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Just Do It! A Reflection of Motivation in Project-Based Learning

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Abstract

This paper reflects on the theoretical aspects of Project-based Learning (PBL), and attempts to connect it with the practical experience of a team of educators in Japan teaching biological and chemical sciences as a backdrop for an English language instruction class. It discusses parallel learning, and where the convergence of English as a Foreign Language (EFL) with content-based teaching methods lies. The paper outlines the path of PBL and its origins in the medical education field, where it began as Problem Based Learning. PBL has a strong link with "teaching without talking," as developed by ideas from Geoff Petty, and can be thought of in theoretical terms by using the ideas of Vygotsky. PBL is influenced by motivational principles, environmental influences, and reinforcement of positive principles. The paper traces the incubation of knowledge and suggests where is the tipping point moment of applied knowledge may be. Suggestions are made for recreating PBL classes in other institutions, using both the practical and theoretical foundations discussed.

Keywords: PBL, motivation, reinforcement principles, EFL

Introduction

In Japan, we teach children to ask questions at a very early age. But later we send them into secondary and tertiary school classrooms where we ask them to quietly absorb information without questioning it. Project-based learning (PBL) encourages students to ask questions and explore topics that interest them within a given subject. PBL really places students back into the driver's seat of learning. PBL is not simply "doing projects": it is a process of learning that involves both the students and the teacher. The teacher serves as a guide while the students control the learning. One major misconception of student engagement is the idea that all learning should be fun. True, "fun" projects can engage some students, but only temporarily. In fact, challenging and rigorous assignments are often more motivating than fun and easy activities. When educators provide rigorous and authentic projects and give students voice and choice, students will accept that challenge. PBL does not necessarily demand *more*; it demands more challenging work. Educators who can implement PBL using the above recommendations will find that their students want to learn the material more deeply, further engaging them in their own learning process. In one form or another, PBL may be seen as a guided form of self-directed learning where students must first become aware of the abilities they already possess, but then be guided by the educator who can show them the many various-colored doors of choice, exploration and creativity. When educators provide rigorous and authentic projects and give students voice and choice, students will accept that challenge.

Students in Japan, as one example, may be able to produce notable test scores, but that doesn't mean they will be prepared to take advantage of future career opportunities that lie ahead of them. What makes someone successful in the 21st century is definitely not their ability to memorize facts. What will make someone successful is their relentless capacity to innovate and to create. It's the students' ability to network, to make friends from their own circles and from other countries. It's their ability to see through challenges, to look for opportunities in problems, and to take action and initiative to change things instead of waiting for someone else to do something.

Many countries, including Japan, are aiming for higher standardized test scores; but this is just a holdover from an outdated educational era. Fixing the horse wagon will not get our current student generations to the moon. Emphasizing test scores over creativity can undermine young students' talents and confidence, which are the very principle qualities that the global economy now requires and encourages. Any "outlier," like Lady Gaga, for example, would be of no use in the village where she grew up. But it is interesting to see how she has become a mega-star in the U.S. because of a desire for diversity of talents. Tolerance, talent and technology are the essential ingredients needed to produce the next generation of innovators or "black collar" workers, defined by Auerswald (2012) as entrepreneurs who do not seek lifetime learning rather than lifetime employment, a phrase he coined to illustrate innovators working in the Steve Jobs mold. They connect, create, and contribute whenever and wherever it makes sense. They try to minimize their spending in order to maximize their flexibility." Innovators will be the ones who will produce not only breakthrough products that affect many, but also new solutions to social, environmental and policy challenges that will keep our global societies running fluidly.

At the heart of PBL lies the idea of asking questions and looking for answers. Students must learn to ask good questions, and teachers must consistently facilitate an inquiry-based environment so that the quality and authenticity of projects progressively benefit the student. Teachers must always ask the question: How can new technologies and methodologies be used to further support and nurture PBL? Students need to be challenged in order to develop their strengths, creativity and confidence.

Because PBL is student-centered, PBL students also need to be consciously aware and think about what they want to gain from doing projects. Each project offers an invitation for students to think about their strengths, interests, and weaknesses that they want to improve. Figuring out what outcome to produce as a result of their learning should get students thinking about another good question: What can I create that is meaningful to me and useful to others?

One necessary element of PBL is that students are able to engage in authentic and meaningful activities. In order to reach this level of engagement students must be able to envision an authentic audience that would benefit from their learning activities. In our case, we engaged students in an authentic, chemical engineering setting working together with Japanese engineering faculty, English as a Foreign Language (EFL) teachers and employees of Nicca Chemical Ltd., a large, local chemical company. Students were required to research Nicca as a company and they were asked to select one of Nicca's various products to highlight during their presentations.

