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Original Paper

Rethinking 'Practice' in Traditional Thoughts and Implications for Science Education Innovation in China

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Abstract

This paper aims at explore what we can learn from rethinking 'practice' in traditional Chinese thoughts for today's improvement of science education in using Problem-Based Learning (PBL). This firstly drives a discussion on four dimensions of Traditional Practical Learning (TPL): 1) practice varying learning, 2) learning in practice, 3) reflective learning on practice, and 4) learning to practice. It further helps to summarize both advantages and limitations of TPL. Secondly, the summary brings ideas on how to enrich our understanding of practical learning and experiential learning models in Chinese science education. Finally, PBL is regarded as one of the potential strategies to innovate contemporary science education that drives an analysis on how to make localization of PBL through TPL in a Chinese context. Briefly, this paper contributes to bridging diverse perspectives of being historical, cultural, and contemporary to address appropriate strategies in science education innovation in China.

Keywords

practice, traditional practical learning (TPL), problem-based learning (PBL), experiential learning, science education

1. Introduction

During the past four decades, China's two historic transformations, from a rural, agricultural society to *an urban, industrial one, and from a command economy to a market-based one, have combined to yield* spectacular results. The successful development strategy has made China an upper-middle-income economy today and changed towards a modern, harmonious, and creative society (The World Bank, 2013). To accelerate the pace of innovation in science and technology, policymakers will need to focus on improving creative problem-solving skills among future young scientists (Zhou, 2020).

For the time being, fast changes are occurring beyond China's educational system, where massive internalization and globalization have rehabilitated the knowledge structure of enterprises and professions (Peng, 2017). As a result, the rise of the most recent transdisciplinary necessitates the development of multi-dimensional talents in science students, such as self-learning, transformable learning, and lifelong learning, among other things (Cui & Wang, 2014). All of the requirements are intended to better prepare science students for handling obstacles and solving complicated problems in their future careers, but they are causing educators and policymakers in China to reconsider how to enhance the current educational system (Fan, Zhang, & Xie, 2015; Xiong, Liu, & Ma, 2017).

In addition, by evaluating developing programs, we can observe that China's educational reform is at a crossroads, requiring a shift away from theoretical study and toward practice-based learning. There has been growing attention to diverse strategies that encourage principles such as student-centered learning, learning by doing, and reflective learning and call for science education innovation change towards a co-creation paradigm (Zhou, 2019). However, any innovation includes a complex set of processes and as a result, innovation connects to a wide range of cultural issues. For example, Problem-Based Learning (PBL) has been recognized as a potential strategy to innovate science education (Zhou, 2020). However, even though there are many theoretical discussions on how to integrate PBL into Chinese curriculum systems, such a newly applied pedagogy is still staying on a level of single courses in practice. This situation underpins that when a new education model is introduced to a new culture, both issues of being cultural-general and cultural-specific should be considered. In other words, particular attention should be paid to how to design an appropriate strategy that should compromise innovative initiatives with traditional culture.

Following the above lines, this paper aims to seek for understanding on practical learning in traditional thoughts and rethink the implications for the improvement of present science education in China. Overall, this paper is followed by three main parts. Firstly, a traditional view of 'practice' will be analyzed. Secondly, a rethinking on enriching our understanding on practice and experiential learning will be explored. Thirdly, a strategy of Problem-Based Learning (PBL) will be discussed with issues of

its localization in science education in China. Accordingly, this paper has both theoretical and practical significance that bridges both perspectives of being historical and contemporary.

2. 'Practice' in a View of Chinese Traditional Learning

2.1 Brief History of Chinese Traditional Learning

Traditional Chinese learning theory is primarily based on Confucianism, which has been passed down for more than 2,500 years since the Chunqiu period (550 BC) and is fused with Taoist, Buddhist, and other schools of educational thinking such as Mohism and Legalism (Sun, 2009). To make a long story short, the historical evolution of Confucianism proceeded through typical eras of Classic Confucianism, Neo-Confucianism, and New Confucianism, as well as a gradual emphasis on practical learning and social requirements (You, Rud, & Hu, 2018).

