Huan Liu (TU Dresden University, Germany)

Barriers of Project-Based Learning in Teaching and Learning of Chinese Technical and Vocational Education and Training (TVET): A review

Abstract

Teaching is one of the main components in designing learning activities and conducting educational plans. As an essential tool for achieving teaching objectives and ensuring the teaching quality in technical and vocational education, Project-Based Learning involves a dynamic classroom approach that empowers students to acquire new knowledge and skills, and solve real-life questions. Meanwhile, students design their own educational activities and performances by interaction with the surrounding natural and social reality (Baysura, Altun & Yucel-Toy 2015). The purpose of this paper is to try to synthesize the literature and studies, summarize available evidence to find barriers encountered by Chinese teachers concerning the application of the PjBL in teaching and learning of TVET. This paper is about the main challenges teachers faced, including deficiency of knowledge, limited skills and enterprise experience in managing PjBL; project designs lacking multiple levels and being unrelated to reality; the absence of developing a rubric for assessing student skills or teachers not being aware of having a different role (role conversion). In response to these obstacles, practical advice and recommendations are discussed to improve the effectiveness of PjBL activities and VET-teachers' teaching quality.

Keywords: *project-based learning, teaching and learning, TVET*

1 Introduction

The effectiveness of teaching and learning not only depends on the analysis of the educational purpose, students in the classroom, learning environment and the curriculum content being taught but also depends on how teachers flexibly use various teaching methods and techniques (Sada, Mohd, Adnan, & Audu 2015). Nowadays, especially in technical and vocational education, traditional teaching methods (curriculum-based, teacher-centered and discipline-focused education approaches) are increasingly being replaced by student-centered educational approaches. This considers learners' individual differences and the aim to develop their autonomy, independence, lifelong learning and problem-solving skills (Altan & Trombly 2001; Huba & Freed 2000; Rutkauksiene, Schreurs, Huet & Gudoniene 2010).

Technical and vocational education is the education that prepares people for a particular job field (Webster 1993). And therefore VET-teachers need to "know both the professional interactions, e.g. in farming, craft, industry and/or service (as domain experts) and the associated teaching activities in school (as professional teachers)" (Hartmann 2017, 104) in order to "equip its students with a range of cognitive and technical skills as well as equipped

with character development worker mind set (attitude, soft skills, employability skills, or generic skills)" (Sudjimat 2016, 1). In TVET, the predominant instruction is work-oriented. The characteristics of this type of education demand - the "student-centered approaches" – are increasing in importance in terms of teaching technical and vocational subjects and in providing the opportunity to students to solve crucial issues of contextualization (Sudjimat 2016). Project-based learning (PjBL) as one of such approach has been accepted for instruction in many fields of study since Dewey first described it at the end of the 1890s, and this idea then further developed by Kilpatrick in his essay (1918). This paper uses the abbreviation "PjBL" to represent project-based learning in order to distinguish it from the acronym "PBL" referred to as problem-based learning that originated in the 1960s. It is also an instructional, student-centered approach that empowers students to "conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem" (Savery 2006, 12). The differences between PjBL and PBL are as follows: 1) The learning goal of PBL is to let students flexibly grasp the knowledge or course content through the experience of solving open-ended problems. On the other hand, PjBL is not just for mastering subject knowledge, it tends to focus on motivating students to plan, investigate, think critically and creatively in students-as-workers settings (Boss 2011) that perhaps has more potential to help students to enhance their flexible understanding, employability skills, and work readiness. 2) Since PBL is for mastering subject knowledge, the time to solve the problem cannot and should not be too long, whereas PjBL, as a long-term program, has no strict time constraints. It is completely normal for some projects to last for one semester or one year. 3) Generally, PBL involves cases or scenarios, therefore, its specific teaching steps are basically fixed, while PjBL uses authentic real-world tasks and follows general steps (Campbell 2014). 4) PjBL ultimately requires the generation of a tangible product or presentation while PBL does not have this requirement. 5) PBL is a subset of PjBL (Hmelo-Silver 2004; Larmer 2014; Savery 2006).

