THE POWER OF PROJECT BASED LEARNING: EXPERIENTIAL EDUCATION TO DEVELOP CRITICAL THINKING SKILLS FOR UNIVERSITY STUDENTS

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Abstract: Can a project based learning (PBL) pedagogy improve critical thinking skills in first-year university students? This was the research question that drove this action research investigation. The purpose of this study was to find the best practice pedagogy to improve critical thinking skills for college students. A literature review examined the themes of PBL best practices, millennial student learning styles, and critical thinking pedagogy. Methodology included a student survey to better understand the needs for university level, critical thinking skills. The potential effectiveness of a PBL approach to improve the critical thinking needs and challenges of these students was analyzed. The results indicate that a PBL method can provide students with effective techniques for improving self-reliant, critical thinking skills. The paper concludes with recommendations for best PBL practices and strategies for developing independent, critical thinking abilities which are essential for students to be successful in their academic endeavors.

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Introduction

First-year university students need critical thinking skills more than ever in the current college environment. This is particularly true for freshmen engineering students in the United Arab Emirates. This paper investigates student needs for developing critical thinking skills in first-year students at the Petroleum Institute; a university and research center in Abu Dhabi, UAE, and suggests pedagogical approaches to support student needs in this area. Specifically examining how constructivist learning approaches and understanding preferred learning styles of millennial learners can support students to be more successful in their university studies and future careers.

The Research Context

The Petroleum Institute's intention is to be a world-class university providing outstanding educational opportunities in engineering and applied sciences to prepare students for engineering careers and to support research in the energy industry. The Institute's mission is to develop students as professionals in their fields of expertise in the UAE and worldwide.

In the freshmen year, students take core courses that need to be completed by everyone regardless of a student's major. One of core courses is communication and this research study was conducted with freshmen students in the first and second semesters of the communication course.

Student Needs in Developing Critical Thinking Skills

In today's multi-media, digital overload of information, where access is everywhere and content is available instantaneously and in overwhelming amounts, it is more important than ever that educators continue to develop strategies to help new university students handle the challenges of processing and thinking critically (Connor-Greene & Greene, 2002; Halpern, 2009).

Millennial Freshmen University Students

Millennial generation students, also known as Net Generation and Gen Y (Bracy et al., 2010) have been identified as those born between 1982 & about 2003 (Nicoletti & Merriman, 2007). These students are Digital Natives, who "are native speakers of the digital language of computers, video games and the internet" (Prensky, 2010), they have always been around computers, keyboards, and digital devices. In 2013 a survey in the USA showed that 84% of 14-23-year-olds use laptops and smart phones regularly (McCoy, 2013). Research shows that this generation of students is more oriented towards multi-tasking, autonomous information gathering, and with shorter attention spans (Nicholas, 2008; Worley, 2011). This has challenges and consequences for curriculum delivery and classroom interaction.

Literature Review

Three areas of previous research are particularly useful to inform this study; (1) Critical Thinking Pedagogy, (2) Learning Styles of Millennial Students, and (3) Teaching Implications. In this section,

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we will discuss key aspects of these three issues.

Critical Thinking Pedagogy

Although the term critical thinking is discussed widely and used constantly in pedagogical approaches today, it is not a new concept. Centuries ago, Socrates used a method of probing questions focused on examining ideas believed to be true but had dubious logical value. Much later, the name 'critical thinking' was introduced as a method for discerning the truthfulness of the information. Paul & Elder (2006) further defined critical thinking by adding in the concepts of problem-solving and metacognition. Progressively, these critical thinking concepts continued to develop to include assessing and analyzing various points of view and challenging the beliefs and theories supporting those perceptions (Brookfield, 2005; Ennis, 1985).