Confucius'educational ideas are based on the Analects and their disciples' remarks. Confucius emphasizes the significance of individual growth and the societal role of education. The expansion of filial piety and amicable brothers will have an impact on society and politics through schooling. Neo-Confucianism was the main idyllic school in the Song, Yuan, and Ming Dynasties, and was the most elaborate and complete theoretical system in ancient China with profound influence (Meng, 2002; Keenan, 2011; Gallinaro, 2017). It was centered on Confucianism and compatible with the tranquil theories of Buddhism and Taoism. Neo-Confucianism is divided into several schools. The Unity of Knowing and Acting, the main concept of Wang Yangming's philosophy school, has had a significant and lasting impact on several east Asian countries (such as Japan and Korea) and has also become the creeds of many liberal Asian reformers (Duncan, 2002; Yu, 2010). However, by the end of the Ming Dynasty, the scholar-bureaucrat study style had devolved into emptiness. Yen Yuan is well-known for being an outspoken opponent of Sung and Ming Neo-Confucianism. The concept of SHI is important and prevalent in Yen Yu'an's philosophical writings. Shih is not simply a question of moral practice or real activities, but it is also a basic principle of the universe (Cheng, 1979). Huang Zongxi, Gu Yanwu, and Wang Fuzhi, known as the three great Confucians of the early Qing Dynasty, supported 'Practical Learning' (Jing Shi Zhi Yong, 经世致用) (Tiwald, 2018), criticizing academic studies that deviated from contemporary social reality and emphasized connecting.

According to the above statement of the evolving stages of Confucianism in China, we can see that practice-based learning has been historically addressed in traditional Chinese philosophies. Knowing from "Practice" and serving for practical society are the tradition and the core concept of Classic Confucianism since the pre-Qin Dynasty (550 BC).

2.2 Four Dimensions of Traditional Practice Learning (TPL)

This section will analyze 'Practice' in the theories of learning in Confucianism, through listing examples and paraphrasing the words of the previous scholars. Generally speaking, the wisdom of Chinese philosophies on traditional practice learning can be concluded into four dimensions: 1) Practice Varying Learning, 2) Learning in Practice, 3) Reflective Learning on Practice, and 4) Learning

to Practice.

2.2.1 Practice Varying Learning

Confucius' theoretical foundation is 'All living beings are one and the same' 'In matters of instruction, there should be no class distinctions'. (Confucius, 2007, p.110), which asserts that all persons have the potential for achievement and morality. As the Analects stated, there should be no class distinction in education. It indicates that no distinction may be made between nobles and citizens, regardless of country boundaries, as long as students with a desire to study can be taught. However, Confucius discovered that, by nature, mankind is virtually identical; by practice, they become far apart (Confucius, 2007, p. 120). He thought that human nature is akin to inborn kindness, but that prerequisite knowledge, experience, ideas, and perseverance distinguishes them. The characters of vacillation and competition, for example, are opposed. Genes determine a person's character traits from a physiological standpoint. When Gong Xihua inquired why Confucius answered the same questions in opposite ways to the question that 'When I hear something, should I proceed to put it into action?' (Confucius, 2007, p. 75) in the Analects chapter Advanced, Confucius explained that Ran, one of his students, has a humble personality and hesitates to act, so he was encouraged to act decisively. However, because Zilu is a competitive and imperfect person, he was advised to consider other people's perspectives and to think twice before acting.

2.2.2 Learning in Practice

Neo-Confucianism dominated the Ming Dynasty, with the theory 'GEWU ZHIZHI (格物致知)' emphasizing the exhaustive investigation of objective things in the world and the expansion of knowledge learning. It has become a practical guideline and a core value for both past and present academic researchers. Traditional Chinese Medicine (TCM) is a concrete example of learning in practice, as it carries the experience and hypothetical knowledge of the ancient Chinese people's struggle against diseases. TCM's theoretical framework evolved over a long historical era, promoting it to become a structured medicinal knowledge from dispersed, self-conscious, local, and popular curative practical knowledge. The concepts of Meridians and collaterals, acupoints originated from the understandings obtained through such a practical method as 'internal evidence'. The 'internal evidence' is a record of the process of drug action in vivo under the condition that the in vivo confirmation test can be carried out. 'Looking, listening, asking and feeling the pulse', which is the guiding principle of Chinese medicine diagnosis, can be considered as the actual practice of Chinese traditional medical schools. Chinese traditional medicine edifies that understanding the words in books is not as good as facing illness. All these principles are tightly connected with clinical practice and learning from experience.

