

What They Learned Won't Go Away: The Impacts of an International Exchange Program on Chinese Teacher Candidates' Understanding of and Practice in Science Education

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Abstract

Purpose: The Canadian university where this study took place has established an international exchange program in teacher education with a large Chinese university. This study was designed

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to examine how the international exchange program influenced Chinese science teacher candidates' understanding of science education and how such learning impacted their teaching in China.

Design/Approach/Methods: The study adopted a qualitative research design with interview and reflective journal as the main approaches for data collection.

Findings: Participants greatly appreciated the opportunity of exchange. They reported an improved understanding of Canadian school education and its science curriculum and pedagogy, which changed many aspects of their original values about the relationship between the teacher and students, classroom environment, and so on. Although they faced many constraints to implement what they learned from the exchange in Chinese science classrooms, what they learned had never been forgotten. Participants tried to apply them here and there at the level they could control.

Originality/Value: There are many reported studies in the literature about Chinese international students on Western campuses. However, research on Chinese students who participate in international exchange programs is very rare. The findings of this study can inform policymakers and education practitioners about student international exchange programs and benefit future exchange participants.

Keywords

Cross-culture learning, cultural competence, international exchange program, teacher education, transformative learning

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Introduction

In the context of globalization, internationalization of education is considered as essential for solving the world's conflicts, promoting equality and fairness, learning from the best practices, and promoting technology transfer (Murphy, 2007). While education collaboration can take many formats such as joint degree programs, visiting scholars, collaborative research projects, short training programs, and so on, student international exchange programs provide an opportunity for participants from both sides to experience a different education environment for a relatively long period.

In 2010, a Reciprocal Learning Program (RLP) in teacher education was established between a Canadian university located in southwestern Ontario and a Chinese university in southwestern China with the funding from the Canadian university initially and later the Social Science and Humanity Research Council of Canada. The purpose of the RLP is to engage participating teacher candidates in international and intercultural reciprocal learning with mutual appreciation and respect among different cultures. It has the potential to allow teacher candidates to learn from

different education practices, develop their awareness and ability in meeting the needs of diverse learners, and become both culturally responsive and globally minded teachers for the constantly changing world. Through the RLP, a cohort of teacher candidates from the Chinese university was selected to come to the Canadian university to audit teacher education courses at its Faculty of Education and observe K-12 local schools every fall semester. In reciprocity, a cohort of teacher candidates from the Canadian university were recruited each year to go to China in the spring. There have been nine rounds of teacher education exchange since 2010.

Studies about international students have reported that Chinese students face many challenges on Western campuses including language barriers, cultural shock, loneliness and homesickness, different educational context and values, and prejudice and discrimination (Guo & Guo, 2017; Wan, 2001; Yan & Berliner, 2011; Zhang & Zhou, 2010; Zhou et al., 2017; Zhou & Zhang, 2014). Such challenges or barriers have profound influence on their social and academic integration and sense of belonging, which determine their academic performance or retention in their study programs (Chen & Zhou, 2019). It is reasonable to hypothesize that Chinese exchange teacher candidates will be subject to some of these difficulties as well. However, they are different from international students who come to study for their degree programs usually over several years. Exchange teacher candidates come to the host university for only a few months and with an expectation to learn from the culture and education differences. Their perceptions and attitudes toward such differences might differ from international students. While there are many reported studies in the literature about the experiences of Chinese students on Western campuses as mentioned above, research on Chinese students who participate in international exchange programs is still very rare.

Our research team has carried on a multiple-year study to investigate the learning experiences and achievements of Chinese exchange teacher candidates who participated in the RLP. We also explored how the RLP experience transformed their teaching performance. In this article, we will report our study findings around the following research questions:

1. How did the exchange experience influence their understanding of science education?
2. What new pedagogical concepts did they learn through the international exchange program?
3. What successes and challenges did they experience when they tried to adapt Western pedagogy in China?

Literature review

Intercultural competence

The underlying belief of international exchange programs is that intercultural learning experience is essential for developing an in-depth understanding of another culture. Bhawuk (1998) asserts

that intercultural learning often involves cognitive, emotional, and behavioral dimensions, and thus cannot be restricted to training manuals and brief orientations that do not engage emotions or behavioral experiences. Similarly, Earley and Ang (2003) argue that intercultural development relies on practical understanding of how one's behavior and physical presence are received in cross-cultural settings. In reference to Mezirow's (1991) theory of transformative learning, Taylor (1994) states that intercultural competence is a long-term process of learning that comprises key learning strategies that allow individuals to move through challenging moments of cultural dissonance. He significantly emphasizes cultural disequilibrium as a catalyst of the intercultural learning process. Such disequilibrium consists of periods of incongruence that challenges the participants' perspectives, pushing them to learn new ways to bring balance back into their lives.

Deardorff (2006) defines intercultural competence as "the ability to develop targeted knowledge, skills and attitudes that lead to visible behaviour and communication that are both effective and appropriate in intercultural interactions" (p. 243). Internally speaking, intercultural competent persons learn to be flexible, adaptable, empathetic, and adopt an ethno-relative perspective. Externally speaking, intercultural competent persons behave or communicate in culturally responsive ways. Attitude, behavior, and knowledge are three dimensions of intercultural competence.