Effective PjBL makes students see that they gain great benefits for example promoting their high-level thinking to develop the capacity to transfer learning to new challenges from the practical application of acquired knowledge (Noga & Depešová 2016), which can prepare them to survive in today's knowledge-based, high-tech society. However, research in China reveals the project method in TVET does not bring the expected teaching effects maybe because vocational teachers are not well informed about PjBL, cannot adequately supervise students in this process, and meet problems in implementing PjBL. This situation raises questions on the effectiveness of the attainment of knowledge and skills through this hands-on approach. Consequently, the research discusses barriers faced by teachers concerning the application of the PjBL in teaching and learning of TVET.

2 Project-based learning

PjBL, which is grounded in constructivist learning influenced mainly by Swiss biologist, psychologist, and behavioral scientist Jean Piaget, Soviet developmental psychologists Lev Vygotsky and American psychologist Jerome Bruner in the last century, refers to a dynamic,

systematic and learner-centered teaching and learning method in which students acquire new knowledge and skills under the guidance of a teacher through exploration of realistic, complex questions, challenges or problems, establishing the project, and designing their own products and tasks (Pecore 2015; Thomas 2000; Shepherd 1998). In this teaching-learning process, students cannot only gain the subject core knowledge more effectively, but they can also make progress in applying knowledge into practice. The literature reveals that PjBL process is associated with five types of learning approaches: activity-based learning, inquiry-based learning, place-based learning, problem-based learning and self-directed learning (Baysura et al. 2015; Cole, Means, Simkins & Tavali 2002). Compared with traditional learning methods (teacher-centered instruction), PjBL approach not only improves students' self-organizing and self-responsibility but also develops students' critical thinking skills (Shepherd 1998), scientific research skills, problem-solving ability as well as social-emotional skills (Baysura et al. 2015; Raghavan, Coken-Regev & Strobel 2001).

From a didactic point of view, PjBL has certain characteristics as outlined by Markham, Larmer, and Ravitz (2003), Gudjons (1989), Frey (1991) and Thomas (2000):

- A project is realistic and existent, not school-like; and “the project is central, not peripheral to the curriculum” (Markham et al., 2003, 4).
- Generally, problems surround the participants are set as a starting point for the project; the problems should "drive" students “encounter or struggle with the core/critical concepts and principles of a discipline” (Thomas 2000, 3).
- The project involves a constructive process to deepen students' understanding.
- It is multidisciplinary and largely depends on students’ self-organization and responsibility.
- It is led by complete learning acts.
- Project work, as learners’ experience-oriented and interest-oriented activity, can be done in bigger or smaller groups and in individual too.
- The students show initiative in participating in the learning activity and have a high degree of autonomy in observing an object, utilizing resources, manipulating tasks and revising work (Barron et al. 1998).

2.1 The comparison between traditional teaching and Project-based learning

PjBL and traditional teaching (textbook-and-lecture driven instruction) are compared with the following six elements, “teaching objectives”, “organizational form of teaching”, “way of communication”, “degree of participation”, “incentive method”,“characteristics”.

2.1.1 Teaching objectives

Traditional teaching is “teacher-centered”, “content-oriented”, focuses on “teaching”; teachers, as the main authority figure, are the source of knowledge, they impart their wisdom, skills, and expertise directly to students to realize knowledge transmission (Gong & Ding 2007; Ahmed 2013).

PjBL is “student-centric”, “self-directed”, focuses on “learning”; instead of providing direct instruction, PjBL provides an excellent path to develop and practice students' thinking skills (Dostál 2015) as well as above-mentioned competencies to explore future work.

2.1.2 Organizational form of teaching

Under traditional mode, lecturers control all the decisions regarding the teaching methods, curriculum content, teaching schedule, and the diverse forms of assessment. Students are passive learners or rather just listen, memorize the course content and sometimes write down notes if necessary. A class is considered as a unit for lecturers to manage and they teach the whole class at the same time (Ahmed 2013).

In PjBL, students organize their own studies by posing, exploring, wrestling with, and answering realistic questions; the teacher is seen as an assistant in project works, and students are split into teams to gain new knowledge or further consolidate, verify and enrich the relevant course content in the project process; and complete the project with a presentation or product.

2.1.3 Way of communication

Under the traditional mode, communication is usually a two-subject process: the teacher asks questions and students give answers (Gong & Ding 2007).

Knowledge is co-constructed in PjBL by both, lecturers and students, and it emphasizes communication and interaction among students to collaboratively share or exchange their ideas, views, and feelings too (Thomas 2000; Baysura et al. 2015).

