Closed-Loop Reiterative Enquiry-Based Learning Benefits Students by Utilizing Multiple Learning Styles and Promoting Student Autonomy: A First-Year Student Perspective

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Abstract

First-Year Seminars (FYSs), which utilize a closed-loop reiterative Enquiry-Based Learning (EBL) format, promote student learning because they incorporate multiple learning styles and appeal to every student’s individual learning preferences in ways that traditional classrooms do not. Enquiry-based seminars also provide students with unique opportunities that they would rarely receive in a traditional classroom setting, such as laboratory field trips, student-directed learning, and a preserved sense of individuality (Delisle 1997, 11-12). Moreover, previous literature investigating the impacts of EBL on student performance suggests that students who successfully completed an enquiry-based First-Year Seminar (FYS) became more efficient learners (Murray and Summerlee 2010, 78). We believe this is an indication of how EBL fosters student autonomy (Delisle 1997, 12; Naylor 2011, 321; Oliver 2007, 13). Ultimately, the aim of this paper, which is written entirely by first-year students, is to provide a student perspective on the importance of EBL at the post-secondary level.

Overview of EBL

History and Fundamentals

The first literature that documented the use of problem-based learning (PBL) likely first emerged in 1972 in medical classrooms at McMaster University (Barrows and Tamblyn 1980, 21). The aim of PBL was to teach students medical knowledge in the context of real clinical
cases which was believed to better prepare them for their future roles as physicians (Duch et al. 2001, 40). Since then, PBL has continued to gain popularity in the field of education.

The fundamentals of PBL are based on the identification of key problems associated with presented scenarios (Duch et al. 2001, 6). What is interesting about this learning framework is that it often uses real-life problems in order to motivate students to meet learning objects set out by the course (Duch et al. 2001, 6). Traditionally, students will be presented with a case scenario at the start of class and a discussion will occur with the goal of generating relevant research questions to help understand the case. After some questions from the discussion have been generated, the students are encouraged to investigate these questions through interdisciplinary research methods (see the section titled *Unique Opportunities in First-Year Seminars*). Often, a faculty member will act as a facilitator throughout the learning process to assist students (Barrows and Tamblyn 1980, 110). Once these research questions have been answered, the skills and knowledge acquired from the investigation are applied back to the case and summarized.

**Contrasting EBL to a Traditional University Environment**

For the purposes of this paper, we decided to adopt the terminology EBL instead of PBL, because PBL implies that students focus on a problem to solve as opposed to focusing on acquiring the skills and knowledge surrounding the problem (Murray and Summerlee 2010, 80). Furthermore, we will define a traditional university classroom environment from our own perspective as first-year students. Therefore, for the purposes of this paper, a traditional university classroom environment will be one that includes greater than or equal to 100 students in a given classroom led by one or more instructors who teach through the lecture method, accompanied by a visual aid (such as the use of overheard notes or slideshow projections).
Unlike a traditional classroom environment, where students are often given problems to solve after they have been provided with all the necessary information to solve it, we believe that EBL encourages students to become accountable for their own learning by acquiring the information needed to solve the problem themselves, with little instructor intervention (Barrows and Tamblyn 1980, 2).

**Introduction to the Argument**

In this paper, we aim to demonstrate the importance of EBL in the university classroom from the perspective of first-year university students who have directly participated in an enquiry-based seminar. We will also offer a potential explanation for why we believe EBL is so successful, which is composed of the two constituents below.

**PART 1: EBL Appeals to Each Student’s Individual Learning Preferences**

We believe that enquiry-based FYs approach material from multiple learning styles which appeals to each student’s individual learning preferences in ways that traditional lecture environments do not (Oliver 2007, 4). Not only do students learn differently, but most prefer to do so using multiple learning styles, which illustrates the need for developing learning environments that encompass multiple learning styles to accommodate each type of learner (Baykan and Naçar 2007, 158; Lujan and DiCarlo 2006, 13; Romanelli, Bird, and Ryan 2009, 4).

We argue that because enquiry-based FYss investigate case studies using interdisciplinary research methods, this not only accommodates each student’s individual learning preferences, but exposes them to new forms of enquiry which may allow them to be more capable learners (Delisle 1997, 10). We will discuss Part 1 in two parts: Section a) will
provide an argument for teaching environments that incorporate multiple learning styles, and b) will discuss how FYSs incorporate multiple learning styles.