2.2.3 Reflective Learning on Practice

Learning without thought is labor lost is one of Confucius'prescriptions emphasizing the importance of learners' thinking (Confucius, 2007, p. 21). It necessitates that learners actively think and digest according to what they have learned, rather than passively accepting the knowledge taught by teachers,

and that they regulate the learning process independently. It implies critical thinking and metacognition as part of the learning process. Learners should be self-conscious and autonomous in their learning, and they should be capable of asking questions and solving problems on their initiative, rather than accepting passively.

The learning process is defined as ‘aspire, erudite, question, deliberate, distinguish, persistent practice, and dedicate’ in Neo-Confucianism. The steps of ‘interrogate, deliberate, discriminate’ include inquiring, examining, disputing, reflecting, and judging, all of which are repetitively reflective actions. Wang Yangming’s concept of ‘the Unity of Knowing and Acting’ exemplifies the learning process by attempting to behave in accordance with self-conscience while also reflecting on the practice. Reflecting on practice is followed by thorough scientific study and advanced learning in a cycle.

2.2.4 Learning to Practice

As previously said, New Confucianism enjoined students to learn for the sake of practice and societal needs. They urged for reform and a series of countermeasures while highlighting societal inconsistencies. A new movement of ‘seeing at the world with an open eye’ evolved, spearheaded by a group of farsighted intellectuals led by Lin Zexu (Qing, 1991). Lin Zexu became the first individual in contemporary China to grasp the outside world after translating Western publications during the anti-aggression campaign. Even though Lin Zexu spent his whole life fighting against the invasion of the West, he was open to western culture, science, and trade, and encouraged studying and putting what he learned to good use in China.

The consciousness of learning for application and participation in society is embodied in Confucius’ practical theory. In Confucius’ Analects, there is a line that says ‘A man may be able to recite all three hundred odes, but if you assign him as an envoy to some neighboring state and he can’t give his answers unassisted, then no matter how many odes he might know, what good is he?’ (Confucius, 2007, p. 89). The way of counseling students through hypothesis and case enumeration exemplifies the idea of ‘Learning to Practice’. ‘Officialdom is the natural outlet for good scholars’, Confucianism’s spiritual proposition of putting knowledge into action is fully expressed.

2.3 A Summary

From the analysis of understanding Chinese traditional practice learning, it is clear that practice is one of the core values of Confucian education, which shapes the basic ground of traditional Chinese didactic concepts. ‘Practice varying learning’ emphasizes the importance of teaching according to individual experience. ‘Learning in practice’ stresses exhaustive investigation of objects. ‘Reflective learning on practice’ employs many ways of reflecting on the practical phenomenon. And ‘Learning to practice’ encourages learners to apply knowledge in professional contexts and serve society. All these points highlight the notion of the ‘unity of knowing and acting (知行合一)’ and strengthen there is adequate soil for experiential learning to thrive in science education today.

As mentioned previously, Chinese philosophers do not seek knowledge for purely theoretical reasons, but ‘seeking truth’ and ‘facts’ are inextricably linked. It promotes the pursuit of knowledge in the form

of ‘facts’ and ‘applicable knowledge that can be used to solve real-world problems. However, they did not write as many theoretical monographs as western philosophers did. They did express their wisdom and thoughts through short articles, prescriptions, and annotations. Traditional Chinese thinkers, like Asian painters, enjoyed ‘leaving blanks’, therefore people’s imaginations may be sparked by the words mentioned in their writings, resulting in a wide range of (or indefinite) interpretations. This sometimes may also mislead scientific investigation into finding accurate explanations. Briefly, the traditional Chinese learning philosophers missed their detailed illustrations on ‘abstract conceptualization’ that indicates the limitation of TPL.

3. Enriching Understanding on Practice and Learning

It is similar to the traditional Chinese view, researchers in Western cultures also argue many values of practice in learning contexts. This has shaped many studies on ‘experiential learning’ that is one of the primary branches in contemporary learning theories. As both advantages and limitations of the traditional Chinese theories are clarified, we may rethink further how to enrich our understanding of practice and how to innovate science education in today’s China. This drives this section to discuss on a) Experiential Learning in Practice, and c) Experiential Learning Models.

3.1 Experiential Learning in Practice

The literature has indicates different definitions of ‘Practice’, while most of the discussions link practice with experience, knowledge, and learning. For example, Ehn (1993) provided a detailed description: through practice, we produce the world, both the world of objects and our knowledge about this world. Practice is both action and reflection. But practice is also a social activity; it is produced in cooperation with others. However, this production of the world and our understanding of it takes place in an already existing world. The world is also a product of former practice. Hence, as a part of practice, knowledge has to be understood socially – as producing or reproducing social processes and structures as well as being the product of them.

