Developing Core Competence With Project-Based Learning: Voices From Chinese High School Students Serving Visually Impaired Students

Linli Zhou (周林莉**)**
University of California Los Angeles

Jia Li（李佳）
Lingyun Education

Highlights

- This study explores the experiences of project-based learning (PBL) experimentation in Chinese high schools, especially the feedback that Chinese students have for better practicing PBL in China.

- We conducted a case study at two Chinese high schools in an intermediate city, Suzhou, which started their first PBL practice. The two high schools were chosen because of their unique initiative to mix visually impaired students (VIS) and ordinary students in a PBL course, which focuses on "designing accessible garbage bins for VIS." Interviews and observations were conducted. All data are anonymized.

- After two rounds of thematic sorting and coding of the qualitative data, we found that the PBL course helped students develop two aspects of the civic participation dimension of core competence: social responsibility and problem-solving. Students learned to empathize with VIS to understand their needs and to build a more feasible and usable garbage bin.

Corresponding author:
Linli Zhou, The Graduate School of Education and Information Studies, University of California Los Angeles, 11811 Venice Blvd, Los Angeles, CA 90095, USA.
Email: llz1722@g.ucla.edu

- This study provides instructional recommendations in terms of how to better utilize the pedagogy of PBL in Chinese K-12 schools, particularly to support teachers to facilitate students' development of core competence and learning of inclusion, social responsibility, and sustainability by using the PBL technique.

Introduction

Scholars and practitioners promoting curriculum innovation argued that project-based learning (PBL) could be a strategy to promote students' academic and social competence development (Hasni et al., 2016; Yao, 2018; Zhao, 2020). PBL often refers to an innovative, student-driven teaching method that aims to teach students "a multitude of strategies critical for success in the twenty-first century" (Bell, 2010; Larmer & Mergendoller, 2015). PBL was introduced in China in the 2000s and became popular in the 2010s due to its significance in enhancing students' deep learning that contributes to their learning outcomes as well as core competence development (Zhao, 2020).

Though PBL has been popular at K-12 schools in big cities like Beijing, Shanghai, and Hong Kong, other Chinese K-12 schools in less developed cities have not yet engaged in PBL practices. Besides, for those schools starting PBL experiments, the impact on students' core competence was not clear enough to motivate high schools' commitment to curriculum innovation to build students' core competence (social responsibilities and problem-solving skills) with PBL (Yao, 2018). Thus, this study explores the experiences of PBL experimentation and implementation in Chinese high schools, especially the challenges and feedbacks that Chinese students have for better practicing PBL in China. Our research question is as follows: What are the opportunities and challenges for Chinese high school students to develop core competence in a PBL course that focuses on designing accessible garbage bins for visually impaired students?

Method

We based our case study on a high school at an intermediate city, Suzhou. Our participants were 16 students who attended the project, 12 of them (11 male students and 1 female student) from an ordinary public high school and 4 ninth-grade male students with visual impairments (different levels) from a special education school. All students claimed that this is the first time to participate

in a PBL course. All students are anonymized properly in the research process as well as in this study report.

The PBL course under study is called *Designing Handicap-Accessible Garbage Sorting Bins*, which was implemented at the selected public high school as a 90-min lesson per week over 16 weeks. During the lesson, students from the ordinary public high school collected firsthand information to define several key problems that visually impaired students (VIS) were facing. Students then address the problems they found through their prototypes of their product—an accessible garbage sorting bin.

A retrospective case study approach, a case study design in which all data are collected after the fact, was used to answer the research questions which aim to reveal the benefits, constraints, and challenges of the PBL selective course case from the perspectives of students. We interviewed students twice in the project to know their experience in the PBL course and their feedback to our support through self-reflection. Five students from the ordinary public high school participated in a 45-min semi-structured individual interview both in the middle of the course (Week 4) and at the end of the semester. Questions included their expectations about the course, their challenges, and gains.

Results

Learning empathy

Valuing VIS. Students were not initially aware of the ability and values of VIS and set out to "provide the help." Helping VIS was a popular motivation among students who enrolled in the PBL course.

