discuss various specific types of inquiry-based learning, including most of them under the rubric of discovery learning. Pure discovery learning is not usually found in undergraduate programs, because it typically involves little or no guidance beforehand from the instructor. It is more common to find some variation of guided discovery, such as problem-based learning, project-based learning, case-based teaching, and hybrids of these types.

What all these forms have in common is that students begin the process without being given everything they need to know. As they work through the process, they identify what they need to learn—knowledge they do not already possess that is required for them to proceed toward a solution; they determine how to acquire that knowledge; they acquire it and apply it and move forward. The differences in the types lie mainly in how much help students receive in the beginning and throughout the process.

It should be clear, then, that embedding inquiry-based learning activities throughout the curriculum does not mean that every course must include a formal research study. Because inquiry-based learning is essentially a structured method of investigation, the inquiry process can be adapted to accommodate increasing levels of responsibility and autonomy. Ketpichainarong, Panijpan and Ruenwongsa (2010) describe the trajectory toward independent learning as having four levels:

Level one is confirmation; students confirm a principle through activities in which the results are known. Level two is structured inquiry; students investigate questions using

the procedure provided by the teacher. Level three is guided inquiry; students investigate teacher's questions by designing their own procedure. Finally, level four is open inquiry; students investigate questions related to learning topics by selecting questions and designing procedures by themselves. (pp. 171-172)

The Characteristics of an Inquiry-Based Learning Activity

Inoue and Buczynski (2011) provide an excellent overview of the characteristics of an inquiry-based activity:

In order to deliver an effective inquiry lesson, a set of general principles typically suggested in pedagogy textbooks are (a) to start the lesson from a meaningful formulation of a problem or question that is relevant to students' interests and everyday experiences; (b) to ask open-ended questions, thus providing students with an opportunity to blend new knowledge with their prior knowledge; (c) to guide students to decide what answers are best by giving priority to evidence in responding to their questions; (d) to promote exchanges of different perspectives while encouraging students to formulate explanations from evidence; and (e) to provide opportunities for learners to connect explanations to conceptual understanding. (p. 10)

Many instructors may recognize that they are already using one or more of these principles in their classrooms. They may already be assigning case studies, problems or challenges that are real-world focused and represent situations that students could likely grapple with during their careers. Thus, they are fulfilling the first general principle: starting the lesson from a meaningful formulation of a problem or question that is relevant to students' interests and everyday experiences.

However, an effective inquiry-based lesson can begin at a much lower level than assigning a case or a problem. Any part of the oral presentation challenge could have been the basis for a simpler inquiry-based activity. For example, the instructor could have focused on visual aids and asked students to bring to class various types of aids, such as photographs, diagrams, or charts. Then the instructor could have asked students to discuss the strengths and weaknesses of the various aids. This exercise would have led to students' discovering some general principles, such as the importance of size and the need to avoid distortion of data in graphical form.

This exercise described above shows how the second principle, asking open-ended questions (what are the strengths and weaknesses of each aid?) and providing students with an opportunity to blend new knowledge with their prior knowledge, can be useful in devising a level-two (structured inquiry) activity.

Open-ended questions invite students into the process of constructing knowledge. These kinds of questions ask, "How?" or "Why?" They ask about possible causes or potential consequences. They invite conjecture, imagination, and invention. This free-form speculation is essential; however, in addition to being grounded by its connection to previous knowledge, as the process proceeds, the options for answers and solutions must also be weighed against evidence. This is the third principle: Guide students to decide what answers are best by giving priority to evidence in responding to their questions.

The emphasis on evidence reveals the roots of inquiry-based learning in the scientific disciplines:

The National Science Education Standard (NRC, 2000) identifies five necessary components of inquiry based teaching and learning: student engages in scientifically

oriented questions, student gives priority to evidence in responding to questions, student formulates explanations from evidence, student connects explanations to scientific knowledge, and student communicates and justifies explanations. (Ketpichainarong et al., 2010, p. 171)

Remove the specific references to *science*, and it becomes apparent that the process can be adapted across disciplines. In literature courses, for example, the ‘evidence’ necessary is provided by the source document, such as a short story, poem, essay or novel. In engineering courses, the ‘evidence’ may come in the form of decision sheets or data sets (Friedman, Crews, Caicedo, Besley, Weinberg, & Freeman, 2010).

Students may chafe at the instructor’s insistence on evidence-based analysis; however, to paraphrase French essayist Joseph Joubert (n.d.), to have imagination without evidence is to have wings but no feet. It’s fun to fly (as Embry-Riddle Aeronautical University students know), but sooner or later, one has to land. This is not to diminish the value of flights of fancy. The fourth general principle of inquiry-based learning is to promote exchanges of different perspectives while encouraging students to formulate explanations from evidence.