**PART 2: EBL Promotes Student Autonomy**

Seminars that utilize EBL provide students with unique opportunities that they rarely have access to in traditional learning environments. By enrolling in a FYS that uses EBL, students are provided with the opportunity to interact in a small group setting and develop personal connections with their peers and professors. Students often develop new or refined skill sets, including leadership skills, advanced group communication skills, and the ability to conduct and present research in an effective manner (Murray and Summerlee 2007, 94-95). We believe that this skill development and the encouragement of students to become accountable for their own learning promotes student autonomy (Delisle 1997, 12; Naylor 2011, 321; Oliver 2007, 13). We will discuss Part 2 in two parts: Section a) will outline the unique opportunities provided by enquiry-based FYS, and b) will discuss the different skill criteria we used to monitor our learning progress.

**Part 1: a) The Need For Multiple Learning Styles**

Every individual learns differently depending on their own personal learning style (Dunn and Griggs 1995, 14). These learning styles can be categorized differently depending on what model is used, but for the purposes of this paper, we will maintain that there are at least five learning style types: visual, auditory, verbal, kinesthetic, and logical. As it is not possible for an instructor to know each of their students’ learning styles, an ideal learning environment is one that incorporates a combination of all five learning styles in order to accommodate every student’s preferred learning style, especially because it has been demonstrated that students
usually prefer to use multiple learning styles (Baykan and Naçar 2007, 158; Delisle 1997, 7; Lujan and DiCarlo 2006, 13; Romanelli, Bird, and Ryan 2009, 4).

However, we believe that most traditional university classes do not accommodate every learning style as it has become increasingly difficult for instructors to accommodate large diverse student cohorts as class sizes continue to expand (Kerr 2011, 4). In fact, it has been argued that traditional learning environments actually result in poorer student learning compared to other models (Kerr 2011, 4). For example, a typical large-lecture classroom setting focuses primarily on the auditory and visual learning styles and often neglects the others as professors usually deliver information verbally (by lecturing) and visually (through visual aids, such as overheads and slideshow presentations). Unlike a traditional university class, our enquiry-based FYS incorporated multiple learning styles, which we will discuss in the following section.

PART 1: b) How EBL Incorporates Multiple Learning Styles

In our FYS, entitled “Stem Cell Research and Society,” which utilized EBL, the sessions featured case scenarios designed by the course instructor, Roman Poterski, based on a presentation format developed by Peter Kahn and Karen O’Rourke at the University of Manchester (2005). The analysis of the case studies we examined throughout the term followed a specific format.

The EBL Process Utilized in Our FYS

First, the course instructor presented a case scenario and the class read the case together to understand the situation. Next, the class featured a student-run discussion surrounding the case. This involved writing down what information they could gain from the scenario itself, as
well as creating research questions to understand parts of the case they did not understand. Once these questions were generated, each student chose some questions to research outside of class. Before the next class, each member thoroughly researched their topic and in the next session, presented their research findings to the class.

While each student presented their research, the class would derive further questions and the cycle would continue over a few more classes until no more questions remained and we reached a conclusion to the case under study. Finally, at the end of each class, we provided feedback to each individual student and the team as a whole on areas that we believed were well-done and on the areas that could be improved. We believe that this reflection helped us improve both as a team and individually and allowed us to consistently produce increasingly higher-quality work (such as more in-depth research and sources, better research questions, improved commentary on our peer’s work, improved clarity of writing, and refined presentation skills, to name just a few). We will refer to this entire process as the EBL Process (EBLP) which is summarized in Figure 1.
Figure 1. A diagram of the EBLP utilized by our FYS during case study analysis.

How EBL Utilizes All Five Learning Styles

To better understand how the EBLP accommodates multiple learning styles, we will analyze two cases in detail. The first case involved a girl who was accepted into a graduate program, but overstated her experience on her application. This case introduced the class to critical thinking and ethical practices in academia.

