The Influencing Factors of Project-Based Learning Implementation in K-12 Education

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Abstract: Project-Based Learning (PBL), a teaching and learning style advocated by many schools around the world currently, differs from the traditional teacher-centered teaching style. Compared with the traditional teaching style, PBL has various standards for the overall teaching and learning framework in the classroom. At the K-12 level, due to the relatively young and immature conceptualization of the teaching population, the three aspects of the teacher role, structural design, and environmental regulation need to be fully considered. This paper argues that there is a wider application prospect of PBL in curriculum teaching at K-12 level based on the deepening of curriculum and teaching reform and the evolution of teaching concepts. But at the same time, the framework of PBL determines that it has many clear and detailed requirements for conditions inside and outside the classroom. This paper reviews the current progress of PBL and compiles the important influencing factors of PBL model development in K-12 education stage, hoping to provide inspiration for future PBL curriculum reform design.

Keywords: PBL, K-12 Education, Teacher, Student.

1. Introduction

1.1. Since the Inception of

During the late 1960s, PBL becomes popular in the United States and Canada, and obtains more attention from researchers and practitioners. What's more, PBL is not only seen as an innovative approach to education, but also as a philosophical way of thinking [1,2]. During its development period, traditional teacher-dominated educational methods emphasize the central role of the teacher and elevate the status of knowledge of the material. In general, PBL gives students a primary role and encourages them to play a more important role in the overall teaching and learning process [3,4]. Students are integral to any period of the program, including learning objectives, learning activities, and final assessments. PBL also requires teachers to play more of a supportive role [3,5,6], which helps motivate students to learn and develop a more outgoing personality. In the following sections, this paper will elaborate on three sections of the role of teacher, the design of structure and the adjustment of environment.

2.   The Essential Implementation of PBL

2.1.   The Role of Teacher

Among the many practices in China, PBL is a difficult and controversial model. This may be because teachers do not understand PBL and play the role of facilitator [7]. There is a contradiction between the traditional teaching style in China and the requirements of PBL in some aspects. The study found that due to the inertia of exam-oriented education, many Chinese students understand learning only by mastering the knowledge of the textbook and passing the exam. [8].

The role of teachers in PBL cannot be ignored, although they are not going to be regarded as the main role of the whole course. Considering how to combine PBL with Chinese education system is a challenging but necessary task for the development of education. Specifically, in Chinese classroom teaching practices, it is obvious to find a deviation in Chinese teachers' positioning in the role of teachers. The Chinese tradition of Confucian education concentrates on three points: the authoritative position of the teacher in the field of teaching, the right to guide the path of students' development, the absolute nature of the teacher's position and so on. [9]. Influenced by traditional Chinese Confucianism, the ideal image of a teacher is shaped by fairly high moral standards, and it is even believed that teachers should be moral saints without desires or needs [10]. But this view places moral shackles on teachers, who should follow only the regulations of professional ethics and professional conduct.

However, teachers, one of the social and professional groups, are also held by the general public. Indeed, they have the desires and needs of ordinary people. In the light of the reality of Chinese society, it can be found that along with the responsibility of teaching, teachers have other main roles in managing classroom discipline. The social media and public opinion accuse teachers of slippery morality and poor quality, and even bring the entire teaching force into disrepute, resulting in some teachers not being able to exercise their management and disciplinary powers in the face of student discipline violations in the educational process[10].

According to Li and Chen, an empirical study conducted at the C School of Medicine in northern China may provide additional insights for studying Chinese teachers. After completing a total of 32 semi-structured interviews, observational methods were used as an aid to cross-validate the resulting data. Qualitative analysis is carried out throughout the data analysis process. The findings are: on the one hand, most PBL teachers believe that they have an inescapable responsibility to manage their students and that this management is dominant; on the other hand, a few teachers prefer to act as bystanders, to be led by the students themselves, and to remain largely absent from their students' processes. [11].

The reason why this is the case is that we need to go back to the source and cultural tradition of the establishment of the Chinese teaching system. The first reason is that in the early years of the founding of New China, due to the low level of education of the nation as a whole, education for all became a major feature of education in China at that time, and schools became the most sacred temple in people's minds, thus consolidated the image of teachers as elite scholars in the minds of the public. Secondly, there were very few educated parents in the social context at that time, and therefore, parents were rarely able to provide academic assistance to their children. This inferiority complex and the sage role of teachers led to a consensus among the majority of parents that "their children would be safe in the hands of teachers " and they would not need to worry about their children's education. Teachers, in turn, accept the trust of parents based on a sense of sacred professional responsibility and see their children's education as their responsibility[10]. In this case, teachers take on the overall responsibility of teaching and raising children, and further believe that whatever goes wrong with their children's character and education is a problem of their education, while society and

parents also uphold this view, and over time, the all-round responsibility of schools becomes a social consensus.