As Wenger (1998) suggested, practice is always social practice; it highlights the social and negotiated character of both the explicit and the tacit knowledge in our lives. It is the community, rather than the individual, that defines what a given domain of work is and what it means to accomplish it (Robertson & Simonsen, 2012; Zhou, 2019). Following these points, experiential learning happens in practice. It is defined as a process of creating and transforming experience into knowledge, skills, attitudes, values, emotions, beliefs, and senses (Jarvis, Holford, & Criffin, 1998). This aligns with the notion of the ‘unity of knowing and acting’. It is also applicable not only in the formal education classroom but in all areas of life; it is the process through which individuals become themselves; it is almost synonymous with conscious living (Zhou, 2020).

The experiential learning theory draws on the work of prominent twentieth-century scholars who gave the experience a central role in their theories of human learning and development - notably John Dewey, Kurt Lewin, Jean Piaget, William James, Carl Jung, Paulo Freire, Carl Rogers, and others - to develop a

dynamic, holistic model of the process of learning from experience and a multi-linear model of adult development (Kolb & Kolb, 2008). Kolb (1984) developed a model that portrays two dialectically related modes of grasping experience - Concrete Experience (CE) and Abstract Conceptualization (AC) - and two dialectically related modes of transforming experience - Reflective Observation (RO) and Active Experimentation (AE) (Figure 1).

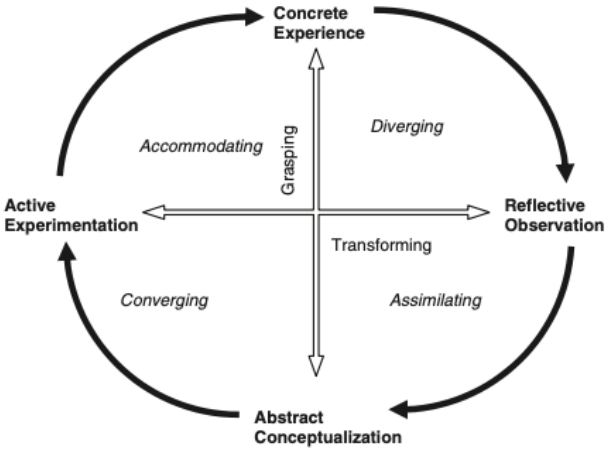

Figure 1. Experiential Learning Cycle

From Figure 1, we can see experiential learning is a process of constructing knowledge that involves a creative tension among the four learning modes that is responsive to contextual demands. This process is portrayed as an idealized learning cycle or spiral where the learner 'touches all the bases' - experiencing, reflecting, thinking, and acting - in a recursive process that is responsive to the learning situation and what is being learned (Kolb & Kolb, 2008). In addition, the learning cycle indicates the typical conditions for each form of knowledge thus (Illeris, 2007):

a) Assimilative knowledge typically develops from comprehension and intention;
b) Convergent knowledge typically develops from comprehension and extension;
c) Accommodative knowledge typically develops from apprehension and extension; and
d) Divergent knowledge typically develops from apprehension and intention.

Meanwhile, immediate or concrete experiences are the basis for observations and reflections. These reflections are assimilated and distilled into abstract concepts from which new implications for action can be drawn. These implications can be actively tested and serve as guides in creating new experiences (Kolb & Kolb, 2008). By such a learning cycle, knowledge is continuously derived from and tested out in the experience of the learner. According to Dewey (1938), the principle of continuity of experience means that every experience both takes up something from those which have gone before and modifies in some way the quality of those which come after. As an individual passes from one situation to another, his world, his environment, expands or contracts. He does not find himself living in another world but in a different part or aspect of one and the same world. What he has learned in the

way of knowledge and skill in one situation becomes an instrument of understanding and dealing effectively within the situation.