At this point, it becomes a critical skill to be able to evaluate evidence accurately. Common criteria for evaluation of evidence include reliability (accuracy), angle of vision, degree of advocacy (bias), and credibility (Ramage, Bean & Johnson, 2012). Credibility in particular, can pose problems. Instructors often guide students toward scholarly sources, in an attempt to help them employ credible evidence; yet the truth is that students will find many types of evidence and must learn to examine the information carefully, even when it is presented by what they perceive as authoritative sources.

In “The Economy of Explicit Instruction,” Kramer (2007) makes the point that unquestioning acceptance of information can easily arise from the wording used to present it, citing the ways facts are referred to as if there were only one interpretation and pointing out how some words, such as *data*, seem to invite automatic confidence. He writes:

These metaphors ... reinforce the belief that facts are proof—for *everyone*, hence the emphasis on discovery rather than on interpretation. This emphasis has consequences: rendering irrelevant the questions of who looks; of whether there might be more than one way to see; of whether there might be more than one way to interpret what is seen, even for the one person who is seeing (p. 103).

Ellen Langer, whose research focuses on the effects of assumptions on perception, makes the strong point that “research only gives us probabilities and we transform those probabilities into absolute facts,” but when unconscious assumptions are challenged, people “begin to see how situated and contextual what we accept as facts actually are” (as cited in Rhem, 2012).

Rhetorical analysis of texts in almost any discipline (mission statements, action plans, reports of all types, histories, analyses) can be inquiry-based learning activities. At the level of confirmation, the instructor might take students through an exercise in which they note their reactions or responses to certain words or phrases, after which they could discuss them and the instructor would use their specific responses to clarify the persuasive power of word choices, a key principle of rhetoric that can be used to determine the degree of advocacy in text. At the level of structured inquiry, the instructor would provide a procedure for students to follow on their own; for example, asking students to determine the degree of advocacy in a text by answering a series of questions. At the level of guided inquiry, the instructor would challenge students to determine the degree of advocacy, and the students would devise their own

procedures. At the level of open-inquiry, students would select their own questions related to the topic of rhetorical analysis; for example, they might want to investigate how rhetorical analysis may have changed over a certain time period or been influenced by a certain event. Then they design the investigative procedures themselves.

The final principle that describes an inquiry-based activity is the provision of opportunities for learners to connect explanations to conceptual understanding. This is the inductive step of going from the specific to the general, from the concrete to the abstract. This is the place in the process where knowledge and skill transfer is to be achieved, so that students can apply what they have learned to other problems in other situations. In student-centered learning, which all methods of inquiry are, the goal is for the students to make these connections themselves, with less and less guidance from the instructor as their proficiency increases.

Instructor Preparation

These are the general guidelines, then, that describe an inquiry-based activity:

- Make the lesson relevant.
- Help students graft new knowledge onto old.
- Give priority to evidence when evaluating possible answers or solutions.
- Encourage the free exchange of ideas.
- Enable students to make the leap from the concrete to the abstract.

When the characteristics are thus simply stated, they might be deceptive. Designing and implementing an inquiry-based activity demands time and effort, and it entails risk. Still, instructors can maximize the chance of a successful activity with careful planning. Having noted earlier that there are many ways to incorporate inquiry-based learning into a course, the first decision usually concerns the type of inquiry-based activity to use. In determining this, Prince

and Felder (2007) suggest that instructors direct their thinking in three areas: the learning objectives, the resources required (including the instructor's time, experience and comfort level), and possible student resistance.

Learning objectives. Like everyone else, students want to understand why they are doing what they are doing. If the connection to course goals or learning outcomes is not clear, instructors must explain it to them. This does not have to happen before the activity is undertaken; in fact, using the inquiry-based learning approach, instructors would refrain from providing too much explanation at the start. However, instructors will find it very useful to make the connections explicit for them, in the creation stage of the activity.

A curriculum design process known as backwards design actually begins with the instructor specifying the learning objective. The instructor then decides how students will demonstrate achievement of the objective, the evidence they will produce. From there, the instructor devises the means by which students will learn the knowledge and gain the skills required to demonstrate this achievement (Graff, 2011).

This backwards design process can be used for an entire curriculum, an entire course, or a single lesson. For the purpose of demonstration, the focus will be on a single lesson.

A simple way to engage in backwards design is to create a diagram or an outline. For example, as mentioned earlier, a common assignment in many courses is an oral presentation. An outline for this activity would detail each step, along with any built-in obstacles that students will have to overcome. Figure 1 shows a possible outline for this activity.