The second reason is reflected in the influence of traditional Chinese teacher philosophy on the teaching community. Chinese teachers are usually given three roles: moral guide, learning instructor, and life protector. The moral role means that students need to follow the teacher's rules if they want to avoid being widely blamed. The learning model means that students will get the most effective way of learning from the teacher, which will help them avoid making mistakes in the exam. The parental role means that Chinese teachers should invest a great deal of attention in their students, not just in the classroom, but also as their guide in terms of personal development [12].

Therefore, for the further development of PBL practices in China, practitioners need to clarify the meaning of learning for PBL and the definition of a good teacher for Chinese teachers who believe that PBL teachers should take full control of the whole teaching. It is not suggested to go beyond the real role played by teachers, so as not to overestimate the actual role of teachers leads to a distortion of the teacher's professional position, resulting in ineffective or even absent educational responsibilities. The role of the teacher should be positioned objectively and fairly, as the subject of schooling rather than the subject of education as a whole, and the educational power of the teacher can be maximized only when it is coordinated with the educational influence of society and the family.

2.2. The design of structure

The implementation of PBL needs a well-designed system to guide students to finish the process of PBL. One of the key concerns of PBL is the entire planning process of the teaching path, which will directly affect the students' learning outcomes. On this basis, it is worth considering about an appropriate framework design based on its principles. PBL should be based on four major elements: content, activity, context, and outcome. This model emphasizes student-centered, cooperative group learning and requires students to investigate real-life, authentic problems. The process or implementation steps are usually divided into six basic steps: project selection, planning, activity exploration, work production, results in communication and activity evaluation [13].

Teachers need to distinguish the center of teaching in PBL, which directly affects the overall teaching effect. The primary characteristic of project-based learning is its centrality, i.e., the project is the center of the curriculum, not the periphery or edge of the curriculum, and students learn the core concepts of the subject through the project [14]. To be specific, many teachers organize project-based learning without involving the core knowledge points of the curriculum but only carry out projects in the form of extensions to the textbook, which are essentially the same as integrated practical activities, and fail to integrate project-based learning with the core curriculum. In such a context, the project-based transformation of subject knowledge based on the concept of curriculum reconstruction is particularly necessary to better promote the application and dissemination of PBL in the core curriculum.

The need to emphasize the design of PBL is due to the many shortcomings of PBL in the traditional classroom environment, such as limited time and space for inquiry activities, and insufficient learning resources. Due to the lack of project-based learning design support in textbooks, many PBL designs are mostly based on teachers' teaching experience, which leads to some problems. For example, projects that do not have an appropriate size when designing projects, and project-based learning sessions are often just simple modifications of the original teaching sessions, resulting in confusing PBL sessions and lack of practicality and innovation; this leads to disorganized teaching and leads to the misunderstanding of PBL. It is difficult to realize students' deep learning [15].

PBL is more demanding for interdisciplinary teaching than traditional classroom teaching models. Based on this, the PBL classroom model should manifest itself as an operational mechanism in which multiple subject teachers participate together and also stimulate students' interest through

interdisciplinary knowledge linkage. Boix-Mansill has proposed the following principles for interdisciplinary teaching: (1) to allow learners to establish their own interdisciplinary learning goals through a holistic view of the problem space; (2) to help learners gain disciplinary insight; (3) to promote learners' integrative competence; (4) to allow learners to reflect on evaluation based on a critical perspective and emphasizing the cultivation of interdisciplinary literacy [16]. It requires instructional design around four aspects of cultivating students' autonomy to establish learning goals, disciplinary insight power, integrative competence, and critical thinking. As PBL courses are mostly conducted by subject teachers, there is a fragmentation between subjects and a lack of integration and innovation of interdisciplinary knowledge, which is not conducive to the development of students' comprehensive abilities. As a result, it is difficult for students to see the hidden connections behind each discipline in the process of in-depth inquiry learning, and they mostly focus on the "points" of knowledge without forming the "facets" of knowledge, and cannot transfer and apply comprehensive knowledge [17]. Students' ability to integrate multiple disciplines and solve problems across contexts is not truly enhanced, making the implementation of PBL superficial and not giving full play to its intrinsic educational value.