Nicca has a broad range of products ranging from hair shampoos and hair styling wax to various industrial grade textile chemicals. We asked students to imagine being inside of Nicca's shoes where they were required to pitch the company's actual product to a targeted audience of their choosing. Students were asked to niche-down their target demographic very specifically, where they would then create a 30-second video advertising not only one of Nicca's products, but also provide a solution for consumers in a creative, engaging way. Many of the results exceeded our expectations. The students enjoyed the activity, and it had a definite impact on their attitude towards learning in the class.

Building projects around authentic purposes like these can make an impactful difference with students; when the work matters and is shared with an authentic audience, students are intrinsically motivated by the fact that what they are doing has value. This hands-on learning and applicative approach has resulted in a virtuous cycle of creativity, which was clearly based from the motivation the students garnered through their own voices and choices. The initial project frame was structurally bendable and guidable, and through the collaborative efforts of the Japanese engineering faculty and EFL faculty, we feel a harmonious and synergistic outcome via project-based challenges that bore much fruit.

Theoretical Framework

The growth of Project-based Learning, from its beginnings in the early 1960's medical community, to classrooms of all levels and types, marks a shift away from the traditional "chalk and talk" methodology of science teaching. In this paper, we will talk about some of the important ideas behind Project-based Learning, and how motivation becomes a key factor in retaining student interest in the project, itself, as well as in the science and ideas.

Project-based Learning has its origins in the medical community in the mid-1960's, where medical schools began to use it to train residents to recognize and diagnose problems in patients. At the time, the teaching method was referred to as "Problem-based Learning."(PrBL) and was focused on a very specific medical scenario and how to complete a diagnosis from a patient presenting symptoms. The first substantive analysis of PrBL from Norman and Schmidt (1992) found that, from the beginning, PrBL was designed to help the students focus on self-directed learning. Students exposed to PrBL learned better, had better recall, and were more motivated to learn on their own. These students found "the learning environment to be more stimulating and humane than do graduates of conventional schools" (Norman & Schmidt, p. 564). There are important differences between PrBL and PBL, and the evolution of the two into separate categories have been noted by Perrenet, Bouhuijs and Smits (2000); Mills and Treagust (2003); and by Savery (2006). Perrenet et al. compared PrBL and PBL in the university setting, finding that the key difference between PrBL and PBL was that PrBL was better for understanding the theoretical aspects of learning, while

PBL was better suited to investigate practical or real world applications. They stressed the application of what was to be learned, particularly in hard-science and mathematically-oriented subjects, and cautioned that PBL cannot be used to make statements about universal truths. However, they further cautioned, outside knowledge must still be obtained. Mills and Treagust base much of their study on the findings of Perrenet et al., and define a project as a "unit of work," within parameters set by their clients (p. 8). They notice too that "skill in metacognition is also essential for successful learning in PBL" (p. 7). They recommend that PBL become a substantial part of engineering programs, so as to foster the real-life feeling of client-driven work. Savery comes to a similar conclusion. Both are learning strategies with student direction in mind, but the major difference dividing the two is that while PrBL can be done by individual students, PBL stresses the need for group learning and cooperation. Savery (2006) notes that PBL has not simply been a fad, it is now an integral part of many school curricula, and is increasingly recognized by industry leaders to produce the critical thinking skills necessary to remain competitive in the engineering and science fields. Savery cautions that the class must have a recognizable goal, but not with defined outcomes, in order to foster these skills, and that autonomous learning is crucial in the venture. Indeed, a number of studies confirm how PBL encourages autonomous learning (Jones, Rasmussen, & Moffitt, 1997; Thomas, Mergendoller, & Michaelson, 1999, Grant, 2002; Dochy, Segers, Van den Bossche & Gijbels, 2003; Harada & Yoshina, 2004; and Hmelo-Silver et al., 2007). An even more comprehensive outline of PBL can be found in Thomas (2000), who gives a broad overview of the state of the research concerning PBL at the start of the millennium, and arrives at the conclusion that PBL is both popular with students, and as, if not more, effective than the traditional classroom. Chu, Chow, and Tse (2011) report the usefulness of PBL to support and furthermore to scaffold inquiry in student academics, which further supports the influential role PBL has in student development.

