A Passage to Self-driven All-Round Students: Projected-Based Learning

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Abstract. Based on social constructivism, Project-based Learning (PBL) is a student-centered teaching model built to address complex and challenging authentic problems, in which students' co-construct core knowledge and apply the knowledge. PBL has obvious advantages over the traditional teacher-centered model in students' gains in academic achievement, problem solving, interdisciplinary and teamwork. This review discusses principles of the implementation of PBL model, a case study, tested effectiveness as well as challenges. The conclusion is that PBL can be a solution to nurturing self-driven all-round students.

Keywords: PBL · social constructivism · self-drive · all-round students

1   Introduction

One dilemma in English teaching and learning in China is the tension between traditional exam-oriented education and ideal holistic education. On the one hand, under the pressure to achieve high scores, many teachers stick to traditional teacher-fronted strategies, mostly using the monotonous lecture-based communicative code mode. Teachers teach and students listen and take notes. The learning outcomes are assessed via standardized examinations. Students may get excellent examination results, but in the meanwhile they may lack innovation and intrinsic motivation. On the other hand, globalization has brought China the largest EFL learners [1], being able to use English as a tool to address authentic problems becomes more important than ever. Learners are required to use English as a communicative tool [2]. The 2010–2020 strategic plan of the Chinese educational system plan was to develop students as "whole healthy persons" with physical, mental, and social well-being, with an emphasis on attitudes, values, ideology, critical thinking, creativity, cognitive and interpersonal skills [3, 4]. Foreign language learning cannot be divorced from other disciplines and it "will foster the development of cognitive, affective, interpersonal, intercultural skills, knowledge and attitudes" [5].

Project-based Learning (PBL) approach is highly likely to be a solution to closing the gap between exam-oriented learning and holistic learning. Previous studies have

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shown that PBL model is an effective approach to expanding educational opportunities, helping students acquire mastery of core knowledge through active exploration of real-world challenges [6]. Compared to traditional instruction, well-implemented PBL increases long-term memory of knowledge, helps students perform as well or better in tests, develops problem-solving and collaboration skills, and improves students' intrinsic motivation [7]. PBL has its roots in social constructivism. Vygotsky thinks knowledge is not simply constructed, but co-constructed [8]. Co-constructing and applying authentic knowledge are key features of PBL model.

While innovative pedagogical changes like PBL are needed to nurture self-driven all-round students, jumping PBL implementation hurdles is not easy. There are some challenges teachers face in the implementation of PBL in the western context. Ertmer found that this may be partly due to the following challenges: 1) Creating a climate of cooperation and interaction; 2) Accommodating to a shift of roles, and 3) Scaffolding students learning and performing [9]. Harris reported that time, state accountability requirements, the standards, implementing the project within the school schedule and designing meaningful activities were most challenging [10]. Since PBL is relatively new to the landscape in China, the issues of staff training, supportive administration, and exam-oriented mainstream are especially difficult to address. However great the challenges are, the core abilities PBL brings about are too important to overlook. PBL, as a likely passage to holistic education, is worth our efforts. The next part will discuss in detail: 1) A definition of Project-based Learning; 2) Five criteria of PBL; 3) Underpinnings of the effectiveness of PBL; 4) Operating principles of PBL; 5) A PBL case study in Dali, Yunnan, China; and 6) Current challenges and future avenue of PBL.

2   A Review of Project-Based Learning (PBL)

2.1   The Definition of PBL

Defining PBL starts from understanding the differences between PBL projects and projects. Take the most authoritative high school English textbooks (published by People's Education Press) and users of this textbook, English teachers in a well-renowned high school for its high university enrolment rate (Chongqing No. 8 Secondary School, China) for instance. While the teaching objectives of each unit include a project, 72% of the teachers choose to ignore it. They never organize students to do any project. 25% of the teachers do projects randomly, depending on time and interest. For them, "doing projects" (applying the knowledge) is a distant second to imparting knowledge. For 3% of the English teachers who choose to do the designated projects, as is often the case, they plan the projects at the end of the unit as an activity for students to present what they have learned in this unit and the teachers usually focus on activities over assessment. For them, they are doing projects (hands-on learning activities or exercise), which are not PBL projects.