A practical case of PBL teaching reveals some of the situations described above to some extent. By a long practice of project-based learning in regular classroom teaching, it was found that teachers often provided too little space for students to solve problems, and it was common for teachers to do it for them; the regular classroom teaching was scheduled according to a single class period, which resulted in limited time for students' activities; teachers were at a loss for words when faced with the vivid and rich problem-solving process and students' performance; students' skills were inadequate in accessing information, reporting and communicating, and collaborating and sharing; unexpected situations and events often occurred in the classroom, and teachers' responses and skills were inadequate [18]. The teachers are often overwhelmed and overwhelmed by the vivid and rich problem-solving process and students' performance; students' skills in accessing information, reporting and communication, and cooperation and sharing are inadequate; unexpected situations and events often occur in the classroom, and teachers' responses and experiences need to be developed.

Indeed, in terms of the content of the program sessions, different disciplines are to be fully considered throughout the process. In K-12 education content, which inherently contains some abstract concepts involving logical principles, for these subjects, students' mastery and understanding of the body of knowledge is necessary. Zhang applied the empirical research and further analyzed the learning effect of PBL from four categories of learner segments, experimental cycles, experimental subjects and technical types. Although PBL has a facilitating effect on learning in different disciplines, the size of the effect varies, with a very significant effect on physical and chemical engineering disciplines and an average effect on mathematical and logical disciplines and other disciplines. "This may be because mathematical logic subjects involve more logical principles, which are more abstract and difficult to design and investigate, while physics, chemistry and engineering subjects are more oriented to the application and practice of principles, which are more suitable for teaching in a project-based learning way "[19].

In addition, the impact effect of PBL varies in the number of technology types used, and the impact on student learning effectiveness increases as the number of technology types used increases. Thus, Zhang & Hu argue that the reason why the more types of technology tools used, the more significant the learning effectiveness of students is because in many PBLs, students need to use diverse technologies to acquire, process, create, discuss, share, and present, and the more types of technology tools used in this series of learning activities, the more diverse the students' learning activities are. It not only helps to expand the scope of students' learning, but also promotes deeper processing of what they have learned, especially to facilitate the connection and application of knowledge, which in turn enhances students' learning effectiveness [19].

2.3.   The Adjustment of Environment

PBL is an interdisciplinary learning approach, which requires the cooperation of other teachers and sufficient resources from schools or even the government. Lam found that information about how schools support PBL could be instrumental for teachers who advocate instructional innovation but are concerned about being rejected or marginalized. If the school encourages teachers to use the PBL method, the school and administration must provide teachers with the support they require [20]. For the sustainability of the PBL teaching model, this support should not only be at the level of classroom teaching but should go deeper into the overall framework of education. Zhang & Hu analyzed the effect of PBL on students' academic achievement through a study using a meta-analytic approach, extracting relevant sample sizes, means, and standard deviations through literature reading, comparing and combining the results of experimental studies in similar fields, and calculating their effect sizes using the Standardized Mean Difference method (SMD) as effect values. Analysis of the study results concluded that PBL largely facilitates the learning of learners at different levels, but the effect sizes differed across levels, with larger effects at university and elementary school and average effects at secondary schools. They believe that this may be related to the reluctance of teachers at the secondary level to spend effort on PBL and to devote more effort to teaching to the test. After all, teachers and students are more concerned about academic performance at the secondary school level, and much project-based learning is conducted outside the main subjects, and some PBL does not have an important position on students' academic performance, which is difficult to accept [19].

In PBL teaching, the current educational situation in China is not fully adaptable, and PBL needs the joint efforts of many subjects to create the corresponding teaching environment. PBL is student-led and open-ended, which leads to a tight teaching schedule and many instances of not completing tasks as expected, or even not having time to implement summary sessions that contribute greatly to students' ability to improve because some sessions with little functional value take up too much time [21]. In terms of scheduling, teachers need to be intentional. The time used in project-based learning implementation is often more than the regular teaching schedule, and when planning projects, it is important to set aside more than 20% of the time to be ready for extensions. Zhang & Hu shows that PBL has the lowest impact from 0 to 3 months and the best impact over 6 months, which may be because the longer the duration of project-based learning, the more knowledge and skills the activities will involve. In addition, the more in-depth the PBL activities will be carried out, and the more effective the students' learning will be [19].

3.   Conclusion

In summary, after years of development, there are a number of cases of PBL application in K-12 with more diverse teaching perspectives in the practical application of classroom teaching, which reflect the deeper integration of the PBL teaching model in the classroom setting. This paper argues that PBL has gotten rid of the drawbacks of traditional teacher-centered teaching and has shown a new vitality in the classroom process. In K-12, the application of PBL has played a positive role in guiding students' personal development. This paper summarizes some of the present research in the form of a literature review. The goal of this paper is that, after studying the components of the PBL model, this paper can provide reference material for future PBL development and practice. However, at the same time, we also need to see that the PBL framework itself makes it also has more development possibilities and is not limited to the elements explored in this paper. This requires educators to base on the specific definition of talent development in the new era and the basic model of PBL, to meet the pedagogical needs of teachers and students, optimize the teaching design of PBL, take advantage of project-based learning, and thereby promoting the further development of education.