The effects of PBL in science classrooms have been studied as well, particularly by Barak and Dori (2003), who studied the effects of using PBL in an university chemistry class. In comparison to students being taught by the same instructors in other classes, the students participating in PBL class had better recall of both concept and information on post-tests and their final examination. A study by Mergendoller, Maxwell, and Bellisimo (2006) compared PBL taught, and lecture-based taught economics classes among motivated high school students. It found that the results of using PBL to be strong, using a rigorous statistical analysis. Finally, Lou, Chung, Dzan, and Shih (2012) find that blended learning and PBL are key components to any successful pedagogical approach, and that science courses be designed upon this model to encourage student intellectual stimulation and growth.

According to Bandura (1994, 1997), students' self-efficacy helps determine how students think, feel and behave, which directly relates to their motivation and performance. Positive self-efficacy protects students against peer victimization and depressive symptoms, both of which have negative influences on their academic performance (Caprara et al. 2004, 2010). In other words, students who lack confidence in their problem solving and ability to socialize are more likely to be depressed and possibly bullied due to the emotional and social maladjustments from self-efficacy deficits (Juvonen et al. 2000). Hence, this can create a vicious cycle where low self-efficacy leads to drops in academic performance and confidence, which further diminishes self-efficacy.

Finally, PBL incorporates many of the benefits that an inductive teaching/learning approach provides (Prince & Felder, 2006, 2007; Smart, Witt, & Scott, 2012). It is seen as an alternative to the "traditional" classroom style of the lecture-driven, "teach-test-teach" (i.e., the "deductive") model. This teaching methodology allows the classroom to become student-centered and more interactive, and creates an atmosphere where students feel more inspired to learn. Here, the emphasis is on the "why" of the learning, rather than simply the "what." Furthermore, it encourages a collaborative spirit among students, and gives them an

opportunity to work with and for their peers. This creates, for the proponents of inductive teaching, the beginnings of a "community of practice"; in other words, groups of people learning together to create an atmosphere of collaborative methodologies for further understanding of mutual problems.

Motivation and Environment

To effectively implement PBL in the classroom, educators must first motivate and engage their students. Teachers can often accomplish this by allowing students to provide input on their learning experiences. When educators begin providing voice and choice to students, however, they often do so sparingly. Instead, teachers need to personalize each student's level of voice and choice based on how they learn. On the ambitious end of offering voice and choice, an educator can serve as a conductor overseeing how students will shape their learning experiences, what path they will take and how they will demonstrate that learning. Educators should continually aim for this student-centered learning style, and not adhere to a permanent practice of offering limited voice and choice.

Students, in our experience, accept the challenge of rigorous projects when they believe that there is an element authenticity in the endeavor. One necessary element of PBL is that students engage in authentic and meaningful activities. In order to reach this level of engagement, students must be able to envision an audience that would benefit from their learning activities. Engaging students in authentic work can make it easier for them to see how their activities could influence an authentic audience by introducing them to real world challenges. Reflecting on questions such as "Who can provide us with relevant, expert feedback?" and "Who would find our work valuable and needed?" can help educators develop meaningful PBL activities. Students can make a difference and educators should build projects around authentic purposes. When the work matters and is shared with an authentic audience, students are intrinsically motivated by the fact that what they are doing has value.

One major myth of student engagement is the idea that all learning should be fun. While interesting and fun projects can engage some students, it does so only temporarily. In fact, challenging and rigorous assignments are often more motivating than what may seem on the surface to be enjoyable and easy activities. One of our reflections is that, as students ourselves, we have experienced times when we were appropriately challenged. During those times, we lost track of time, we thought more deeply, and we learned—which is to say, we retained knowledge and were able to reproduce it later. Educators should seek to challenge students. PBL does not demand "more more more"; it demands challenging work.

Educators who implement PBL using the following strategies will find that their students want to dig deeper and learn the material. Sometimes these projects "get out of control" in a good way and spawn new, authentic projects that teach important content skills. A skilled educator can see this deviation as an opportunity to harness students motivation and to further engage students in the learning process.

Reflections on Motivation and PBL

In our classroom, we used a fusion of current practices and ideas of inductive teaching and classroom lecture. We were guided by two streams of thought: first, the theories of Lev Vygotsky, particularly in his vision of the Zone of Proximal Development (ZPD); and second, the teaching practices of Geoff Petty, where he advocates the "teaching without talking" principle we have followed in our classroom. Both of these worked to help navigate the students throughout their learning. A close reading of both of these thinkers shows how the combination of what may at first seem to be contradictory practices are actually encouraged by both authors. Furthermore, it has helped us to define our ideas of using the ZPD to what we call "the tipping point." Let us first turn to each of these authors, to understand our reading

of their thoughts.