Learning Objective: Students demonstrate understanding of the characteristics of an effective oral presentation

Inquiry-based learning activity: Producing an oral presentation

Activity steps:

1. Provide the basic information (time limit) and give the assignment (produce an effective oral presentation).
2. Have students prepare their presentations
 - a. Planned problem area: students do not have a list of these characteristics (organized, focused, clear language, visual aids)
 - b. Possible solutions: students brainstorm their own list; students look up information online; students base their plans on presentations they liked
3. Students make their presentations; discuss the experience, drawing out the concepts students must learn (learning objective) and helping them link the particular experience to the concepts

Figure 1: Outline of inquiry-based exercise in producing an effective oral presentation

In the planning stage, the major value of an outline is that it helps instructors think through every aspect of the planned activity. It helps instructors see if they've made any leaps in logic, missed anything important or gotten off track somehow. And it reminds instructors to ensure that students see the linkages between what they have been asked to do and what they are expected to learn. This is especially important when the activity does not obviously connect to the course content.

As is evident, the strategy of 'starting at the end' includes a decision about how to assess the success of the activity. Madden (2010) describes one of the hidden pitfalls here. Inquiry-based learning activities encourage students to generate their own answers and solutions, but instructors must be able to evaluate them. This often necessitates that the instructor create a model answer or solution, as is specified in 2.a. in Figure 1. The temptation then can be to

evaluate the students' work, based on how congruent their results might or might not have been with the instructor's model.

An outline can keep an instructor from falling into this trap, primarily by keeping the learning objective in the forefront of the exercise. For example, in the presentation exercise, it could seem that the desired evidential outcome would be an engaging, interesting presentation. However, that is not the case. Students' efforts might produce presentations that are bland or boring, and yet their analyses (in Step 3) might reveal excellent comprehension of the characteristics of an effective oral presentation, the true goal of the exercise.

Subject matter content, of course, must be learned. Critics of inquiry-based learning worry that content knowledge is given short shrift in the service of mastering the process. Defenders counter that knowledge is learned more effectively. In addition, by learning how to learn, students are better able to transfer knowledge and skills from one area to another (Friedman et al., 2010; Justice, Rice, Roy, Hudspith, & Jenkins, 2009).

Resources required. There is much to think about when considering the resources that will be required for the chosen activity. Perhaps the first question that comes to mind concerns the kinds of raw materials needed. Are the challenges pre-written or must the instructor create them? Are facilities such as labs available? Is the classroom space appropriate?

Prince and Felder (2007) compare the instructional demands of various types of inductive teaching methods, showing required resources, planning time and instructor involvement, and student resistance. The range in demands on instructor time and involvement is great, from small demands when using existing cases and individual projects; through moderate demands for just-in-time teaching, which requires the instructor to tailor the lesson plan to accommodate gaps in knowledge indicated in students' responses to pre-class questions on content; to considerable

demands for team projects and cases. There's a fourth level, extensive demands on instructor time and involvement, reserved for original problems.

These are the kinds of concrete questions anyone might think to consider when designing a class activity. However, another important factor in a successful inquiry-based activity is the social atmosphere in the classroom or online environment. Inoue and Buczynski (2011) say that "preparing a non-traditional lesson requires the teacher to predict the possibilities of classroom interactions and carefully consider ways to shape the social norms of the classroom to facilitate student-centered thinking" (p. 11). This can be a challenge, especially at the beginning of a course when the classroom climate is still unknown.

As instructors consider ways to shape the learning environment, they should carefully examine their own attitudes and expectations. The instructor's teaching philosophy has to be compatible with the constructivist underpinnings of the inquiry-based approach (Justice et al., 2009). Inoue and Buczynski (2011) cite research showing that novice instructors, even those who get training in inquiry-based instruction, often believe that student-constructed knowledge is inferior to that provided by the instructor.

Veteran instructors may encounter difficulties, as well. Justice et al. (2009) note that some very well respected, excellent instructors may feel devalued if they are preached to about the superiority of inquiry-based methods, a circumstance that often accompanies the adoption of a new concept, approach or practice in an institution. The authors also point out that other attitudes, even subtly held, can have profound effects; for example, viewing inquiry-based learning as a passing fad, considering it irrelevant to the higher purposes of a university education, and expecting that students have already developed the skills before entering their classes.