References

[1] Savin-Baden, M.(2003). Facilitating Problem-based Learning: Illuminating perspectives. The Society for Research into Higher Education and Open University Press.

[2] Barrett,T., Moore,S.(2010). New approaches to problem-based learning: Revitalizing your practice in higher education. London: Routledge.

[3] De Graaff,E., Kolmos,A.(2003). Characteristics of Problem-based Learning. International Journal of Engineering Education, 19(5), 657-662. Retrieved from: https://www.ijee.ie/articles/Vol19-5/IJEE1450.pdf.

[4] Li, H. (2013). Educational Change towards PBL (Problem Based Learning): An Organizational Perspective. Aalborg: River Publishers.

[5] Ertmer,P.A., Simons,K.D.(2006). Jumping the PBL implementation hurdle: Supporting the efforts of K–12 teachers. Interdisciplinary Journal of Problem-based Learning, 1 (1), 40-54. Retrieved from: https://doi.org/10.7771/1541-5015.1005.

[6] Li, H., Du, X.(2018). Educational Design for Future: Case Study of the Curriculum Model and Education Idea of Problem Based Learning at Aalborg University in Denmark, Chongqing Higher Education Research, (3),117-127.

[7] Long, T., Qin, D.(2014). Challenges of Conducting Problem-Based Learning in a Large Class. Chinese Education and Society, 47 (3), 106-110. Retrieved from:https://doi.org/10.2753/CED1061-1932470312.

[8] Kirkpatrick,R., Zang,Y.(2011). The negative influences of exam-oriented education on Chinese high school students: Backwash from classroom to child. Language Testing in Asia, 1(3), 36. Retrieved from: https://doi.org/10.1186/2229-0443-1-3-36.

[9] Hofstede, G. (1986). Cultural differences in teaching and learning. International Journal of Intercultural Relations, 10(3), 301-320.

[10] Yang,S.P., Xue,J.H.(2016). Dilemma of the Teacher's Almighty Role and Countermeasures [J]. Theory and Practice of Education,36(34):40-43.

[11] Li,H.C., Chen Y.Y.(2018), International Journal of Learning, Teaching and Educational Research, 17(9), 25-27, https://doi.org/10.26803/ijlter.17.9.2

[12] Zhao,K., Zhang,J., Du,X.(2017). Chinese business students' changes in beliefs and strategy use in a constructively aligned PBL course. Teaching in Higher Education, 22(7), 785-804. Retrieved from: https://doi.org/10.1080/13562517.2017.1301908.

[13] Liu,J.F., Zhong,Z.X.(2002). A Study on the Model of Project-based Learning [J]. Studies in Foreign Education,2002(11):18-22.

[14] Thomas, J. W. (2000). A review of research on project-based learning. California: The Autodesk Foundation. http://www.bobpearlman.org/BestPractices/PBL_Research.pdf

[15] Yan，X.M. (2020). Problems and countermeasures of concept teaching in project-based learning implementation [J]. Journal of Teaching and Management,2020(28):33-36.

[16] Mansilla V B. Learning to synthesize：The development of interdisciplinary understanding [M]//Frodeman R，Klein J T，Pacheco R CD S. The Oxford handbook of interdisciplinarity. Oxford：Oxford University Press，2010：288-306.

[17] Fang, Z.F. (2022). Design and Practice of Evidence-Based Project-Based Learning in an Online Environment [J]. Theory and Practice of Education,2022,42(11):49-52.

[18] Hou,X., Hu,J.H.(2019). Exploring Project-Based Learning in Regular Classroom Teaching：A Case Study of Chemistry Teaching [J]. Journal of Educational Studies,2016,12(04):39-44.DOI:10.14082/j.cnki.1673-1298.2016.04.006.

[19] Zhang,W.L., Hu,J.(2019). Is the Learning Effect of Project-based Learning Happening: A Meta-analysis of 41 Experimental and Quasi-experimental Studies,2019,40(02):95-104.DOI:10.13811/j.cnki.eer.2019.02.012.

[20] Lam,S.F., Cheng,R.W.Y., Choy,H.C.(2010). School support and teacher motivation to implement project-based learning. Learning and Instruction, 20(6), 487-497. https://www-sciencedirect-com.proxy.library.brocku.ca/science/article/pii/S0959475209000693

[21] Xu,Y.M., Li,X.D.(2014). Exploration to Project-based Flipped Classroom—New Concept, Method and Technology in English Teaching: A Case Study Based on New College English [J]. Foreign Languages in China,2014,11(05):81-87.DOI:10.13564/j.cnki.issn.1672-9382.2014.05.011.