Of the many definitions of critical thinking that have been suggested over the years - most have similar fundamental concepts, such as the definition by Halpern (1999) below;

“Critical thinking refers to the use of cognitive skills or strategies that increase the probability of a desirable outcome. Critical thinking is purposeful, reasoned, and goal-oriented. It is the kind of thinking involved in solving problems, formulating inferences, calculating likelihoods, and making decisions. Critical thinkers use these skills appropriately, without prompting, and usually with conscious intent, in a variety of settings. When we think critically, we are evaluating the outcomes of our thought processes – how good a decision is or how well a problem is solved.”

Critical thinking skills in university study are essential because they allow students “to deal effectively with social, scientific, and practical problems” (Shakirova, 2007).

Learning Styles of Millennial Students

The digital society in which millennial students have grown up has had an impact on their preferences and skills in reference to education. Prensky (2007) claims “... students are clamoring for these [new] technologies to be used as part of their education, in part because they are things that the students have already mastered and use in their daily lives, and in part because they realize just how useful they can be”.

As the students in this study are in the millennial generation, it is important to understand and teach with their learning styles and preferences. According to Sweeney (2006):

“the millennial student prefers to learn under the following conditions;

- In a collaborative learning environment. They exhibit a preference for teamwork incorporating cooperative learning and constructivist principles.
- In a challenging environment that has as its purpose a 'life plan' that is goal orientated and directed toward their future plans.
- In a flexible, personalized and customized program.
- In an environment that makes learning interesting. Fun and humor are important additions to instructional components without compromising learning and classroom management.
- In a structured environment. They prefer structured activity in the learning process.
- In an environment that uses technology to enable them to be more productive and connected.
- In an environment in which individuals are respected and all members of the group are supported.
- In an environment that is goal and achievement orientated.”

Another challenge of the digital culture in which millennial learners find themselves is the variety of literacies they need to master (Gurr, 2015):

Literacies in the 21st Century

- Computer Literacy
- Information Literacy
- Technological Literacy
- Social Network Literacy

- Media Literacy
- Visual Literacy
- Aural Literacy

Central to this concept of literacies is the significance of critical thinking as the key variable to mastering these skills. Larmar & Lodge (2014) put forward that millennial learners need support and development of metacognitive skills (critical thinking) to be successful in university study. They have developed an approach for doing this, that provides students with “opportunities to develop a deeper understanding of their own learning, [where] students are able to engage in university curriculum in a way that integrates positive study skills and supportive learning strategies that provide scaffolded support.”

A major characteristic of the millennial generation is their understanding of and fluency in using technology. This is not always the case with instructors in higher education. Prensky (2010) not only labelled students of the millennial generation ‘Digital Natives’ but also referred to the often less fluent educators as ‘Digital Immigrants’ - suggesting they were foreigners in the technological territory of the Net Generation. He believed the gap between the immigrants and the natives to be “the biggest single problem facing education today.” Researchers recommend that due to this disparity teachers need to modify and enhance their pedagogical approaches and classroom activities to address the needs and interests of this different type of learner (Prensky, 2010; Frand, 2000). A key recommendation which motivates this study.

Wade (1995) suggests the following “eight skills that students need to become critical thinkers:

- (a) ask questions and be willing to wonder,
- (b) define problems clearly,
- (c) examine evidence,
- (d) analyse assumptions and biases,
- (e) avoid emotional reasoning,
- (f) avoid oversimplification,
- (g) consider alternative interpretations, and
- (h) tolerate uncertainty”

From this literature review I applied many of these concepts to enhance the pedagogical approach to the course curriculum to address the students’ challenges and requirements for the improvement of their critical thinking abilities in their freshman year academic needs.

Methodology

Needs Analysis

For a number of years now, my colleagues and I have conducted surveys, interviews and observational studies on the Petroleum Institute freshmen students in the communication courses, to identify what needs and challenges they have during their first year of college. The data clearly demonstrates that our students belong to the profile of the millennial student and possess similar learning styles and preferences as mentioned above.

Action Research Curriculum Applications

After analyzing this data, teaching techniques and learning approaches were modified to focus on the specific critical thinking needs of these students. I have additionally added teaching and learning strategies discussed in this study to test out what works best with these students.