Attitude. Attitude refers to one's personal traits, affections, and mindsets, which are shaped by personal experiences and predispositions and can be changed through learning and socializing (Ingraham & Peterson, 2004). Attitude is a powerful tool that affects how people communicate and relate themselves with others. Positive attitudes include elements such as curiosity, openness, willingness to suspend judgment, respect, flexibility, and tolerance (Byram & Zarate, 1997). McLeod and Wainwright (2009) find that cross-cultural programs can facilitate positive attitudinal change and enhance characteristics essential to teaching by reshaping their culture views, global mindedness, and intercultural sensitivity. Douglas and Jones-Ridders (2001) find that study-abroad programs shape peoples' global mindedness, which improves their intercultural abilities and enhances their careers and personal development.

Behavior. In the context of intercultural competence, behavior refers to the conduct and action one engages in effective communication with people from different cultural backgrounds. This includes the willingness to relate themselves to others and explore, interpret, and interact with one's environment (Byram & Zarate, 1997). This necessitates the willingness to listen, observe, interpret, and analyze situations, and the readiness to adapt to the unknown or uncertain situations. These behaviors facilitate successful intercultural communication and can be enhanced through language learning (Deardorff, 2006). Crossley and Watson (2006) contend that intercultural education allows teacher candidates to better understand one's own educational system, develop a deeper comprehension of the connection between education and the wider society, consider solutions to the

problems in educational policy and practice, and cultivate an increased sensitivity to different worldviews and cultures.

Knowledge. Byram and Zarate (1997) describe two categories of knowledge in intercultural competence: knowledge about the international students' native culture and social groups and the culture of host country, and knowledge about the process and concepts of interpersonal and social interaction. Deardorff (2006) notices additional knowledge components that impact students' intercultural competence development, such as understanding others, the value of cultural diversity, the role and impact of culture, and the situational, social, and historical contexts involved.

International experiences for teacher candidates

International experiences for teacher candidates can take place in different formats such as international teaching placement and study-abroad programs. Since the 1980s, studies have recognized the multiple benefits of international placements. International placements are reported to provide teacher candidates with more learning opportunities and increase their employability (Bryan & Sprague, 1997; Cushner, 2007; Kissock & Richardson, 2010). It can enhance teacher candidates' knowledge and skills and cross-cultural communication effectiveness, help them to cope with new surroundings, and increase their independence and confidence (Kabilan, 2013). The new knowledge and skills acquired from placement practicum increase their professional competence (Quezada, 2004; Ward & Ward, 2003). These competencies are crucial components of professional development that teachers should convey and translate into daily teaching. Through international placement, teacher candidates can learn additional languages, acquire different teaching methods, redefine their understanding of their own culture, and change their cultural perceptions (Lee, 2011). In addition to the personal growth, international placement has enriched teacher candidates' culture understanding and worldview while enhancing the effectiveness of curriculum implementation (Hanvey, 1979; Kabilan, 2013; Stachowski & Sparks, 2007). It is considered as a way in preparing teacher candidates for diversity (Mahan & Stachowi, 1990).

Through study-abroad programs, teacher candidates can develop an understanding of how students from other cultures learn and grow in different cultural and social contexts. For instance, Malewski and Phillion (2008) discover how, as the cultural outsiders, teacher candidates are able to develop an understanding of how students from the host culture learn. They are able to better identify cultural attributes and understand learning disabilities. They learn to be opened-minded when trying to meet the needs of diverse learners. Allaman (2012) and Clement and Outlaw (2002) report that teacher candidates in study-abroad programs can learn what it is like to be the minority in the classroom and become more sensitive and empathetic to the needs of ethnic minority students within a culturally diverse classroom.

However, there are challenges that can impede the success of international placements and study-abroad programs. There are concerns that these international experiences do not always achieve their predetermined goals and sometimes may lead to negative results (Mahan & Stachowski, 1990; Talburt, 2009). To address this, Stachowski and Sparks (2007) suggest that teacher candidates learn about the host culture's people, food, and education system before departure. Teacher candidates may also struggle to integrate themselves into the host society due to a lack of financial and pedagogical support (Kholer, 2012; Yang, 2011). Furthermore, teacher candidates may have difficulty readjusting themselves back to their own native culture after they return home (Maynes et al., 2012). Teacher candidates' negative perceptions of the curriculum of the host school (Pence & Macgillivray, 2008) and their excessive enthusiasm and idealism (Willard-Holt, 2001) may lead to a negative understanding of local culture.

The current literature on the study of the development of intercultural competence of teacher candidates through international experiences has clear limitations. First, past studies focused on the participants' knowledge learning about the host cultures. These studies took place during or right after the international adventure but did not follow up the impact of such learning on participants' actual teaching practice. It is hard to tell if the international program provides participants with transformative learning experiences. According to Mezirow (2000), transformative learning is a process through which a person reflects upon and challenges a preconceived frame of reference, which includes conditioned cognitive processes and mindsets, before adopting a new, more inclusive and open belief to guide one's actions. Not all learning is transformative. If experience and knowledge do not create or lead to transformation, it is not transformative learning (Mezirow, 1991). To achieve transformative learning, one must engage in critical self-reflection, and the reflection of the experience must lead to an intellectual growth that brings about transformation.