2.1.4 Degree of participation

In the traditional classroom, students listen to the teachers’ instructions and commands, and act as recipients of the teachers’ lecture content and powerpoint presentations passively (Ahmed 2013).

In PjBL, student have opportunities to take responsibility of their own lives and learning activities, thus they have a sense of ownership over their studies and show a more initiative, active, engaging style of learning (Thomas 2000).

2.1.5 Incentive method

Traditional mode focuses on external incentives such as a certificate, plaudits or prizes; it is not easy to sustain long-term learning motivation or enthusiasm (Gong & Ding 2007).

In PjBL, students’ internal drives are fully mobilized because they are more autonomous to make necessary decisions of their studies. Their learning enthusiasm is dependent exclusively on the intrinsic interests which allow learning to be more durable and sustainable (Baysura et al. 2015; Hmelo-Silver 2004; Noga & Depešová 2016).

2.1.6 Characteristics

In traditional teaching, teachers supplement the lecture content according to students' weaknesses and emphasize knowledge acquisition rather than its application in real-life situations.

Using students' advantages to carry out the learning activities, PjBL highlights how to apply acquired knowledge and skills in new situations, and this significantly reduces the gap between knowledge and practice (Thomas 2000; Baysura et al. 2015).

2.2 The importance and effectiveness of PjBL in TVET

Students involved in PjBL demonstrate a deeper and more profound understanding of the subject they are studying and retain content longer (Fernandes, Mesquita, Flores & Lima 2014), especially in the mastery of the concept of science. For example, in Schneider, Krajcik, Marx and Soloway's study, students participating in a Project-based science (PBS) curriculum scored higher than the national sample on content knowledge assessments of NAEP science test (Schneider, Krajcik, Marx, & Soloway 2002). Meanwhile, PjBL can increase students' engagement in learning compared with the traditional teacher-led dialogic instruction (Fernandes et al. 2014) as PjBL is a learners' interest-oriented activity where they learn from "trial and error" or their mistakes, rather than learning by passively receiving. This promotes students passion and enthusiasm, increases creativity, improves their learning efficiency, learning autonomy and individualized expression. Moreover, applying acquired knowledge to carry out the real-life tasks also stimulate individuals' willingness and increase their motivation to participate (Bartscher, Gould & Nutter 1995).

Actually, students who are involved in PjBL can benefit much more than only acquiring the content. According to Iwamoto, Hargis, and Vuong (2016), students of an experimental group that engaged in the project outscored the control group in the following three indicators for academic performance: self-efficacy, level of perceived control, and growth mindset. In addition, PjBL offers opportunities for students to work in groups, and this has been shown to improve their collaborative, communication and interpersonal skills, which are identified as the essential competencies to explore a future career. Besides, Baysura et al. (2015) cite studies by Bell (2010), and state that 21st century competencies such as critical thinking, usage of digital resources, higher-order thinking skills, problem-solving skills can also be acquired via PjBL (Baysura et al. 2015; Thomas 2000; Noga & Depešová 2016). Another essential point, PjBL method is particularly suitable for the teaching of study-work combinative courses of vocational education (Zhang 2013). Students' learning through PjBL (as a bridge that connects educational situations to the real 'macro world') is not an isolated process; they embrace "learning by doing", make progress in putting theory into practice, concentrate on experience and reflection, and eventually build their transferable skills (Thomas 2000) that are pursued after being in full-time school-based vocational education or apprenticeship training.

3 Methodology

Taking other literature reviews (Ismail, Nopiah & Rasul 2017; Mustaffa, Ismail, Tasir & Said 2016) as a guide, determining the inclusion criteria is crucial for conducting this synthesis review. To begin with, only articles published from 2007 until 2018 were selected in the in three prominent Chinese database systems, namely CNKI, VIP, WANFANG DATA, and one English database Google Scholar. In addition, titles, abstracts, keywords, and results were retrieved, and studies were screened to be included if they pertained to the addressed issues concerning the barriers of PBL implementation encountered by teachers. The following keywords or terms were applied to conduct the search: 'China', 'TVET', 'Teaching and Learning', 'Project-Based Learning', 'Barriers' or 'Issues'. This electronic search yielded a full review of 29 articles that meet the above-mentioned criteria. Besides, this review only focuses on PjBL in the teaching of science and technology fields for secondary vocational schools and higher vocational colleges. The abstracts of the articles, which are related to these fields were examined, this second search results in 14 publications. Then, the "snowball method" was applied to review the references of these chosen articles for additional works. One new study emerged after finalizing this method. 15 papers finally are included in this review.