Even instructors who want to avoid being *the sage on the stage* may find it is no easy task to re-orient students' perceptions of their authority. Gerson and Bateman (2010) define four types of authority that instructors have: institutional authority that is theirs by reason of their appointments as instructors, content area authority, authority conferred by expertise in the subject area, and “performative” (p. 200) authority, which arises from their successful engagement with students.

An instructor cannot simply lay aside these various mantles, even if that is the instructor's wish. However, the authors point out that the varying types of authority can exert greater or lesser influence; that is, both instructors and students can deliberately choose to emphasize one type over another. Therefore, although precisely equally shared authority may not occur, some type of very useful shared authority can be brought to bear in the service of inquiry-based learning.

As noted in the outline discussion, one benefit is that the instructor thinks through the activity, including the planned problem area and possible solutions. This takes time, of course, but instructors may be accustomed to investing time in the planning stage. However, many challenges can arise in the implementation phase that can sabotage the goal of the activity by eating up time. The open-ended aspect of inquiry-based learning means that students' creative responses can be unexpected, and instructors run the risk of undoing all their efforts if they do not respond in ways that encourage continued inquiry.

Three qualities that will help instructors avoid traps as they conduct inquiry-based activities are patience, depth of content knowledge, and a variety of pedagogical strategies

Patience is perhaps the primary virtue. A key component of the constructivist approach is cognitive dissonance, an intellectual tension—usually uncomfortable—that propels students to

discover new ways to put information together to make sense of the information and decide the next steps toward finding a solution, arriving at an answer or achieving a goal (Ketpichainarong et al., 2010).

Inoue and Buczynski (2011) point out two common temptations that instructors must resist: jumping in with an answer when there are no responses and rejecting a student's response when it is off target. Both actions exert the teacher's authority and take the responsibility for learning away from the student. In particular, rejecting a student's off-target response can derail an otherwise well-constructed inquiry lesson.

An off-target response should be seen as an attempt by the student to construct knowledge by connecting new information to old (Inoue & Buczynski, 2011). This is a key concept in inquiry-based learning. The instructor's role is to try to facilitate that connection. Instructors should seek clarification of the student's thinking, while avoiding leading questions if possible. Inoue and Buczynski (2011) caution, "In inquiry based lessons, students develop, carry out, and reflect on their own multiple solution strategies to arrive at a correct answer that makes sense to them" (p. 10). They stress that it is important to allow students to share their answers, responses and/or solutions and to find ways to validate them, while still guiding students toward evidence-based outcomes.

This ability to validate and redirect requires both a depth of content knowledge and a variety of pedagogical techniques (Friedman et al., 2010; Inoue & Buczynski, 2011; Ketpichainarong et al., 2010). Instructors can run into trouble if they do not know how to explain concepts in different ways, if their content knowledge is not deep enough or their pedagogical techniques are not varied enough so that they have other avenues of expression to try if their first efforts do not succeed.

So how do instructors prepare for the moment when their brilliantly planned exercise goes off course? Certainly they can try to consider a range of possible responses during the preparation phase, but it is realistically impossible to think of every potential response. Getting feedback from peers often helps, but when the teachable moment turns out to be completely unlike the vision that inspired it, sometimes the best course of action might be to say, “I’ve never thought of it that way!”

Constructivist learning involves everyone, and the instructor who encloses himself or herself within the circle of learners can enhance rather than damage credibility. The unexpected development presents an opportunity for the instructor to affirm that students are true partners and collaborators, not “mere executors of processes predefined by authority” (Gilardi & Lozza, 2009, p. 254).

In the presence of the unexpected, many opportunities for learning arise. However, taking advantage of those opportunities requires that everyone in the room be able to remain in the uncomfortable presence of uncertainty, rather than take refuge in automatic conditioning. When students and instructor alike have stepped into the unknown, they have the chance to experience what Rhem (2012) calls “real learning [which] is always a shared inquiry, not a top down delivery of information.”

Student resistance. The final area of consideration concerns possible student resistance to the inquiry-based process. Understanding the source of the resistance is the key to defusing it. Ketpichainarong et al. (2010) call this learning to inspire at the right moment.

The right moment could be at the beginning of the inquiry-based activity. Savery (2006) advises that instructors clearly outline the process to be used and get the students’ commitment to it. For example, suppose that in an ethics course, the instructor wants to discuss a highly

emotionally charged, controversial issue. The instructor could clearly state the rules for discussion; for example, one person speaks at a time and for no more than three minutes; no inflammatory or otherwise inappropriate language may be used; speakers must keep the discussion focused on the topic and avoid personal attacks. However, it would be even more effective for the instructor and the students together to formulate the rules and agree upon them, thus creating a rubric together. “Rubrics are used to incorporate students in the process to further support student knowledge and problem solving” (Friedman et al., 2010, p. 770).