PBL projects combine "knowing" and "doing". In the PBL model, students learn core knowledge and apply this knowledge to address authentic problems with teamwork, and produce important practical results. In the PBL model, teachers don't plan the project at the end of course. On the opposite, the project is planned at the very beginning, and all the elaborate activities are designed for a high-quality end product. Well-executed PBL

features a carefully planned assessment which integrates constructive feedback, detailed criteria, and scientific evaluations of contents and skills. The freedom students are given in PBL is highly structured and meaningful. PBL is not for a random demonstration of knowledge. It is for a well-prepared demonstration that integrates authentic skills necessary in life and rewards intangible assets like intrinsic motivation, empathy, creativity, cooperation, passion and resiliency, which cannot be learned from textbooks [11].

PBL is defined as a model that organizes learning around complex and challenging projects based on real-life problems. This model engages participants in product-designing, decision-making, problem-solving, and investigative activities; gives students meaningful freedom to work relatively autonomously over extended periods of time; and culminate in authentic products or presentations [12, 13]. Other defining elements include authentic content, authentic assessment, teacher facilitation (not direction), explicit educational goals [14], knowledge co-construction, reflection, and incorporation of sub skills provided by adults [15]. According to Vega [7], PBL consists of two different inquiry-based teaching frameworks: problem-based learning and project-based learning. The former tackles a problem (no project). The latter involves a complex task and some form of student presentation, and/or an actual product. Both methods engage students in creating, questioning, and revising knowledge, while developing their skills in critical thinking, collaboration, interdisciplinary, communication, reasoning, synthesis, and resilience [15].

2.2 Five Criteria of PBL

Five criteria distinguish PBL projects from other projects, which are centrality, driving question, co-construction, autonomy, and realism [16].

2.2.1 Centrality

Projects are the curriculum, by which students are designed to carry out activities and learn the central concepts and core knowledge. "Enrichment" projects outside the curriculum are not real PBL projects, however engaging they are [16].

2.2.2 Driving Questions

Driving questions must be carefully crafted to guarantee that deliberately designed activities can foster the required underlying conceptual knowledge and skills [17]. PBL projects are interdisciplinary, so the driving question, activities and products must be "orchestrated in the service of an important intellectual purpose" [18].

2.2.3 Co-construction of Core Knowledge

One function of PBL activities is transformation and construction of knowledge on the part of students [19]. It infers one underlying feature of PBL projects is difficulty and complexity. In PBL, students team up to co-construct a solution, using already-learned information and newly-acquired knowledge and skills. Accomplishing PBL projects means students' development and transformation.

2.2.4   Students' Autonomy

Learning is more effective when participants are autonomous. In PBL climate, a shift of classroom roles activates student control over learning. In the meantime, teachers serve as facilitators of inquiry and reflection, establishing a positive environment and making sure that carefully chosen resources and meaningful experiences are available to students to promote active learning [20]. In light of that, PBL projects are student-centered, not teacher-lead, scripted or packaged.

2.2.5   Real World Skills

PBL projects feature real-life challenges [21]. Teachers have the advantageous position to be present in classroom to guide, observe and assess students' development of real world skills. Teachers' well-designed assessment and constructive feedback can help students adjust and develop skills necessary for future life and work, such as cooperation, leadership, decision-making, convincing others, writing, PPT making, public speaking and critical thinking. This gives students a sense of meaning and purpose.

2.3   Underpinnings of the Effectiveness of PBL

According to Thomas [16], the effectiveness of PBL consists of five sections: 1) gains in academic performance, 2) gains in problem solving abilities, 3) gains in mastery of the discipline, 4) gains in understanding sub skills necessary for the project, and 5) changes in cooperation, work habits, and other PBL process behaviors. Four studies serve as underpinnings of the gains from PBL: 1) Social constructivism, 2) Autonomous discovery, 3) The explore-exploit trade-offs, and 4) Flow experience and intrinsic motivation.

