A Toolbelt for High Expectations: Problem-Based and Project-Based Learning as Interactive Inquiry-Based Pedagogy

Michael Dominick Andreas

University of the People

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There is a call from many 21st century educational stakeholders for an interactive, transdisciplinary pedagogy to prepare students for a flexible, collaborative, life-long learning outcome deemed critical for the fast-paced, diverse, globalized workplace (Bybee, 2009; Reimers, 2009). Some even possess grander ideals for transforming the status quo into a cooperative, reflective, critically-minded world signified by a collective post-capitalist growth-mindset devoid of "docile, compliant workers" (The New London Group, 1996, p. 67). The required capabilities to achieve either outcome, a future civil or social engineer, demand creativity, critical thinking, metacognition, communication, adaptability, self-development skills, and systems thinking for "non-routine" problem-solving (Bybee, 2009, p. 4). Yet, existing structures and institutions and some stakeholders preferring different outcomes, provide obstacles to either of these goals (Mills, & Treagust, 2003; The New London Group, 1996). According to evidence-based research for maximizing educational outcomes leveraging cognitive, psychological, sociological, neurological, and systems design models, *interactive* inquiry-based learning (IBL) pedagogies such as Problem-Based Learning (PBL) and Project-based Learning (PjBL) all provide avenues for improving education over the traditional classroom techniques (Brown & Green, 2016; Bybee, 2009; Dornan, Conn, Monaghan, Kearney, Gillespie, & Bennett, 2019; Kimberlin Education, 2019; Newman, 2005; Larmer, 2015; Oberg, 2010; Schwartz, 2012). Application of IBL should be undertaken independently by instructors when crafting lesson-plans for classroom instruction, on a grander scale through the creation of fit-to-purpose curricular components that align interactive pedagogies with specific content, and

via evidence-based professional development linked to a rigorous hiring process for educators when applicable and proven to add value.

Researchers and practitioners suggest that IBL models such as PBL and PjBL are fundamental pedagogical components that expand upon the assessments and more importantly, outcomes, of standard traditional teaching models by providing pathways and frameworks for a variety of evidence-based educational tools (Boss, 2011; Brown & Green, 2016, Mills, & Treagust, 2003; Newman, 2005; Oberg, 2010; Schwartz; 2012). In research-orientated educational dialogues, one often hears the terms and phrases 21st Century Skills, learner-centered instruction, differentiated instruction, reflective learning, discrepant teaching, collaborative inquiry, constructivist pedagogy, deep learning, active learning, experiential learning, growth-mindset, transdisciplinary integrated science, technology, engineering, and math (STEM), Engagement, Exploration, Explanation, Elaboration, and Evaluation Models (5E), understanding by design (UBD), universal design for learning (UDL) and *assessment as learning;* all are models seeking the progressive, holistic outcomes described by Bloom and Gagne for maximized cognitive, affective, and psychological capability development facilitating Maslow's well-adjusted, self-actualized problem-solvers capable of high achievement in any chosen endeavor (Brown & Green, 2016; Bybee, 2009; Longfield, 2009; Wang, Moore, Roehrig, & Park, 2011; Tanner, 2010). IBL, PjBL, and PBL activities naturally utilize all the above evidence-based frameworks.

IBL learning models such as PjBL, and PBL, are applied manifestations of research by Dewey, Piaget, Vygotsky, and other theorists' constructivist cognitive models utilizing student-driven, collaborative, authentic, and active student inquiries in instructor designed and facilitated environments where realistic problem-solving occurs using transdisciplinary tools developing

transferable skills within the context of a subject or subjects such as multidisciplinary STEM models (Educational Broadcasting Corporation, 2004; Kimberlin Education, 2019; Wang, Moore, Roehrig, & Park, 2011). IBL is the principal framework, according to Larmer (2015), encapsulating all authentic, large, or small, student-led investigations. What are the differences in voltage between a series and a parallel resistor circuit utilizing identical components, and how does this relate to Kirchoff's laws? A textbook, google, wires, power supplies, resistors, voltmeters, calculators, analyses software, collaborators, direct instruction, and practice problems are all potential components of this inquiry. PjBL is a type of IBL that generally involves longer-term investigation with a detailed deliverable reporting one's findings and or production of an artifact, though the format or the tools to achieve this outcome may remain open. Break into small groups and design an experiment to calculate the acceleration due to gravity on the earth and deliver a presentation on your apparatus, methods of data collection, and analyses preceded by a project plan and a collaborative rubric. All of the required skills must be pre-loaded or closely scaffolded in this truly collaborative and transdisciplinary process similar to that which I have experienced as a technical consultant. Students can develop this expertise. PBL may have a smaller scope, and is centered around a potentially unidentified "ill-structured problem" at the beginning of the inquiry and is the most student-driven of the group with an unknown outcome, which may be a "proposed solution" (Larmer, 2015, para. 8). What effects does hydropower have in South East Asia, and how should those effects guide stakeholder's choices? The investigation of this theme may occur through an economic, environmental, cultural, political, or even philosophical lens and involve interviews with community experts, trips to the hydropower facility, or visits to relocated communities affected by the creation of a dam. The deliverable may involve facilitating community awareness seminars, a fund-raising concert for dislocated