4 Result and Discussion

The main findings contributing to the issues faced by vocational teachers concerning the application of the PjBL include: lack of knowledge, skills and enterprise experience in managing it; project design lacking multiple levels and being separated from reality; absence of a developed rubric for assessing student skills; teachers' role conversion – not being aware of having a different role in PjBL settings. To teach effectively, teachers should be aware of these barriers and notice certain requirements as a way to improve teaching quality.

4.1 Lack of knowledge, skills and enterprise experience in managing it

The constraints faced by vocational teachers in the process of project implementation are mainly manifested in their insufficient knowledge, less exposure to skills training and lack of work experience (Gong & Ding 2007; Lin 2009; Xun 2009;). One of the reasons why teachers lack of knowledge in implementing PjBL in China is that teachers' interdisciplinary knowledge gradually fades or lags behind because of many years of engaging in teaching one or more specific courses (Gong & Ding 2007). Their insufficient knowledge and skills of adjacent disciplines, related fields, and interdisciplinary subjects make them unable to guide students or unconfident to answer students' various types of questions covering a wide range of fields during the project process. Another reason is that teachers lack the awareness to update their knowledge. As Wu (2012) noted, the company is using the textbook of a current version but teachers are still teaching an earlier version at their colleges. If teachers' instructional designs could not evolve with the new emerging technologies and rapidly changing knowledge, they will inevitably fall behind and cannot meet the needs of the time,

even less the knowledge they taught to students synchronizes with the time. In addition, most of the vocational teachers do not have rich and flexible practical knowledge of the subjects they teach, and a lack of training opportunities in practical operation such as how to cut metals or control electronic equipment among teachers in vocational colleges makes them less skilled (Qingwen 2005). This, to some extent, reduces the effective learning outcomes of the practice-based and highly interactive PjBL activities. Besides, teachers generally lack enterprise experience, as they are not familiar with real product design and development procedure. This will result in teachers not being able to help students to set up projects with educational value by selecting a significant professional work task from the perspective of overall connection, or guide students in the subsequent PjBL process to align with the actual development of enterprise projects (Gong & Ding 2007).

4.2 Project design lacks multiple levels and is separated from reality

Various student sources in Chinese higher vocational colleges such as secondary vocational students, high school students, retired soldiers, farmers directly lead to the diverse basic knowledge level and to a discrepancy aptitude in the ability to learn among students in the same class (Gong & Ding 2007). However, in reality, the designed project, not in accordance with this fact, is simply based on the same level and curriculum content (Zhao 2015). A project does not need to be highly complicated and complex but the simple and quick project may not be enough to provide students with a constructive investigation, which involves their new understandings and new skills. Project design should connect with the actual production and potentially have multiple levels, which could be reached in multifarious ways, making the solutions vary from person to person. This design goes beyond providing simple answers or products for the final presentation that would eventually lead to drive students' in-depth inquiry, foster their creativity as well as capabilities for critical thinking (Liu 2016; Sun 2014; Tu & Chen 2008; Zhao 2015). Moreover, the project refers to the task of producing a specific meaningful product not only with the aim of education that enable teachers to fulfill the curriculum demands but also with practical application value (Albion 2015). According to Gong and Ding (2007), when designing a project, teachers often think more about whether the project links to curriculum or reflects essential content – covering the knowledge and technology to be mastered. Without considerations about whether the project is suitable for current production and actual life or whether it meets the actual needs and development of the enterprise, it is often difficult to inspire students' interest and innovation to achieve good learning outcomes (Liu 2016).

4.3 The absence of a developed rubric for assessing student skills

Assessing the effectiveness of PjBL can also be a challenge and the absence of rubrics make teachers unclear how students' tasks will be assessed and evaluated (Xun 2009). The project teaching method first presents a large case to the students, and at the beginning, students have no idea where to begin. Therefore, if we use the traditional evaluation method, the initial teaching effect is difficult to present or there is no obvious progress. Furthermore, it is not

easy to determine each student's score for a group project because individuals' degree of participation and effort is different (Xun 2009), so developing a scoring rubric is crucial for assessing students' learning outcomes.