Lev Vygotsky was a Russian psychologist who developed his theories of childhood education and language development in the early 20th Century. He was well known and respected in the USSR during the 1960's, and came to the attention of educators and psychologists outside of the Soviet Union during the late 1970's and early 1980's (Kozulin, 1990). Vygotsky's research focused on the cognitive development and mental practices of children and adolescents. His most widely available works (Vygotsky, 1978, 2012) give an outline of how the mind works to supply a person with the thinking, and therefore the analytical tools necessary for both action, and, importantly, communication. He outlines one of his most important theories, the Zone of Proximal Development, in this way: "It [the ZPD] i*s the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers"* (Vygotsky, 1978, p. 86).

His followers later categorized four main steps in using his theoretical practices: one, stimulating motivation to solve a problem by creating interest in it; two, giving the students the facts and informational access tools to research the problem; three, giving students an outline of how to do good research, and to narrow in on the problem at hand; and finally, four, giving the students a focused project or problem to be solved, and the guidance of how to do this effectively (Karpov, 2014, p. 186-187). It is important to note that Vygotsky and his adherents find that the purely inductive approach to learning is counter-productive, and can cause serious problems to the development of a learner's ability to create solid research capabilities. Allowing the student to simply "go find knowledge" forgets, they say, the fact that without some structuring, the student may confuse facts, distort the questions, or follow strange paths of inference. In order for actual development (i.e., learning) to occur, according to Vygotsky, scaffolding from someone with expertise is necessary.

A strong proponent of inductive teaching is Petty (2014), who is less a theorist than a proponent of the practical side of this means of teaching. He emphasizes that the best approach to material presentation is quite similar to the Socratic Method, in that he asks students to answer questions pertaining to the topic at hand, and then asks them follow-up questions based on their answers (Petty 2002). These questions are planned to elicit thoughtful answers and designed to allow the student some interest in the topic at hand. This also inspires the student to create a line of inquiry of her own, and this becomes a feed-back loop, whereby the teacher gives guidance and instruction, the student answers the questions provided, and the teacher then learns also, in that the student provides the direction for learning in future classes—all of which he calls the "Quality Learning Cycle" (Petty 2014, p. 45).

Petty cautions, however, that the tasks the students undertake be a challenge to them, and that they are pertinent to the material at hand, which is in the same vein as the warning of the Vygotskyans. We have found in the classroom that this is an important part of the class preparation. Without sufficient planning, a seemingly interesting lesson can quickly go awry. In our first iteration of our class, one of our students discussed his and his fellow students desire to practice and use more English in the class. This informed our class preparation, and we learned ways to mediate the desire to communicate with the science learning.

Our PBL class allowed students to apply their knowledge and learn through the very process of asking a specific question or by solving a problem. Done effectively, it can scaffold students' self-directed learning and support them through each stage of problem solving, thereby positively boosting their self-efficacy. PBL also naturally encourages teamwork and community building, as students work on their group projects while encouraging one another through the challenge and discovery process. Given the right context and environment, students can further strengthen their confidence "muscles" and revisit their own views of themselves in relation to others to ultimately develop a stronger and

more enlightened version of themselves. When students become truly active participants in their own learning, breakthroughs, both large and small, take place. This tipping point threshold is a student-centered, individual phenomenon that can only take place within optimal contexts and environments

This is exactly the feedback loop that Petty describes, and it was our first insight into what we determined to be the "Tipping Point." However, a closer look at this process reveals the theoretical basis of Vygotsky's ZPD, and stylizes the practical steps necessary to understand how to go from the first ZPD to the next. In figure 1, below, we mark our imagination of the steps leading there.