2.3.1   Social Constructivism

Cognitivists such as Piaget and Perry believe knowledge is actively constructed in students' interactions with environmental stimuli. Vygotsky emphasizes culture-language role in human intellectual development and perceiving of the world. Human cognitive structures are fundamentally socially constructed. Knowledge is not just constructed, but co-constructed [8].

   According to Vygotsky, knowledge acquisition in an individual's development appears twice: first between people (the social level: interpsychological) and then inside the child (the individual level: intrapsychological). In fact, all the higher functions are constructed between people and social settings [8]. This research serves as the foundation for PBL model, in which knowledge is not imparted but investigated and constructed.

2.3.2   Autonomous Discovery

Teachers should try their best to facilitate autonomous thinkers, who will keep exploring on his own all his life [22]. Bruner emphasizes four benefits which are derived from "learning through discovering": 1) The gain in intellectual potency, 2) the change from extrinsic to intrinsic rewards, 3) understanding the heuristics of discovering, and 4) helping memory processing.

While children will go about "finding-out-for-themselves" when left to themselves, discovery favours the well-prepared mind. The act of discovery can be encouraged and strengthened with the guidance of teachers. Meaningful freedom is an inherent feature in PBL setting. Participants are encouraged to explore and discover. In this way, some students can develop and exceed their teachers' horizon and venture into uncharted territory untouched by people before them.

2.3.3   The Explore-Exploit Trade-Offs

Gopnik discussed that human development of "being a child first and an adult later" automatically results in the explore-then-exploit sequence [23]. The sequence is an extended exploratory childhood followed by an exploitative adulthood, when children do the learning and grown-ups exploit what they have learned. It is a social labour division.

But human childhood is expensive. Early brain development is energetically costly, compared with adults (20%), 4-year-olds' brains consume 60% calories [24]. Adults' massive caregiving investment to raise and protect the young into puberty frees up children for exploration, without having to simultaneously exploit. Consequently, human children have evolved to be very creative and playful. However, children are weak in executive function [23].

PBL serves as a solution to explore-exploit tension, where children and adults team up, combining creativity and execution. Evidence from laboratory experiments find children have a better performance than adults on exploratory tasks. In student-centered and authentic PBL projects, children tend to quickly discover novel abstract features of dynamic environments [23].

2.3.4   Flow and Intrinsic Motivation

In the old stories, before living happily ever after, the hero had to confront fiery dragons and wicked warlocks in the course of a quest [25]. This metaphor applies to the complex and meaningful challenge at the core of PBL model [11] and the satisfaction upon accomplishing the challenge. This metaphor is used to describe the "flow" experience, which is defined as the best moment that usually occurs when a person's body or mind is pushed to its limits in an active effort to solve difficult and meaningful problems [25].

PBL challenge's "being difficult and meaningful" inherently match the conditions of the occurrence of flow experiences. Although flow experiences may not be pleasant during their occurance, they gradually accumulate to a sense of control, a sense of participation in determining the meaning of life. In the state of flow, people are so engaged in an activity that they forget emotions, which means a reduction of anxiety. This emotion-free engagement is one of the reasons why such an experience becomes enjoyable and rewarding that people want to repeat it. Flow can serve as a trans-formative power to awake the autonomous learner in participants.

2.4   Operating Principles of PBL

To achieve satisfying results and guarantee high-quality learning experience, a deliberately designed process and specific devices are required. Thom [11] designed seven

specific principles to help teachers implement a coherent project, align with the core curriculum standards and bring out the best product.