After reading through the case, we developed questions to research. By developing research questions, we appealed to those with a logical learning style because the research
questions encouraged an understanding of the underlying problems in the case and why they were important. Throughout this case we improved our research skills because we conducted extensive research prior to each class and became more confident and comfortable presenting our information. This additional practice allowed us to have more experience generating questions, researching them, finding reputable sources more quickly, writing concisely, presenting our information, etc., which were components that all led to enhanced research abilities. An example of this occurred when members of the class would practice their auditory learning by listening to the information presented by their peers and each member would practice their verbal skills when they presented their own information. In this way, the logical, verbal, and auditory learning styles were emphasized during the first case.

Another case we studied featured a woman who had been hit by a car which resulted in a spinal injury. Like the previous case, we created questions based on the scenario by utilizing our logical and critical thinking skills; however, this case in particular emphasized both the kinesthetic and visual learning styles. During this case, we visited two different laboratories: the human anatomy and the animal anatomy laboratories, both of which are located in the Ontario Veterinary College at the University of Guelph. During these laboratory excursions, we were able to examine a human spine, brain, heart, a cow’s brain, a horse’s spine and a cat’s nervous system.

We were encouraged to examine the specimens to further our understanding of the way in which they operate in order to comprehend the severity of the spinal injury. For example, seeing a spine in the laboratory and being able to see how the nervous system connects through it to different parts of the body allowed us to appreciate how a seemingly small injury can impact other bodily functions. These laboratory experiences allowed both the kinesthetic and visual
learners to grasp the information in the case on a deeper level by observing the specimens in the laboratory and physically interacting with them and some of the equipment. Furthermore, an additional benefit to visual learners was available through the use of videos and diagrams used during the research presentation portion of our seminar. These videos covered multiple research topics, including “Quadriplegic technologies” and “spinal cord injuries.” In this way, this particular case appealed to the kinesthetic and visual learning styles.

**How EBL Appeals to Each Student’s Individual Learning Style**

Since each learning style was utilized in our seminar, the material was presented in a way that accommodated each student’s preferred style of learning (Oliver 2007, 3). The cases also offered the freedom to investigate questions related to the subject matter that piqued our interest. Unlike EBL courses, which have frequent research opportunities, traditional learning environments rarely integrate research activities into current teaching structures. Moreover, when research opportunities are involved, students are usually limited to investigation of particular topics, and their methods of investigation (such as conducting a literature review) are usually dictated to them (Delisle 1997, 9).

We believe that this is a poor practice because it represses personal freedom, individuality, and creativity because students cannot investigate topics of personal interest, and their investigation usually takes place in the form of a written report, which only appeals to students with particular learning style preferences. We feel that the academic freedom to research areas of interest through interdisciplinary methods (for example, by visiting a laboratory and asking the researchers questions as an alternative to reading literature online) preserves and promotes students’ individuality and creativity, which are essential skills for professional
research practices. This occurs because professional research fields usually require investigation of areas that are not well understood. This means that new interdisciplinary ways of investigation are often a necessity, and the development of these new techniques often requires creativity for development (Delisle 1997, 10). Therefore, because of the exposure to all five learning styles and preserved academic freedom, individuality, and creativity, we believe that our enquiry-based FYS exposed us to a unique method of learning that could not be replicated in a traditional learning environment.

PART 2: a) Unique Opportunities in First-Year Seminars

Enquiry-based FYSs often provide students with opportunities that are not offered through traditional teaching methods. These opportunities are not only effective learning strategies, but also involve hands-on experience and real-world applications of what students are learning in the classroom. For example, we were able to visit a laboratory that cultures stem cells and a human anatomy laboratory during our FYS. These field trips not only helped us understand our case better, but allowed us to actually experience potential careers with stem cells, instead of just learning about them briefly in a classroom. As first-year undergraduate students with little laboratory experience, these excursions piqued our interest in the course material in a way that learning about it in a classroom could never accomplish.

This was especially important to us as first-year students because many lectures discuss a topic abstractly instead of using the real-life scenarios that EBL adopts (Delisle 1997, 8-9). In our FYS, we did not feel this barrier because our cases were based on plausible events, and we could see how our work could be impactful in a practical setting (Porter and Swing 2006, 106). Moreover, our small class size allowed us to learn using our own inquiry and exploration, rather
than simply having material presented to us (Delisle 1997, 9-10). We believe this helped us improve our conceptual understanding of the material in a way that is not available in traditional classroom environments (Kerr 2011, 4).