Evaluation

Student surveys, observational analysis and exit interviews all were used to assess the increase in critical thinking skills of the students.

Results

I would now like to describe how the action research applications suggested in this study have informed practice with my students. I have tried to adopt a cognitive apprenticeship model in my classroom, that is, learning by observing and providing an ‘expert’ model (Svinicki, 1999).

Constructivist approaches to learning include a theory of experiential cognitive apprenticeship. This kind of apprenticeship is a procedure by which a master of a skill teaches that proficiency to an apprentice. Experiential cognitive apprenticeships “are designed, among other things, to bring tacit processes into the open, where students can observe, enact, and practice them with help from the teacher” (Collins et al, 1989). This approach is complemented by Bandura's (1997) theory of modelling, which states that “in order for modelling to be successful, the learner must be attentive, must have access to and retain the information presented, must be motivated to learn, and must be able to accurately reproduce the desired skill.” For example, when asking students to go online or go to the library to find an academic journal article as part of a literature review or source analysis assignment, I first demonstrate how I go online and walk them thru the steps of using a database to find appropriate scholarly journals that can be obtained through the university library or downloaded online. I show them how to determine the factors that will help them decide if the article is credible and reliable, which they then go out and search and evaluate for themselves.

Teaching Suggestions

Other lessons learned from this action research study resulted in teaching applications to increase critical thinking skills and appeal to millennial learners.

- **Modelling Critical Thinking Skills**

The article search illustration above is a good example of how we can teach by doing. Another way I model critical thinking skills in the classroom is by showing a video of a group wrestling with a contentious problem and then have the students discuss ways to analyze and evaluate solutions presented in the video and in their own discussions. I offer ideas and model critical thinking of my own in the discussion without dominating the interaction.

- **Questioning Techniques**

Socratic dialog is an excellent method for generating critical thought processes. “The art of Socratic questioning is important for the critical thinker . . . What the word ‘Socratic’ adds is ‘systematicity,’ depth, and a keen interest in assessing the truth or plausibility of things” (Paul & Elder, 2006). I ask questions designed to elicit examination and critique of issues and facts. I dig deep to ask questions that students need to struggle with and become aware of new possibilities and solutions.

- **Changing the Technology**

Using a variety of media and mixing technology appeals to millennial learners. Even with their zeal for all things digital, these students prefer a moderate amount of IT in the classroom. In fact, according to Oblinger et al. (2005), “the actual use of technology is not as important as the activity the technology allows students to do.”

Therefore, I have increased the variety of technology and media that I use in class (i.e., shorter PowerPoint presentations, streaming video examples, including social media samples where appropriate, conducting on-line team research data searches, podcasts, excerpts from TED talks). Also, assignments for student teams to create multi-media examples of topics covered in class. This addresses the millennials’ preference for variety and diversity in IT delivery forms and keeps them from losing interest with a single (or similar types of) classroom activity.

- **Classroom Environment**

As these students like to be in an environment that makes learning interesting (Sweeney, 2006), I do my best to keep the classroom atmosphere as relaxed and enjoyable as possible. Humour and fun without compromising learning and classroom management (as Sweeney suggests) is a goal to strive for, and I find this often increases participation and interest in class discussions (and often makes the classroom interaction a joy for the professor).

Conclusion

This action research study was not about changing or reinventing the curriculum but about enhancing and customizing the pedagogical delivery and classroom activities to best suit the needs of the study’s student population. Student exit surveys and interviews show that these enhancements provided our millennial generation students with constructive and practical tools and techniques for learning independent, critical thinking skills which they need to be successful in their university experience and beyond.

Developing critical thinking abilities, to be able to explore and evaluate all kinds of information is an essential skill for first-year university students (Connor-Greene & Greene, 2002; Ellis, 2009). By addressing the way millennials best learn and by adopting best practice techniques, teachers can offer their students the tools to be able to solve problems, make the best decisions and identify solutions in their educational experience and future professional careers.