1) Identify the Challenge. A meaningful and workable challenge is at the heart of PBL. Every PBL project starts with a vital authentic issue and ends with a creative solution. The challenge must be carefully designed into the project process to meet the learning objectives.
2) Craft the Driving Question. Turning a meaningful challenge into a powerful driving question requires a lot of thinking and craft. A qualified PBL teacher should be trained to keep the outcome in mind and craft a driving question that captures both the intent and the depth of this chosen challenge.
3) Build the Assessment. Every PBL project generates a product or a solution, which is assessed by specific criteria with equal focus on teamwork, creativity, content, delivery, personal strength and sub skills. Remember the assessment is not the purpose. Rather, it is for further development.
4) Plan Backwards. PBL learning relies on both process and end products. The planning backwards principle helps the instructor decide what sub skills (such as collaboration, empathy, PPT making, public speaking and video editing) are needed to coach students through the process.
5) Enroll and Engage. As PBL is student-centered, the instructor should be aware that starting right is the key to final success. So teachers are advised to use field-tested practices to engage students in the preliminary interaction. With students' choice and voice incorporated into the project plan, they will be more autonomous.
6) Facilitate the Teams. Effective PBL looks to teamwork that demonstrates purpose, commitment, achievements and constant growth. Running such a team is similar to running high-performing businesses, which requires strong leadership as well as followership.
7) Manage the Work Flow Wisely. The PBL process is a non-liner problem solving process, which can be divergent, chaotic and loose. An insightful teacher knows how to manage the work flow and adjust accordingly. Many projects fail as a result of overlooking the meaningful freedom for students to explore, think and practise

2.5   A PBL Case Study in Dali, Yunnan, China

While the advantages of PBL sound good to educators, many still stick to traditional knowledge imparting. According to a survey based on 100 convenient samples from 100 different primary schools and secondary schools in Chongqing, China, carried out by the author and her team, only one middle school has a pilot PBL program (6 classes), which started from 2019, coached by a Sino-US team. 58 schools randomly conduct projects (not PBL projects) and 41 schools ignore the concept of projects.

To understand the challenges and test the effectiveness of PBL model, our team (four teachers from middle schools, one teacher from a primary school, two graduate students majoring in education from Cambridge University and Glasgow University and one undergraduate majoring in media form Duke University) conducted three pilot experiments. Here we present one experiment in a private pioneer primary school in Dali,

Yunnan, China. Based on Thom's seven principles, we conducted the 8-day project ("I, New Daliers!–What Makes a Town Hometown?").

1) We identified our PBL challenge as "new immigrant children have difficulty integrating into this new community."
2) The driving question was: "What makes a town hometown?" Thirteen primary students were supposed to make a product to promote their new hometown.
3) Our assessment consisted of two phases: 1) the product-making process (attendance, teamwork participation, interaction, performance and respect) and 2) the effectiveness of the product presentation (creativity, language, delivery, interaction and value).
4) We planned backward. To make the kids develop a stronger connection with their new hometown and integrate via their product, we designed activities such as doing research about Dali, interviewing local residents about highlights of Dali and making field trip to collect data, images and videos. Each teacher taught a sub skill, such as PPT making, English writing, researching methods, convincing skills, cooperation skills, audio and video editing and public speaking skills.
5) We engaged the students in making the classroom conventions, teamwork division, the decision of the product, schedule and assessment criteria.
6) We ran the team with a strong sense of purpose–to make immigrant children discover the beauty of their new hometown, become proud of it and connect with it.
7) We arranged the time carefully and left abundant highly structured freedom for the kids. In addition, considering the children's age (9–12 years old), there was one mentor for each team, to make sure they could get resources and support.

The process was very difficult for the following reasons: 1) There were only two teachers on site and the other mentors were online because of Covid-19; 2) Mixed ages of the students; 3) Students' English levels were extremely different; 4) Most of our team members had no experience with young kids.

However, the effectiveness of PBL model was obvious. At the end of the project, the kids presented amazing products such as Vlogs, posters, postcards and paintings in English. And they became proud of their new hometown and began to understand that it was love and interaction with a place that made a town hometown. They did go through a transition both in knowledge, skills and attitudes. In the process of this PBL project, the kids experienced resistance, frustration, teamwork conflicts and finally a strong sense of self-satisfaction upon the accomplishment of their products and positive feedback from their audience. This flow experience empowered the kids and to some extent increased their intrinsic motivation to venture into future projects.

2.6   Current Challenges and Future Avenue of PBL

2.6.1   The Current Challenges

According to literature reviews and our case study, the current challenges of PBL in the setting of China are: challenges encountered by the students, challenges encountered by the teachers, challenges associated with school administration and challenges presented by the Covid-19.