3.2 Calling for Experiential Learning Models

The fact that learning is a continuous process grounded in experience has important educational implications. Put simply, it implies that all learning is relearning. How easy and tempting it is in designing a course to think of the learner's mind as being as blank as the paper on which we scratch our outline. Yet this is not the case. Everyone enters every learning situation with more or less articulate ideas about the topic at hand. One's job as an educator is not only to implant new ideas but also to dispose of or modify old ones. In many cases, resistance to new ideas stems from their conflict with old beliefs that are inconsistent with them. If the education process begins by bringing out the learner's beliefs and theories, examining and testing them, and then integrating the new, more refined ideas into a person's belief systems, the learning process will be facilitated (Kolb, 1984).

However, although experiential learning in all its forms may have become a new orthodoxy, there are many situations when we have to learn from secondary or mediated experience. In these cases, we have to recognize that we are learning from other people's experiences and interpretations. These must be assessed critically before we accept them. But without learning from secondary experiences, our knowledge of the world would be greatly impoverished (Jarvis, Holford & Criffin, 1998). The key point lies in the fact that all learning is 'situated', i.e., that the learning situation not only influences but also is a part of the learning (Lave & Wenger, 1991). Briefly, as suggested by Jarvis (1992), learning occurs in a tension field between the individual and the social: the process of learning is located in the interface of people's biography and the sociocultural environment in which they live, for it is at this intersection that experiences occur.

In order to prepare learners for future learning in which they can deal with a variety of new tasks or problems, we should not only expose learners to new clarifying information, e.g., by means of lectures but preferably also stimulate them to compare and contrast tasks derived from relevant contexts (Bransford & Schwartz, 1999). Through discussing contrasting tasks, learners notice what critical features are of a variety of tasks. This is especially true for ill-defined tasks, i.e. tasks with one or more unknown elements and a variety of solutions that are often situated in the real world (Jonassen, 1997). When designing or redesigning curricula, meaningful, authentic, or professionally relevant tasks should be the starting point (Harden, 2018). Learning tasks can be presented as problems, but also as cases or projects. The basic idea is that learning tasks are aimed at enabling the student to acquire an integrated set of knowledge, skills, and attitudes, instead of a fragmented set of specific knowledge, skills, and attitudes. Instead of teaching knowledge, skills, and attitudes piece by piece, the tasks set should enhance the integration of knowledge, skills, and attitudes. In addition, teachers should offer a variety of tasks, ordered from the simple to the complex, and provide the learner with scaffolds that diminish at each level of complexity to enhance the transfer of knowledge to new situations (Van Merriënboer & Kirschner, 2017).

4. Problem-Based Learning (PBL) for Science Education Innovation

4.1 A Brief Overview of Problem-Based Learning (PBL)

What is PBL? Briefly, it is a student-centered educational model. Student learning centers on a complex problem that does not have a single correct answer (Zhou, 2016). Students work in collaborative groups to identify what they need to learn in order to solve a problem. They engage in a self-directed learning experience and then they apply their new knowledge to the problem and reflect on what they learned and the effectiveness of the strategies employed (Zhou, 2017).

PBL advocates experienced-based education (Hmelo-Silver, 2004): it provides students with guided experience in learning through solving complex, real-world problems, and therefore it helps students to a) construct an extensive and flexible knowledge-based, b) develop effective problem-solving skills, c) develop self-directed, lifelong learning skills, d) become effective collaborators, and e) become intrinsically motivated to learn. In PBL, curricula are organized to support the development of disciplinary patterns of discourse and representations of a domain, emphasizing the importance of formulating and evaluating, questions, problems, arguments, and explanations (Hmelo-Silver, 2004). Teachers facilitate knowledge construction as students are guided through their problem-solving processes; they behave as learning experts in sharing the learning experience with students and act to facilitate the learning process rather than only to provide knowledge (Zhou, 2020).

Today, PBL is widespread across the globe. Besides its growing interests in science education in China, PBL has been drawn much attention by educators who are striving for reforms in many other Asian countries, such as Japan, Korea, Singapore, and Vietnam, where also have a Confucianism-dominated traditional culture that values morality, collectivism, enormous power distance, seeking harmony, and self-cultivation. There have been some successful cases of applying PBL in Science, Technology, Engineering, and Mathematics (STEM) education in Chinese universities (Zhu & Zhou, 2019; Zhou, 2020). Meanwhile, the usage of PBL in other Asian countries like the Malaysia's University of Technology, and University of Tun Hussein Onn (Yusof, 2005), and Singapore Polytechnique (O'Grady, 2012) implies that PBL will be a feasible solution for Chinese science education innovation.