Additionally, because we were able to research questions relevant to the case that personally interested us, we felt we had more academic freedom. We believe this resulted in more effective learning as it encouraged students to take ownership of the course material (Delisle 1997, 12-13). To better illuminate this, one of the students in our FYS commented: “I personally find EBL more intellectually stimulating than the lecture method. Students are more able to enjoy course material because the subject matter is that of their choosing, therefore improving [their] understanding of...[the]...material.” This ownership and interest in the subject matter not only enhances students’ learning, but fosters a sense of autonomy in a way that traditional learning environments rarely accomplish (Delisle 1997, 12; Oliver 2007, 13).

Furthermore, our seminar encouraged us to be creative when we brainstormed and discussed new applications of stem cells, such as “stem cell band-aids” to accelerate the healing of burn wounds, and “genetically-engineered trees” containing the green fluorescent protein to offer an environmentally-friendly alternative to streetlights. In our experience, most of our undergraduate science courses do not incorporate creative activities and instead focus on presenting material. We believe that the chance to be creative cemented our understanding because it forced us to apply what we had learned to a (hypothetical) practical setting.

Moreover, because enquiry-based FYSs follow a flexible format, in the sense that the term work between seminars may vary depending on the nature of the seminar, it allowed us to direct our own education beyond what questions we researched. For example, we were given the choice to write a group paper as our final assignment or prepare a take-home case study.
addition, as a group we decided to have an in-class debate. The content of this ranged from the potential medical benefits of cloning organs and eliminating the risks of transplant rejection, ethics involved with cloning of deceased childhood pets, and the possibility for the revival of extinct organisms. We also discussed the impact of such innovations on the environment, economy, etc., which we believe allowed us to go beyond our course material and consider how it would affect other sectors in society (Porter and Swing 2006, 106).

Few traditional university courses provide the chance to use alternative learning tools like this because of the restrictions surrounding large class sizes, and even debating in seminars of 30 students is difficult because not everyone can voice their opinion and not all students will be comfortable doing so. We had the opportunity to bond with our classmates and professor which made it easier for all students to feel comfortable participating, which one of the student in our FYS commented on by saying “…Discussion among a small amount of classmates created a high comfort environment where I could freely express my opinions.” We believe this illustrates how FYSSs accommodate diverse student personalities, such that both those who identify as more introverted or extroverted can feel comfortable participating. We also believe this allows them to be personally recognized for their contributions, and reflects the high level of interaction between students and their instructors.

In this way, we believe that enquiry-based seminars offer unique experiences to students that result in more positive learning outcomes that are not available through traditional classroom environments (Kerr 2011, 4). Students are provided with the freedom to research phenomena of personal interest pertaining to real-life case studies, gain valuable skills, and creatively apply this knowledge beyond the classroom (Delisle 1997, 8). Finally, the EBLP encourages students to
develop as autonomous learners, which is not often fostered in traditional environments (Delisle 1997, 12; Oliver 2007, 13).

PART 2: b) Criteria Used to Monitor our Learning Progress

The following section provides an analysis of the different skills we used to monitor our learning progress throughout the semester.

Use of the Reasoning Process

The reasoning process is the process of making logical decisions in new situations based on previous knowledge, which is important for the discovery of new phenomena as emerging disciplines often involve using creative, abstract methods of investigation (Funkesson, Anbäcken, and Ek 2007, 1110). In our enquiry-based FYS, we were able to take advantage of the smaller class size to creatively approach problems (Delisle 1997, 10; Oliver 2007, 13). In the first two stages of the EBLP (see Figure 1), we used the reasoning process by deciphering the cases as a team with decreased instructor intervention as the semester progressed. This occurred by generating questions, researching them, briefing the group, and then repeating the process through additional case analysis. Therefore, we feel that enquiry-based seminars are important because they allow students to develop analytical reasoning skills that are not usually fostered through traditional learning environments (Kerr 2011, 4).