Artificial criteria is normally employed to judge regular classroom learning, however, as an authentic experience, PjBL takes place beyond the classroom walls, and the products are demonstrated to a real audience, so, in order to get external perspectives, it also needs to be judged against public authentic criteria that may involve outside experts. Cai (2010) points out that the project teaching should be based on the developmental evaluation (DE), and adopt a diversified evaluation method, respecting students' differences in individual development and uniqueness; evaluating students' knowledge, abilities and emotions objectively, fairly and impartially in the entire learning process.

The representative rubrics of assessment in PjBL is 4 C's (refers to "creative/critical thinking, collaboration, communication, and creativity") created by Buck Institute for Education, and these rubrics are used to grade the intangible skills and enable teachers to assess students much more objectively and simpler (Clark 2017, 7). Besides, students also have opportunities to evaluate their own learning, sum up experience, and critic, review or grade the work of a peer. This self-evaluation, self-perception as well as peer assessment can contribute to finding inadequacy and practicing their critical-thinking, which may also help them get ideas for enhancing their own work. All in all, the goal of these evaluations should be centred on the revision and improvement of the project.

4.4 The teacher is not aware that he/she has a different role (role conversion)

Literature shows that traditional, teacher-centred styles are still dominant in the actual practice of PjBL (Xun 2009). Teachers occupy an excessive proportion in the implementation of the project (Cai 2010) and give students less control and less ownership so that students do not have sufficient autonomy to prepare for, engage in and/or manage "their own acquisition of learning" (Warren 2016, 34). Although students participate in the project, they are not active enough. Thus, teachers need to make adaptations to PjBL approach and shift from directing instruction of traditional classroom to facilitating it.

According to Zhang (2013), there are three critical stages in a PjBL process: 1) project design; 2) project implementation; and 3) project evaluation. At every stage, the teacher plays different roles in terms of guiding students. The teacher should be knowing more at the pre-project stage, challenge and inspire the student to propose a project, and formulate their project objectives. At the during-project stage, the teacher must be more like a learning facilitator, a consultant, or a co-learner, they counsel students, encourage them to learn how to use their knowledge to deal with the problems with promoting their innovation, imparting a sense of ownership to students, and intervening if students' direction deviates from practice. At Post-Project Stage, the teacher's role is to serve as a commentator and appraiser. Since the PjBL basis lies in its real-world application and authenticity, teachers ought to combine both

private and public evaluations, collect and analyze feedback from students' self-reflection, mentors' comment as well as public critiques to get wider perspective (Zhang 2013).

5 Recommendations

In response to the above problems, the following measures are proposed to enhance teachers' competencies of managing PjBL activities:

5.1 Provide on-site PjBL training

School authorities should invite experienced and expert PjBL practitioners from domestic or overseas to conduct on-site guidance and training to educators and college teachers who are longing to employ such an approach in their courses, which include introduction of the key principles of PjBL, criteria for good projects, common application challenges, sharing case studies with high-quality implementation of PjBL, etc. Staff training on the use of PjBL should focus on how to switch the role from content-delivering lecturers to content-guiding facilitator, when and what specific type of scaffolding students need to practice into PjBL, (scaffolding refers to "the tools, strategies, or guides that enable learners to reach higher-levels of understanding and performance than would be possible without them," Ertmer & Simons 2006, 44), what are effective rubrics for evaluating student projects, as well as how to give students more autonomy, and listen to students' needs to best facilitate their learning. This specific training will help teachers with insufficient knowledge of PjBL approach and with limited relevant experience in PjBL application to deepen their understanding of PjBL, learn how to adopt this approach to develop their own curriculum and raise the teaching quality.

5.2 Form on campus PjBL Team

Teachers from different expert fields or different departments cooperate with each other to create a PjBL team in their school based on PjBL's multidisciplinary characteristics. Set aside some time before the PjBL starts for individuals to get to know each other and one another's subjects to create a positive and harmonious working condition. To do so they can learn other perspectives concerning the application of PjBL, get the opportunity to (brainstorm) provide, discuss and debate idea on how to overcome PjBL implementation obstacles in an efficient and effective way, then take away representative ideas and views for their own PjBL execution and to reflect on. Overall, the collective knowledge, skills, expertise, and experiences from the PjBL team may lead to better decisions, more productive solutions that make teachers feel more confident in their PjBL implementation.