At other times, resistance could arise from different learning styles. Based on student responses to surveys after her history of economic thought course, Madden (2010) suggests that students who prefer to think in concrete terms and want facts and knowledge delivery may have trouble with inquiry-based methods and need additional support from the instructor. She notes that such students “could benefit by exercises highlighting uncertainty in human knowledge” (2010, Synopsis and lessons learned, para 3).

Resistance can also arise from course content, for example, when students are challenged to examine their value systems or status in society. Mthethwa-Sommers (2010) describes the effects of the inquiry process on students in a Foundations of Education course that addresses issues of social injustice and discrimination in the educational system:

The findings showed that through the inquiry-based method of teaching and learning, 47 out of 50 students were able to re-examine and transform their previous knowledge on certain diversity topics.... Such readjustments were critical in the reduction of resistance and were possible because the inquiry-based method positioned students as owners of knowledge. (p. 62)

Perhaps Prince and Felder (2007) provide the most helpful summary. In their analysis, they rank student resistance from minimal to major and say the highest level “follows both from the burden of responsibility for their own learning placed on students and the additional demands imposed by cooperative learning” (p. 17).

Instructors can diffuse resistance by building students’ confidence in the instructors’ ability to handle classroom dynamics including unexpected responses, take in account various social and cultural factors, link subject matter to students’ experiences, and present knowledge in different ways (Friedman et al., 2010; Inoue & Buczynski, 2011; Ketpichainarong et al., 2010). They can also inspire confidence with well-developed lesson plans (Savery, 2006) and comfort with cognitive dissonance, including their own (Ketpichainarong et al., 2010).

Conclusion

Inquiry-based learning activities have been shown to improve student achievement in many types of courses: biotechnology (Ketpichainarong et al., 2010); educational technology (Ma, Xiao, Wei, & Yang, 2011); writing (Radhakrishnan, Schimmack, & Lam, 2011); philosophy, business and technology education, public health, engineering, social work (Friedman et al., 2010); economics (Madden, 2010). Inquiry-based learning also seems well positioned to help students develop their professional identities (Gilardi & Lozza, 2009). (Readers who are interested in learning about specific activities in courses or programs are encouraged to read some of the references cited at the end of the paper, particularly Friedman et al., 2010).

In addition, student responses to inquiry-based learning have been quite positive: (Friedman et al., 2010; Justice et al., 2009); Ketpichainarong et al., 2010; Ma et al., 2011; Madden, 2010; Summerlee & Murray, 2010).

The infusion of inquiry-based learning activities into most Embry-Riddle Aeronautical University courses is not only possible but, given the broad definition of such activities, likely also a simpler process than many might fear. Perhaps it would be useful to employ the succinct process description that was settled on by an interdisciplinary group of instructors at the University of South Carolina, who were charged with developing inquiry-based learning activities across the curriculum. They described five stages of an iterative cycle: “ask, investigate, create, discuss, and reflect” (Friedman et al., 2010, p. 768). This cycle encompasses the general guidelines that describe an inquiry- based activity that were described earlier:

- Ask (a relevant question).
- Investigate (helping students graft new knowledge onto old).
- Create (possible answers or solutions from the evidence).
- Discuss (incorporating the free exchange of ideas).
- Reflect (make the leap from concrete to abstract).

As noted, however, embedding inquiry-based learning activities into courses will not be without challenges. Yet every inquiry-based learning activity that is incorporated into a course helps to create the solid research-supportive culture demanded in *Ignite* and facilitates the desired transformative effect of quality enhancement required by the Southern Association of Colleges and Schools (SACS).

Moreover, the University desires this transformative effect over and above whatever SACS might require, for the good of its students. While it is expected that Embry-Riddle Aeronautical University students will become proficient in the various traditional methods of research, a more fundamental way to express the *Ignite* research goal is to expect to develop in

each student a curious and highly skilled investigative mind, the type of mind that will significantly increase the preparedness of students for personal fulfillment and career success.

Although this paper has covered many characteristics of inquiry-based learning and attempted to provide an indication of how instructors can successfully prepare and conduct inquiry-based activities in their classes, at bottom it might help to remember that inquiry is a natural way of learning. It relies on one of the most fundamental characteristics of human beings: curiosity. “Inquiry as a teaching method seeks to develop inquirers and to use curiosity, the urge to explore and to understand, as motivators leading to learning through personal engagement” (Justice et al., 2009, p. 843).

In the case of inquiry-based learning, it is true, as many have said in other venues: “It’s so easy, even a child can do it!”

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