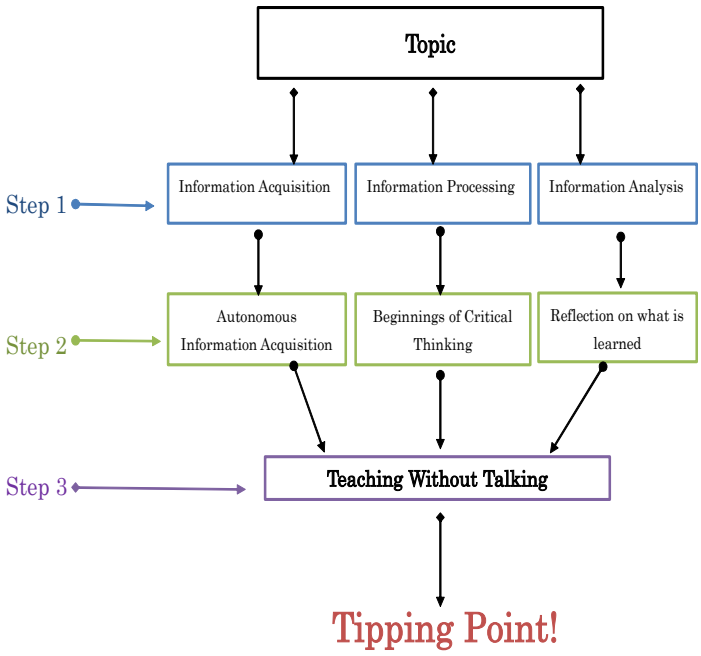

Figure 1: Process to the tipping point

First is the presentation of the topic. Here, the questions from the teacher, the refinement of vocabulary meaning, and the problem to be discussed are all addressed through the communion of teacher and student interaction. Step one of the process is the acquisition of knowledge, through the navigation of facts and information. The black lines represent the direction of the interaction: from the topic comes the steering principle of what is to be learned, and how. In step one, the three modes of knowledge acquisition derive from the topic of inquiry; in step two, these information bases stimulate the student to analyze the facts or principles she has gathered, and to begin to synthesize them into a more coherent fashion. This fosters her own interest in learning, and allows her to better understand the subject, and, after successful navigation of the topic by using this process, primes her for another moment of learning. She now has the expectation that enjoyment is not simply in unplanned, unstructured "play," but in the correct means of inquisition. This is the moment where we believe a teacher has "taught without talking." Finally, as the student becomes accustomed to the process, the disinclination to learn based on fears of failure or lack of interest in the learning process decreases. This is what we believe is the Tipping Point: where a student is no longer a passive purveyor of facts, but an active participant in her own learning. It also marks the end, for a time, of the ZPD, in which the knowledge of the teacher and that of the student realizes a gap. However, it is at this moment where the student is ready for more complexity in the classroom. By scaffolding not only the learning within a lesson, but scaffolding the expectations of learning during the course of a class, we can encourage our students to view

problems not as insurmountable challenges, but as puzzles to be solved. This can also lead to greater moments for independent study, where a student no longer needs a teacher to constantly become the interlocutor, but rather the student can begin to ask demanding and intelligent questions, herself.

Conclusion

Project-based learning allows students to apply their knowledge, and learn through the very process of solving a problem. Done effectively, it can scaffold students' self-directed learning and support them through each stage of problem solving, thereby positively boosting their self-efficacy. It can also encourage teamwork and community building, as students work on their group, or team, projects and encourage one another through the process. In this environment, students can build up their confidence again and revamp their own views of themselves in relation to others.

In this reflection, we have sought to pair the theoretical with the practical. A danger in traditional teaching is that students will cease to be interested in a subject, when they are not vested in the outcome of learning. Demotivation is a dragon-like creature, which seeks to destroy all attempts at teaching, burning away the desire to learn. However, the moment the student believes that what they are doing is relevant to their life, this beast is slain. The zone of proximal development is an actual gap, but one that can be negotiated, and through the inductive approach of project-based learning, teachers can reach out to students, confident that the students are going to reach back.

With independent study, students may learn at their own pace at a level that is challenging and appropriate for them. Curriculum that realistically meets students at their level serves to motivate and encourage them, as the material will neither be too difficult nor too easy. Instructors are also available to support students on a one-to-one or small group basis to tackle difficult skills together. With more personal, student-driven learning, many students with low self-esteem can rise above the negative mindset of being a victim. Instead, they may learn to see themselves as empowered individuals who are active participants in their own learning. One of the major advantages of project-based learning is that it makes school more like real life. PBL is an in-depth investigation of real-world topics, worthy of students' attention and effort. By bringing real-life context and technology to the curriculum through this PBL approach, students are encouraged to become independent workers, critical thinkers and lifelong learners. Teachers can also communicate with administrators, exchange ideas with other teachers and subject-area experts, all the while breaking down invisible barriers such as isolation of the classroom, fear of embarking on an unfamiliar process and lack of assurance of success. PBL is not just a way of learning; it's an effective way of learning together. Students learn to take responsibility for their own learning in order to form the basis for the way they will work with others in their adult lives. This can then foster the love of lifelong learning advocated by Aeurswald, through learning how to transverse the ZPD, and becoming shapers of the 21st Century.

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