5.3 Strengthen cooperation with enterprises

School administrators should strengthen contact and cooperation with enterprises and establish the corresponding regulations and rules, which allow and encourage in-service teachers' rational flow between enterprises and schools on a regular basis to augment

practical skills, gain enterprise-based expertise and accumulate experience. This cooperation not only enables teachers to work with employers, for example, through “professional development placements” (PDPs) (Ireland, Golden & Spielhofer 2002) to keep subject knowledge up to date and keep abreast of new technology and practices but also create opportunities for teachers to seek support from production and research departments, understand market potential and demand, make the project design more realistic and suitable for current production and actual life. More importantly, introducing enterprise projects into their school's curriculum is also an effective, practical approach to help them create a learning context-based on the actual needs and development of the enterprise.

5.4 Continuing professional development (CPD) on PjBL

Once in-school PjBL specific training has been provided, the comprehensive CPD on PjBL will also be necessary to support those who begin to apply PjBL to systematically maintain, grow and broaden their PjBL knowledge, up-to-date skills, and practice.

Teachers’ CPD on PjBL can be realized through the following activities such as:

- reading, reviewing, and summarizing PjBL books and articles written by experts to upgrade knowledge;
- learning from recommended PjBL websites, case study videos, materials, and resources to widen the vision;
- sustained school support (e.g. offering train-the-trainer PjBL workshop on campus, arranging in-school meetings where teachers can discuss PjBL issues with peer implementers, providing financial support and encouraging teachers to attend PjBL conferences) to equip them with capability on the basis of PjBL, etc.

6 Conclusion

The provision of interdisciplinary knowledge, the reposition of teachers’ roles as well as the preparation for corresponding practical experience and application skills, are proposed to improve abilities to guide students in the PjBL process and enhance teaching effectiveness. This paper focused on implementation obstacles of PjBL activities on the part of teachers. Actually, how to run a PjBL smoothly and effectively not only depends on the teachers' interdisciplinary competency, practical knowledge, work experience, and employed approach and method but could also depend on a number of other factors. These are including the students in the class (for example, if these students have the capacity to use digital technology as a tool to search relevant knowledge and practical solutions scientifically, timely and systematically), the equipment involved, as well as the surrounding environment.

References

Ahmed, K. -A. (2013). Teacher-Centered Versus Learner-Centered Teaching Style. In: The Journal of Global Business Management. 9, 1, 22-25.

Albion, P. (2015). Project-, problem-, and inquiry-based learning. In Henderson, M. (eds.): Teaching and digital technologies: big issues and critical questions. Port Melbourne: Cambridge University Press, 240-252.

Altan, M. -Z. & Trombly, C. (2001). Creating a learner-centered teacher education program. Forum, 39, 3, 28-35.

Barron, B. J. S., Schwartz, D. -L., Vye, N. -J., Moore, A., Petrosino, A., Zech, L., & Bransford, J. D. (1998). Doing with understanding: Lessons from research on problem- and project-based learning. In: Journal of the Learning Sciences, 7, 271–311.

Bartscher, K., Gould, B., & Nutter, S. (1995). Increasing student motivation through project-based learning (Master's Research Project). Saint Xavier and IRI Skylight.

Baysura, O. -D., Altun, S., & Yucel-Toy, B. (2015). Perceptions of teacher candidates regarding project-based learning. In: Eurasian Journal of Educational Research, 62, 15-36.

Boss, S. (2011). Project-Based Learning: What Experts Say. Online: https://www.edutopia.org/project-based-learning-experts (retrieved 22.02.2019).

Cai, M. -J. (2010). The Requirement of Project Teaching Approach for Teachers' Job. In: Journal of Tianjin Vocational Institutes, 4, 12.

Campbell, C. (2014). Problem-based learning and project-based learning. Online: https://www.teachermagazine.com.au/articles/problem-based-learning-and-project-based-learning (retrieved 22.01.2019).

Clark, B. -A. (2017). Project Based Learning: Assessing and Measuring Student Participation (Master's project). Research and Evaluation in Literacy and Technology. Online: http://digitalcommons.unl.edu/cehsgpirw/39/ (retrieved 22.01.2019).