1) Students encounter challenges in (a) raising meaningful questions, (b) managing complexity and time, (c) analyzing statistics, (d) forming a logical and forceful argument [26], (e) sustaining motivation [27], and (f) efficient teamwork [28].

2) Teachers encounter challenges in (a) time (often longer than planned); (b) classroom management (the "autonomous student activities"-"maintain order" tension); (c) control (teachers' control of information flow-students' building their own understanding); (d) support (the tension between scaffolding students' activities too much or too little); (e) technology use (the tension between technology as a cognitive tool or an instructional aid); (f) assessment (Teachers have difficulty designing assessments with validation) [29]; and (g) the lack of PBL training.

3) Challenges connected with school administration factors. School policies either facilitate or impede the successful implementation of PBL. A number of practical constraints interfere with successful inquiry, such as fixed and inadequate resources, inflexible schedules, compatible technology [30], class composition and size, and district curricular policy [31]. As Chinese education system is still exam-oriented in practice, most schools are hesitant to shift focus from examination scores to real holistic educational practice.

4) Challenges presented by the Covid-19. The global educational status quo ante has been disrupted by the worldwide outbreak of COVID-19. Forced to shift from traditional on-site learning setting to remote learning, both teachers and students face key challenges in adapting practices. In the PBL model, the challenges are greater as without face-to-face focus, it is very difficult for the teachers to scaffold and mediate; as well as in the absence of teamwork cooperation in person, expanding the whole team's learning repertoire becomes even more challenging [32].

2.6.2 The Future Avenue of PBL Model

Educators in China are still groping towards a totally different model of education and the PBL model is still in the making. While the PBL model works excellently in pilot programs and in reviews, most schools, especially high-performance schools in China don't adopt it. It is too risky to start a revolution. Schools tend to rely on traditional curricula with some minor adjustment. However, moving forward requires a whole new framework. In fact, the PBL model is not a whole new framework in theory in western educational setting, but it is a ground-breaking initial in practice in China.

Education into the future should be a blend of autonomous learning and cross-disciplinary knowledge co-construction. PBL can serve as a holistic learning model in which students can develop mental, physical and social well-being, with an emphasis on values, attitudes, ideology, cognitive, interpersonal skills, and critical thinking. If executed thoroughly and properly, it might become a passage for our kids to grow to be self-driven all-round persons.

3   Conclusion

PBL is a learning model to mediate the tension between traditional exam-oriented education and ideal holistic education. PBL approach is based on the following underpinnings:

1) Social constructivism, 2) Autonomous discovery, 3) The explore-exploit trade-offs, and 4) Flow experience and intrinsic motivation.

The PBL model organizes learning around complex and challenging authentic problems. In this student-centered setting, teachers' facilitation and students' highly-structured freedom, combined with real life skills obtained by the students in the project, contribute to a solution to mastery of core knowledge as well as holistic interdisciplinary real life skills.

Compared to traditional learning model, the effectiveness of PBL model includes: 1) gains in academic performance, 2) gains in problem solving abilities, 3) gains in mastery of the discipline, 4) gains in understanding sub skills necessary for the project, and 5) changes in cooperation, work habits, and other PBL process behaviors.

According to Thom [11], there are seven principles in the implementation of PBL projects, which are: 1) Identify the challenge; 2) Craft the driving question; 3) Build the assessment; 4) Plan backwards; 5) Enroll and engage; 6) Facilitate the teams; and 7) Manage the work flow wisely.

To understand the challenges and test effectiveness of the PBL model, our team designed and conducted three pilot experiments, one of which was an 8-day project launched in Dali, Yunnan, China—"I, New Daliers!—What Makes a Town Hometown?" The outcomes of this experiment proved the effectiveness of PBL model.

However, according to literature reviews and case studies, the current challenges of PBL model are great in the setting of China, which were discussed from four aspects, challenges encountered by the students, the teachers, the school administration and the Covid-19.

Despite the challenges, educators in China are still groping towards this totally different framework of holistic learning. Education into the future should be a blend of autonomous learning and cross-disciplinary knowledge co-construction. PBL can serve as a passage to a holistic education model to nurture autonomous young learners.

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