individuals, or a prototype for “fish friendly dams” (ATS, 2015). The alternative might be a lecture and independent textbook reading followed by cranking through the mathematics of resistors and Kirchhoff’s laws in a worksheet, gravitation word problems, or a prescriptive step by step lab. A video on hydropower, a trip to the library, and a 3-page essay would be another common lesson during a traditional educational experience. All these familiar teacher-centered lessons are useful *as components of an IBL activity*. A huge drawback is the familiarity and simplicity of the traditional lesson’s execution as opposed to the perceived obstacles for IBL.

Collaborating with the students in facilitating hands-on, authentic experiences is the teacher’s new (more rewarding) job, as opposed to handing down content knowledge from a position of superiority with the currently available cookie-cutter methods. Yet, most of the planet has a shallow ‘meritocracy’ system focused around high-stakes summative assessments of content with deeply entrenched systems, hierarchies, institutions, traditions, and practices along with influential stakeholders that might prefer a more passive, less critical citizen with low expectations, satisfied to keep the ship sailing steadily (and sometimes sinking) as she always has. One must factor in the current context. Also, many teachers are low-wage workers lacking the capabilities for robust learner-centered environments as they are products of the subpar systems meant for mass-producing factory workers and shutting-down critically-minded change-makers and boat-rockers (The New London Group, 1996). Where does one begin to overcome these obstacles assuming the expected outcomes are preferred? Crafting time-consuming hybrid models (for efficient execution) and baby-steps are needed until *all* citizens can collectively upskill.

First, individual instructors must start practicing inquiry models in their classrooms in any manner that they can immediately, IBL, PBL, PjBL, large or small, get the students actively

learning. Educators, understandably, often fall back to doing what they have experienced or what seems immediately manageable. The more students who participate in interactive pedagogies, the more future teachers will later adopt these models along with curriculum designers and administrators. Success, even in small doses, goes viral.

Second, it is possible, and likely preferable, to try and do it all. There is no room for dogma or adherence to a single model in a growth mindset environment where maximizing potential outcomes by any available means is the prime directive. One can prepare students of any subject for high-stakes summative exams that are content-specific *and* develop their independent life-long learning skills. The author has had success with high-stakes testing and heavy PjBL. Success means abandoning ideological purity and passionately working long hours for mastery. A hybrid paradigm allows elements from all the available learner-centered models and frameworks, including aspects of teacher-centered directed learning to adapt to the immediate context, environment, and goals permitting successful execution of transdisciplinary, transferable authentic learning specifically designed for student discovery of content and aligned with a "testable" knowledge-based curriculum (Newman, 2005; Mills & Treagust, 2003). If learner-centered models are not delivering on an element, investigate why; possibly, the answer could be teacher-centered instruction for that element. Educators must be as flexible as the students, and raise the expectations for everyone, including themselves, by creating hybrid models not yet in existence (Mills & Treagust, 2003).

Three, citizens must lobby in their communities (all educational stakeholders) for evidence-based practice in schools and increased status and respect for educators, which comes along with better financial incentives but higher expectations for qualification. In another life as a management consultant, I was highly paid, and had many benefits, yet went through a rigorous

hiring process involving quality certifications, multiple interviews with psychological profiles included, peer reviews, and an audition period. Educators must embody the traits and capabilities that society wishes us to facilitate in our learners, and systems must ensure that unprepared or emotionally ill-suited teachers are an anomaly. Not everyone is ready or suited to be a pilot, a psychologist, or a teacher, at least not yet. Teachers are more important than medical professionals as they create medical professionals so the process for certification should be rigorous and lucrative.

In conclusion, PBL and PjBL are powerful IBL tools for maximizing learning outcomes in addition to all the other methods available to educators. They can complement or enhance traditional methods gaining in importance as the existing structures develop and transform along with the world. The hard work is worth it, and more rewarding than conventional teaching when we witness our students' motivation and potential for growth maximized. I have experienced this firsthand, and in a low-resource developing nation with a tradition of rote-learning seen as unsuitable for high expectations.

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