Cole, K., Means, B., Simkins, M., & Tavali, F. (2002). Increasing student learning through multimedia projects. Virginia: Association for Supervision and Curriculum Development.

Ding, X. -L. (2012). Discussion on problems and countermeasures in the implementation of the teaching of secondary vocational schools. In: Talent, 35, 334.

Dostal, J. (2015). Theory of problem solving. In: Procedia – Social and Behavioral Sciences, 174, 2798-2805.

Ertmer, P. & Simons, K. (2006). Jumping the PBL implementation hurdle: Supporting the efforts of K–12 teachers. In: Interdisciplinary Journal of Problem-based Learning, 1, 1, 5.

Fernandes, S., Mesquita, D., Flores, M. -A., & Lima, R. -M. (2014). Engaging students in learning: Findings from a study of project-led education. In: European Journal of Engineering Education, 39, 55–67.

Frey, K. (1991). Die Projektmethode. Weinheim; Basel: Beltz.

Gong, H.- L. & Ding, Z. -Z. (2007). Discussion on the Teaching Method of Projects in vocational Colleges. In: Science and Technology Information: Science Teaching and Research, 14, 123-170.

Gudjons, H. (1989). Handlungsorientiert lehren und lernen: Projektunterricht und Schüleraktivität (2nd edition). Bad Heilbrunn: Klinkhardt.

Hmelo-Silver, C. -E. (2004). Problem-Based Learning: What and How Do Students Learn. In: Educational Psychology Review, 16, 235-266.

Hartmann, M. -D. (2017). Theory and method of reflection levels: Its use in Vocational Education and Training. In: Vocational Education in Subsaharan Africa. Current Situation and Development. Bielefeld: wbv, 104–111.

Huba, M. E., & Freed, J. E. (2000). Learner-centered assessment on college campuses: Shifting the focus from teaching to learning. Boston: Allyn and Bacon.

Ireland, E., Golden, S. & Spielhofer, T. (2002). Professional Development – A Review of Teachers' Placements in Business and Industry. Online: http://www.nfer.org.uk/research/down-pub.asp (retrieved 22.01.2019).

Iwamoto, D.- H., Hargis, J. & Vuong, K. (2016). The effect of project-based learning onstudent performance: An action research study. In: International Journal for Scholarship of Technology Enhanced Learning, 1, 1, 24-42.

Ismail, K., Nopiah, Z. -M. & Rasul, M. -S. (2017). Malaysian teachers' competency in technical vocational education and training: A review. In: Abdullah, A., Aryanti, T., Setiawan, A. & Alias, M. (eds.): Regionalization and Harmonization in TVET. London: Taylor & Francis Group, 59-64.

Jing, B. & Liu L. (2015). Teacher as a Designer of Project-Based Learning Practice. In: US-China Foreign Language, 13, 6, 437-441.

Kilpatrick, W. -H. (1918). The project method. In: Teachers College Record, 19, 319–335.

Larmer, J. (2014). Project-based learning vs. problem-based learning vs. X-BL. Online: http://www.edutopia.org/blog/pbl-vs-pbl-vs-xbl-john-larmer (retrieved 22.01.2019).

Lin, Y. (2009). The Question and Solution of Classroom Project Teaching. In: Higher Education Forum, 12, 86-88.

Liu, F. (2016). Problems and Countermeasures of Practical Project Teaching in vocational colleges. In: Research on Teaching Methods, 28, 58-61.

Markham, T., Larmer, J. & Ravitz, J. (2003). A Guide to Standards-Focused Project Based Learning for Middle and High School Teachers. Oakland: Wilsted & Taylor Publishing Services.

Mustaffa, N., Ismail, Z., Tasir, Z., & Said, M. (2016). The impacts of implementing problem-based learning (PBL) in mathematics: a review of literature. In: International Journal of Academic Research in Business and Social Sciences. 6, 12, 490–503.

Noga, H., & Depešová, J. (2016). Project method in technology and IT education. In: Proceedings of the International Scientific Conference, II, 231-239.

Pecore, J. -L. (2015). From Kilpatrick's project method to project-based learning. In Eryaman, M., Bruce, B. (eds.): International Handbook of Progressive Education. Peter Lang Inc., International Academic Publishers. 155-171.