4.2 Localization of PBL through Traditional Practical Learning (TPL)

PBL locates all learners in a community of practice where there is an aggregation of people who, through joint engagement in some enterprise, come to develop and share ways of doing things, ways of talking, beliefs, values - in short, practice (Zhou, 2020). This requires a wide range of capabilities - knowing facts, concepts, and principles; understanding social relations and norms of interaction; knowing how to communicate and how to interpret documents and other information sources (Illeris, 2007). This further reflects the concept of culture. Culture represents the typical pattern of behavior by people and the artifacts they use and produce while implicit culture comprises the values, beliefs, and norms that underpin behavior that is observable (Zhou, Otrel-Cass, & Cass, 2018). Culture also shapes the interconnection between individuals and objects in an environment through their usage in a specific and socially legitimate way. Therefore, culture is both, a contextual and a cognitive phenomenon: the

context influences and creates human cognitive structures and vice versa (Zhou, 2020). Indeed, cramming education from a completely different western culture into Chinese culture is a bad idea. The development of PBL in science education in China has to consider the issues of localization of PBL through traditional practice learning.

The following lines will offer how conventional learning methods might aim to accommodate the prerequisites of current practical learning. Here a metaphor is developed: the renovating TPL to PBL is based on the hypothesis that takes culture as the soil for learning methodology, theories as the roots, and learning elements as branches and leaves (Figure 2). Accordingly, a tree of PBL is planned in the soil of TPL. In order to make the tree grow up, appropriate environmental conditions should be considered. This means it is necessary to explore deeper rethinking on 1) the common theoretical ground of PBL and TPL, 2) strategies of policy in education changes, and 3) facilitation of learning methods in practice of science education.

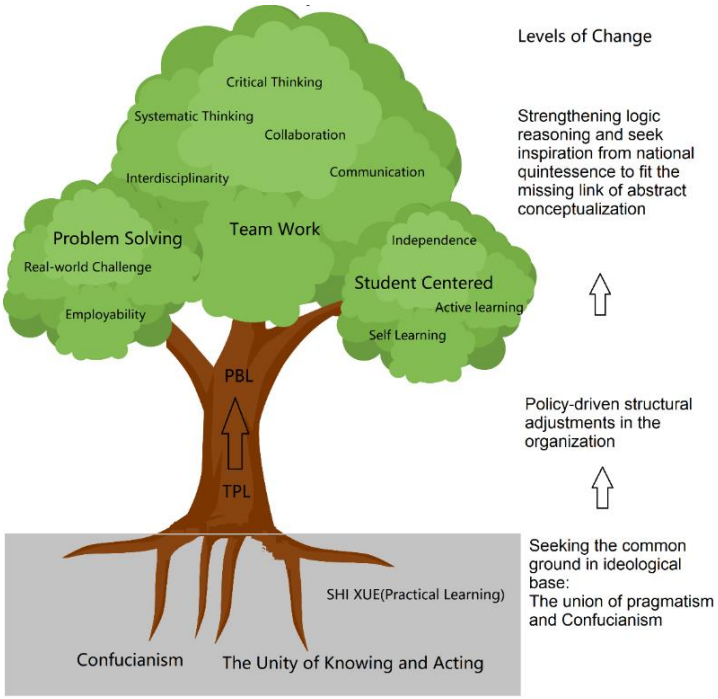

Figure 2. Planing a Tree of PBL in the Soil of TPL

As Figure 2 shows, the union of pragmatism and Confucianism is the common ground in the ideological base of PBL and TPL. Recently, American and Asian scholars began to realize that Dewey's pragmatism shares many important assumptions with Chinese Confucianism (Kim, 2015). For example, both theories regard individuals as constituted by relationships, which are maintained by effective communication. A complete individual is the product of clear social relations and well-known functions of the public (Ames & Hall, 2015). Both Confucianism and Pragmatism show the attempt to improve cultural conditions and to influence personal behaviors so that self-cultivation is more likely achieved.

In this sense, PBL can be fostered with a core value of 'the unity of knowing and acting', by theoretical roots of Confucianism mixed with Pragmatism, which can be also called the Chinese way of experiential-based TPL. Most notable Chinese educators today had some early exposure to Confucian learning, grew up through periods of rapid change, and witnessed wars, revolutions, and extreme political movements (Hayhoe, 2007). These Chinese educators, such as Tao Xingzhi and Li Bingde (Hayhoe, 2007; Xingzhi, 2016), are more like a blend of Deweyan and Confucian, who enthusiastically embraced Dewey's revolutionary ideas while judiciously recognizing Chinese ideology's essential principles.