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References

- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: Freeman.
- Bracy, C., Bevil, S., & Roach, T. D. (2010, July). The millennial generation: Recommendations for overcoming teaching challenges. In *Allied Academies International Conference. Academy of Educational Leadership. Proceedings* (Vol. 15, No. 2). Jordan Whitney Enterprises, Inc.
- Brookfield, S. D. (2005). *The power of critical theory for adult learning and teaching*. Berkshire, Great Britain: McGraw-Hill.
- Collins, A., Brown, J. S. & Newman, S. E. (1989). Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics. knowing, learning, and instruction. *Essays in honor of Robert Glaser*, 18, 32-42.
- Connor-Greene, P. A., & Greene, D. J. (2002). Science or snake oil? Teaching critical evaluation of "research" reports on the Internet. *Computers in Teaching*, 29(4), 321-324.
- Ellis, D. (2009). *Becoming a master student* (12th ed.). Boston, MA: Houghton Mifflin.
- Ennis, R. H. (1985). A logical basis for measuring critical thinking skills. *Educational Leadership*, 43(2). 44-48.
- Frاند, J. (2000). Information age mindset: Changes in students and implications for higher education. *Education Review*, 35, 16-24.
- Gurr (2015). All things learning. Retrieved from <https://allthingslearning.wordpress.com/2011/11/01/getting-fluent-with-the-5-fluencies/>.
- Halpern, D. (1999). Teaching for critical thinking: Helping college students develop the skills and dispositions of a critical thinker. *New Directions for Teaching and Learning*, 80, Winter; San Francisco, CA: Jossey-Bass.
- Halpern, D. (2009). Foreword. In D. S. Dunn, J. S. Halonen & R. A. Smith (Eds.), *Teaching critical thinking in psychology: A handbook of best practices*. Hoboken, NJ: Wiley-Blackwell.
- Larmar, S. & Lodge, J. (2014). Making sense of how I learn: Metacognitive capital and the first-year university student. *The International Journal of the First Year in Higher Education*, 5(1), 93-105.
- McCoy, B. (2013). Digital distractions in the classroom: Student classroom use of digital devices for non-class related purposes. *Faculty Publications, College of Journalism & Mass Communications*. Paper 71. Retrieved from <http://digitalcommons.unl.edu/journalismfacpub/71>.
- Nicholas, A. (2008). Preferred learning methods of the Millennial Generation. *The International Journal of Learning*, 15(6). ISSN 1447-9494.
- Nicoletti, A., & Merriman, W. (2007). Teaching millennial generation students. *Momentum-Washington*, 38(2), 28.
- Oblinger, D., Oblinger, J. L., & Lippincott, J. K. (2005). *Educating the net generation*. Boulder, Colorado: EDUCAUSE.
- Paul, R., & Elder, L. (2006). *Thinker's guide to the art of Socratic questioning*. Foundation Critical Thinking.
- Prensky, M. (2007). *How to teach with technology: Keeping both teachers and students comfortable in an era of exponential change*. *Emerging Technologies for Learning*, 2.
- Prensky, M. (2010). *Teaching digital natives: Partnering for real learning*. Corwin Press.
- Shakirova, D. M. (2007). Technology for the shaping of college students' and upper-grade students' critical thinking. *Russian Education & Society*, 49(9), 42-52.
- Svinicki, M. (1999). *Teaching and learning on the edge of the millennium: Building on what we have learned*. San Francisco, CA: Jossey-Bass.
- Sweeney, R. (2006). *Millennial behaviors and demographics*. Newark: New Jersey Institute of Technology.
- Wade, C. (1995). Using writing to develop and assess critical thinking. *Teaching of Psychology*, 22(1), 24-28.
- Worley, K. (2011). Educating college students of the net generation. *Adult Learning*, 22(3), 31-39.w