However, the perception about the VIS community started to change when students got to communicate and do activity with them. "I was surprised how they (VIS) do not need others' help in their everyday activities at school" (students Dang and Wang). "They are not as vulnerable or inable as we thought" (student Tang). Students realized that they underestimated the ability of VIS and found out VIS are just like normal people in so many aspects. "They actually live independently and have no difference from normal people in their daily lives" (student Dang).

Students participated in the project wanting to help the VIS community. During the process of the PBL course, students discovered the abilities and values in VIS who had helped them, the "helper," to complete the project. Students not merely joined the project to help others but also learned to value others' help and realize the reciprocal relationship between us and the others. Students came to a "mind blowing moment" (student Tang) when they broke the stereotype they had and learned empathy. "During this project, the biggest inspiration I gained is how to look at issues from a different perspective" (student Dang).

Solving problem with empathy and perspective-taking

Perspective-taking was gained by student Dang when he realized what he used to assume about VIS (i.e., how they needed help) was in fact the opposite of what VIS wanted. "VIS would like to keep an independent life and not rely on others' help" (student Dang). This made Dang reflect that we cannot guess what others think based on our own position. Instead, we need to actively seek information and to know others. Student Gao shared the same reflection where she mentioned the importance of being empathetic is "not to make assumptions about others from our own perspective."

Empathy helped students to solve the problem. In other words, when students realized the ability of VIS was not as inferior as they thought, they came up with more feasible plans for their final product.

> We found out that VIS actually has good ability in categorizing garbage and they know where the garbage bins are, so we do not need to help with the garbage categorizing nor change the appearance of the garbage bins to make it more recognizable.

Empathy was the key that helped their design of the project. "We imagined ourselves as a visually impaired person to understand the difficulty in sorting garbage and embodied that in our design." The strategy of imagination later supplemented with the real communication with VIS. "The original plan was that we don't seek feedback until we have our prototype while what we actually did was to communicate with VIS during our plan at the designing stage."

Students found that both empathy and real communication helped because they "wouldn't create something that was not needed by the VIS community" (student Tang). Students learned to use empathy to understand VIS' needs and to design garbage bins based on VIS' feedback. The empathy and communication with VIS helped students' progress in the project to make a product that is both practical and usable for VIS.

Reflection on the PBL pedagogy

Active learning. The PBL pedagogy—which let students explore on their own—has been perceived by students as promising for their learning. "All materials and sources were collected by ourselves, that made the information more reliable and made me understand them better" (student Dang). Benefited from the information collected by themselves, students found it was better than the traditional classroom because they were "active in the learning process which helped me to accept the knowledge and be explorative and open-minded about it" (student Dang). PBL offers students a special opportunity so that they can gain knowledge on their own to deepen their understanding of the knowledge and to "practice whether the knowledge is right or wrong" (student Sun).

Information searching difficulty. However, PBL also challenges students. Students felt difficult in researching key information out of a million. "I was very nervous when we started to do research about how to design a garbage bin." One student explained that this is the first time he had to design something and to search information and knowledge on his own. "All my previous experience in class was to learn what the teachers told me, so this self-initiated research process was unfamiliar to me and made me nervous" (student Tang).

Upset about the final product. Because of the diverse opportunities and challenges that the PBL course presented, students engaged in the project had different feelings about the final product of the project. Though many students tended to agree on a more practical approach to the garbage bin, student Wang was upset about not having the automatic voice recognition function in the garbage bin. The student seemed to want to achieve goals that are beyond the scope of the project as she continued: "the VIS community needed help on so many other issues and sorting garbage was maybe not what they really needed" (student Wang). Another student shared the same upset as the garbage bin was not really put into use and was too far from what they imagined in terms of functionality and usability. Therefore, the PBL project has so many aspects to improve including setting a common expectation so that students were on the same page of the goal and scope of the project. A follow-up on the product's usability, like putting the product into real use, might also be important for students to increase their sense of achievement.

In sum, this section revealed that the PBL course helped students to develop empathy, meanwhile it could be challenging for students or needed better explanation and teacher support for students to gain most of the experience. The following section explained the experiences of teachers during the PBL process and especially discussed how the PBL course design can be improved in the context of Chinese high schools.