Raghavan, K.; Coken-Regev, S., & Strobel, S. A. (2001). Student outcomes in a local systemic change project. In: School Science and Mathematics, 101, 8, 417-426.

Rutkauksiene, D., Schreurs, J., Huet, I. & Gudoniene, D. (2010). Train the teachers in student centred learning and teaching. In Auer, M. & Schreurs, J. (eds.): Academic and corporate e-learning in a global context, 865-874.

Sada, A. -M., Mohd, Z. -A., Adnan, A. & Audu, R. (2015). Effects of Problem-Based Learning in Teaching and Learning of Technical and Vocational Education and Training. In: International Journal of Scientific and Research Publications, 5, 5, 1-3.

Savery, J. -R. (2006). Overview of problem-based learning: Definitions and distinctions. In: Interdisciplinary Journal of Problem-based Learning, 1,1.

Schneider, R. -M., Krajcik, J., Marx, R. -W. & Soloway, E. (2002). Performance of students in project-based science classrooms on a national measure of science achievement. In: Journal of Research in Science Teaching, 39, 410–422.

Shepherd, H. -G. (1998). The probe method: A problem-based learning model's effect on critical thinking skills of fourth- and fifth-grade social studies students. In: Dissertation Abstracts International, Section A: Humanities and Social Sciences, 59, 3-A, 0779.

Sudjimat, D. -A. (2016). Implementation Of Project-Based Learning Model In Mechanical Machining Skills Package Of Vocational High School. AIP Conference Proceedings.

Sun, L. -H. (2014).Talking about the Project Teaching Method in the Teaching of Computer Major in Secondary Vocational Schools. Economic Vision.

Thomas, J. -W. (2000). A review of research on project-based learning. San Rafael, CA: Autodesk. Online: http://www.k12reform.org/foundation/pbl/research (retrieved 22.01.2019).

Tu, L.G.R. & Chen, B. -F. (2008). Problems and Countermeasures of Project Teaching in vocational colleges. In: Chinese Vocational and Technical Education, 9, 35-36.

Wang, X. -N. (2008). Basic characteristics of project teaching and new challenges for teachers. In: Vocational Education Research, 1, 12-14.

Warren, A. -M. (2016). Project-Based Learning Across the Disciplines Plan, Manage, and Assess Through +1 Pedagogy. Thousand Oaks, CA: Corwin Publishing.

Webster (1993). Merriam-Webster's collegiate dictionary (10th ed). Springfield, MA: Merriam Webster.

Wu, X. -L. (2012). Talking about the Problems and Countermeasures in the Implementation of Project Teaching Method. In: Science & Technology Information. 3, 278-294.

Xun, D. -Y. (2009). Talking about the Problems and Countermeasures in the Application Process of Project Teaching Method. In: Special Coverage, 8, 32, 90-92.

Yang X. -M. (2011). Analysis of the obstacles of secondary vocational teachers in project teaching and countermeasures. In: Vocational Education Research, 33, 21-23.

Yao, W. (2013). The training of teaching ability of higher vocational teachers and the improvement of their conceptual obstacles. In: Vocational Education Research, 6, 74-75.

Zinyakov, V. (2016). Method of projects as an effective development of creative abilities of pupils in the process of professional training. Online: www.olympiadatechniky.zcu.cz (retrieved 22.01.2019).

Zhang, Z. -F. (2013). Application of project-based learning in the teaching of the curriculum of combining study with work of higher vocational education. International Conference on Education Technology and Information System (ICETIS). Atlantis Press.

Zhao, Y. - J. (2015). Talking about the Problems and Solutions in the Teaching of Secondary Vocational School Project – Project Teaching Based on Computer Plane and Animation Direction. In: Primary and Secondary School Audio-visual Education, 9, 52-54.

TVET@sia The Online Journal for Technical and Vocational Education and Training in Asia

CITATION:

Liu, H. (2019). Barriers of Project-Based Learning in Teaching and Learning of Chinese Technical and Vocational Education and Training (TVET): A review. In: TVET@Asia, issue 12, 1-14. Online: http://www.tvet-online.asia/issue12/Liu_issue12.pdf (retrieved 30.01.2019).

Author(s) Profile

Huan Liu

PHD student
TU Dresden University, Germany

Email: liuhuan666@hotmail.com