Acquisition and Integration of Knowledge

By integrating our knowledge during the first three stages of the EBLP, we were able to answer our questions about the case much faster than if we had to research all the questions independently. Due to this acquisition and integration of knowledge, we were able to conclude
our case studies in the most efficient way possible (Delisle 1997, 12). This integration of knowledge would not be possible in a traditional university classroom that may involve up to hundreds of students. This occurs because there are limitations on time such that each student would likely not be able to share their research during a single session, and a discussion would be hard to administer among a large class. Moreover, group projects in traditional classes are less frequent so students have less time to integrate their knowledge (Gavin and Butcher 1995).

In contrast, students in enquiry-based seminars are provided with the opportunity to integrate knowledge with a group a few times a week for an entire semester, and have their work regularly monitored by their instructor, so there is more time for skill development. To illustrate this, one student in our seminar said: “I think the interdisciplinary approach to learning provided me with a richer perspective of the course material. So many of the [non-FYS] courses I’ve taken only approach the material from one perspective and I think that limits my understanding because so much of it can connect to other disciplines, but we never seem to explore these connections...” which we feel demonstrates the importance of integrating knowledge and approaching the problem through interdisciplinary perspectives (Delisle 1997, 10). Therefore, it is important that enquiry-based FYSs remain accessible so students can gain experience with the acquisition and integration of knowledge to prepare them for their future endeavors.

**Group-Centered Learning and Communication**

Throughout the EBLP we improved our oral communication, organization, teamwork, and independent research skills through multiple group-oriented tasks such as: multiple case studies, a poster on stem cells, a debate on cloning, and a final paper. Unlike traditional learning
environments which often only require short-term group work, FYSs require students to work as a group all semester and get to know their classmates personally instead of just thinking of them as some anonymous student who they have to collaborate with for one three-week project (Kerr 2011, 3). We all felt more accountable to the team because we knew each member personally and were recognized for our individual contributions to the group. We believe this encouraged us to be more autonomous learners in order to aid the group because we depended on each other to solve the case studies (Delisle 1997, 12). Therefore, we believe that enquiry-based FYSs preserve individuality among students, promote autonomy, and allow students to greatly enhance their communication and group skills.

*Evaluation and Assessment Skills*

Constructive criticism is crucial to identify personal strengths and areas of improvement. After each class in our FYS, we would evaluate our individual and team performance levels and provide feedback to our peers. Again, this not only allowed each individual to feel recognized and accountable to the group (which promoted student autonomy), but allowed us to identify our personal strengths and weaknesses (Delisle 1997, 12).

This process is unique to the EBLP where students receive feedback regularly, not just from their instructor, but from their peers and through self-reflection, instead of receiving a single rubric with comments from an evaluator (Delisle 1997, 16). Furthermore, students are rarely encouraged to reflect upon their own progress in traditional learning environments, which may lead to less refined group and self-assessment skills. Therefore, we argue that enquiry-based FYSs are important for preserving individuality in the classroom, promoting autonomous learning, and allowing students to refine their group and self-evaluation skills.
**Tying it All Together: A Visual Summary**

The following figure visually summarizes the argument we have presented and illustrates how we believe that enquiry-based FYSs benefit students by exposing them to all five learning styles and fostering student autonomy.

![Diagram](image)

**Figure 2.** A concept map illustrating the importance of closed-loop reiterative EBL utilized our FYS from a first-year student perspective.
Conclusion

We believe that enquiry-based FYSs appeal to all kinds of learners by utilizing all five learning styles to help students learn new material; this benefits students throughout their academic careers by accommodating their preferred style of learning and exposing them to new interdisciplinary research approaches (Delisle 1997, 10; Oliver 2007, 4). Moreover, because students prefer to use multiple learning styles, this may explain why EBL results in more positive learning outcomes compared to traditional learning environments (Baykan and Naçar 2007, 158; Kerr 2011, 4; Lujan and DiCarlo 2006, 13).

Additionally, we believe that FYSs provide students with unique opportunities that traditional learning environments cannot replicate, which promotes student autonomy by encouraging them to become accountable for their own learning. This is something Murray and Summerlee (2010) identified when they reported that students who completed an enquiry-based seminar tended to exhibit higher academic accomplishments compared to those who did not (Delisle 1997, 12; Oliver 2007, 13). Therefore, we feel it is critical for universities to preserve enquiry-based FYSs to accommodate diverse student learners and promote student autonomy.

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