Discussion and implications

The PBL course of Designing Garbage Bin for VIS showed a good example in which setting a meaningful problem of investigation could encourage students' empathy and perspective-taking. As the learning objective of the PBL course, considerations of social well-being as the problem to be solved in a PBL course turned out to be an innovative and important attempt, which has promoted the students' social-emotional development that other academic courses might not reach (Zhao, 2020). Based on this, we recommend the PBL project to come up with interdisciplinary and meaningful problems as the goal in a PBL course because it could not only offer learning for knowledge and skills but also provided social-emotional learning opportunities (i.e., learning empathy, perspective-taking, and collaboration).

The PBL course was found to help students learn actively with its design of student-centered activities. Students are encouraged to research information on their own, to make their own proposals about the final product, and to present their ideas and actively seek feedback. In the process, students thus felt responsible for their own project so that they became more active in learning and researching different information and actively thinking and adjusting their products based on the resources they have. Based on this finding, we recommend that, pedagogically, teachers can design a PBL course with social-emotional learning goals by focusing on a meaningful social problem to investigate and also by creating activities for students to engage with each other and collaborate for the learning goals.

By examining the PBL implementation and the experiences of students in the course, this study also reveals several challenges that PBL pedagogy brought to those Chinese students who had their first-time experiences in a PBL course. Many students expressed their anxieties and hardship in seeking information on their own. Teachers did not provide enough explanation or scaffolding in the process that makes the PBL objective (i.e., creating an accessible garbage bin) a difficult and overwhelming one for students, especially since this is the first time they are able to learn in a free environment of exploration. To support students to engage efficiently in the PBL course, some initial guidance from teachers could be helpful to provide more scaffolding toward the projects.

Another challenge for those Chinese students interviewed in this study is that they were not clear about the expectation of the PBL course. Most students complained and were upset about the final product being too simple, while not recognizing the time and resource limitations of the PBL course that make it just a process-oriented practice rather than a product-oriented exercise of creation. To address this, teachers could have set a shared expectation among students at the beginning of the PBL course. The shared expectation could clarify that the goal of the PBL course is about practicing the problem-solving process of creating a feasible and realistic product (i.e., accessible garbage bin). This would prevent students from thinking and striving to make an overcomplex project that is not feasible given the limited amount of time and resources a class could have.

A further relevant recommendation for teachers is that teachers could explain the philosophy behind the PBL pedagogy to students explicitly in order to clarify the expectations of active learning during the process and the practice of their social-emotional and problem-solving skills so that students realized the unique opportunities of interdisciplinary learning in the PBL course rather than focusing too much on creating an advanced product.

Contributorship

Linli Zhou was responsible for writing the abstract and the bulk of the main body, finalizing the paper, and responding to the reviewers' comments. She contributed by identifying, conceptualizing, and responding

critically and thoroughly to students' competency development in project-based learning (PBL) based on research in Chinese and English literature. She covered data analysis of the paper including theorizing, coding, and analyzing how students' core competencies developed during their PBL experiences. Jia Li was responsible for the research data collection by designing and conducting interviews with students and teachers. She contributed to the design and implementation of the research by providing pedagogical consultancy in terms of how PBL pedagogy helps students' core competencies development and writing relevant sections of the paper.

Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

ORCID iD

Linli Zhou 🄳 https://orcid.org/0000-0003-3870-4225

References

Bell, S. (2010). Project-based learning for the 21st century: Skills for the future. *The Clearing House*, *83*(2), 39–43. https://www.jstor.org/stable/20697896

Hasni, A., Bousadra, F., Belletete, V., Benabdallah, A., Nicole, M.-C., & Dumais, N. (2016). Trends in research on project-based science and technology teaching and learning at K-12 levels: A systematic review. *Studies in Science Education*, *52*(2), 199–231. https://doi.org/10.1080/03057267.2016.1226573

Larmer, J., & Mergendoller, J. (2015). *Gold standard PBL: Essential project design elements*. Buck Institute for Education. https://www.pblworks.org/blog/gold-standard-pbl-essential-project-design-elements

Yao, J., & Guo, Y. (2018). Core competences and scientific literacy: The recent reform of the school science curriculum in China. *International Journal of Science Education*, *40*(15), 1913–1933. https://doi.org/10.1080/09500693.2018.1514544

Zhao, K. (2020). Educating for wholeness, but beyond competences: Challenges to key-competences-based education in China. *ECNU Review of Education*, *3*(3), 470–487.