As discussed previously, we should enrich the understanding of practice learning based on considerations of the limitation of traditional thoughts. By incorporating current scientific reasoning into the learning process, Chinese TPL may be improved in the development of local knowledge systems. The discovery of artemisinin (Qinghaosu, 青蒿素) in Chinese medicine (Tu, 2011) provides a sliver of proof. The therapy of malaria with artemisinin was discovered in ancient Chinese medical literature, and Tu Youyou was a researcher in traditional Chinese medicine. Ge Hong of the Eastern Jin Dynasty was also an inspiration for her effective artemisinin extraction. Although traditional Chinese medicine has a theoretical structure that is entirely distinct from biological medicine and pharmacognosy, it might supply more inspiration for Western medicine research.

Furthermore, the implementation of PBL requires organizational changes in science education institutions. Facts have shown that a bottom-up PBL transformation begun by teachers without the assistance of management is difficult to sustain at the organizational level. On the one hand, there is no mechanism in place to reward instructors for their commitment to the change, and on the other side, there is no relevant support system, teaching resources, or funding stream (Kolmos & De Graaff, 2007; Kolmos, 2008). Another situation is that if the university under change does not have a PBL tradition, once the reformative leader is removed from his position, whether or not to continue with the PBL teaching policy will be determined by the new leader's views (Ruth, 2012). A new course plan needs the assistance of organizational resources and listed educational strategies, which are founded on institutional management agencies' changing ideologies. Curriculum reform policy is gradually molded and implemented via ongoing emphasis and conceptualization throughout the development process. The unclear understandings then evolve into systemic challenges that may be addressed as part of the organization's strategy. Plans and decisions on policy choices may be put into effect by institutional activities, including cyclical trials and debugging throughout the process from policy-initiating, resource preparation, example case-building, model generalization, and feedback-gathering.

In Figure 2, as the large domain in branches of the tree model demonstrates, the most challenging conversion is in the participation-oriented practical learning method. TPL in classrooms is the typical lecture-based approach in which students passively ingest fill-in knowledge, which is the underlying reason. Unfortunately, the legacy of traditional educational philosophy's flaws has trapped students in their pursuit of excellence, i.e. mechanical teaching and learning, a lack of critical thinking and

creativity, and a lack of the foundations of 'formal logic system', making it difficult for foreign learning approaches to thrive in China. Because of the enormous power gap between professors and students, which is informed by Confucianism's idea of hierarchical rituals, teacher-dominated, lecture-based learning is reluctant to move to the innovative student-centered learning method. As a result, claiming democracy in the classroom is a countermeasure for reducing the power gap and achieving student-centered classrooms. And the instructor must constantly remind himself to speak less and ask more questions, allowing more time for pupils to think, naturally incorporating group activities into the teaching plan, perfecting the teaching cadence, and lowering lecture time. By integrating thinking with both a qualitative and quantitative approach, fieldwork is a genuine way to discover solid practical evidence and answers to a real problem. A detailed study in levels of phenomenon-profession-society can stimulate the use of systems thinking and untying links in multidisciplinary domains when dealing with an ill-structured social challenge.

5. Conclusion

Science is a subject of practice. Science education innovation motivates the implementation of new strategies with values of practice and experiential learning, such as PBL. As we cannot copy any successful educational models from other cultures, any innovation should be localized. This requires us to seek traditional thinking on practice learning that further brings implications for contemporary educational methodology. This study contributes to an analysis that PBL and Chinese traditional practice theory share the core value of 'practice'. The four dimensions of 'practice varying learning', 'learning in practice', 'reflective learning on practice', and 'learning to practice', build up a foundation of traditional practical learning (TPL). PBL, when combined with a dedication to self-improvement and transformative development, is already a critical tool for addressing the numerous issues of better learning and teaching in a variety of cultures, while also contributing to current Chinese science education at large. We should try to establish a stepping stone for Chinese indigenous practice-based learning theory by designing the Tree Model of PBL to incorporate Western educational ideals in the Chinese cultural environment. The localization of PBL requires efforts of strengthening the ground of traditional thinking, making new policies, and providing new facilitation of methods. Shortly, a holistic view is necessary to integrate experiential learning models such as PBL into contemporary science education in China.

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