Method

This study employed a qualitative research design to explore Chinese exchange students' experiences and learning outcomes from the RLP. Three science-majored participants (L, X, Y) were recruited on a voluntary basis from a cohort who came to the Canadian university in one semester. The cohort was selected from the fourth-year students of teacher education programs of the Chinese university. They were chosen because they had best academic performances compared with their peer students and were interested in intercultural learning experiences.

Participants' experiences in the RLP and subsequent efforts to implement what they learned in their first year as teachers in Chinese high schools were the focus of data collection. A series of four semistructured interviews were conducted with each participant. The first three interviews were conducted while they participated in the one-semester long RLP, respectively, at the beginning, in the middle, and upon the completion of the international exchange program. The last

interview was conducted about 2 years later when the participants had completed their first year of teaching as full-time Chinese school teachers in southwest China. Guided by the theoretical framework of intercultural competence, open-ended interview questions were developed to collect information about the participants' attitude, knowledge, and behavior around the RLP. In other words, participants were asked to respond to questions about their motivations for participation in RLP, the benefits they gained, and their reflection on what they knew before and what they learned from the RLP. In the last interview, the focus was on participants' transformative performance. Participants were asked questions about their efforts and challenges to apply what they learned to the Chinese education context.

Each interview lasted from 30 to 90 min varying from participant to participant and depending on the stage of the program when the interview took place. Participants were given choices to speak either Chinese or English. All of them chose Chinese as interview language so that they could fully understand the interview questions and express themselves clearly. Interviews were audio recorded and later transcribed for analysis. To improve data richness and credibility, field notes were also taken during the interview process to record information that audio recorders could not catch, such as participants' body language, emotive responses, and facial expressions. In addition, the researchers briefly noted down the quick thoughts they came up with while interviewing participants. These types of quick notes could serve as a reminder to the researchers when they analyzed the data.

For the purpose of data triangulation, participants were also asked to write daily reflective journals to record what they experienced and learned from all the events of the RLP, including auditing teacher education courses, placement at schools, workshop series, and field trips. Each participant was also required to develop a portfolio to document their learning and growth during the RLP.

Both deductive and inductive processes took place in data analysis (Berg & Lung, 2010). In the deductive process, our theoretical framework suggested some key issues around participants' experience and intercultural competence growth. However, this deductive process only served as the background information. It was the inductive process that determined our final themes of findings. For the inductive process, content analysis approach was employed to interpret the data. It involved coding, recording, and theme generation. First, the researchers read all forms of data and marked key words or phrases on the texts. Then, they reread the texts and made necessary changes to the initial coding. Finally, all codes were consolidated and grouped into themes. Interview transcripts were the main focus of data analysis used to generate coding and themes. Data from reflective journals and portfolios were used to provide further evidence and supplementary resource to refine and enrich the coding and themes generated from interview transcripts.

The research team consisted of faculty members and graduate students who had finished their teacher education programs before. Most of them had teaching experience either in China or in Canada, and some of them had teaching experience in both countries. Some of them were international students, which made them knowledgeable about both Chinese and Canadian education systems. Such rich background allowed the team members to easily appreciate the study participants' experience and perspectives about education in China and RLP experience in Canada. Meanwhile, the research team also understood that their knowledge and experience might bring bias to data collection and interpretation. Therefore, they were always on alert about their possible bias when we collected and interpreted data. Data analysis results were cross-checked by multiple researchers to ensure the creditability of the results and reduce the possible bias of any individual researcher. In addition, analysis results were sent back to participants for accuracy check.

Findings

Data analysis revealed four themes about participants' gains from the international exchange program and their follow-up efforts in applying what they learned: participants' perceptions about science teacher education, their understanding of science education, applicable and beneficial Western pedagogy, and successes and challenges in the application of what they learned from the RLP.

Participants' learning about science teacher education

When being asked about their learning about science teacher education, study participants reported that Canadian teacher education emphasizes cultivating teacher candidates' capacity to develop and deliver lesson plans and class activities under the notion of learning through inquiry. They noticed that teacher education courses in Canada required teacher candidates to read an extensive number of journal articles. The placement in the Faculty of Education provided participants with opportunities to learn innovative perspectives regarding fields such as special education. In China, special education refers to the education for students with physical disability. In Canada, special education is based on students' special needs, which may result from their physical disability, behavior problem, and learning difficulty. Gifted students were also covered in the domain of special education. Such new perspective about special education inspired participants' awareness of adjusting their future teaching based on students' needs. Participants shared the pedagogical differences between Chinese and Canadian teacher education and noted how Canadian teacher education encourages teacher candidates to critically reflect on teaching pedagogy. This learning experience reshaped their view on the goals of science education. They expressed how their understanding of the goals of science education initially focused on delivering knowledge and

gradually took on the ultimate goal of science education as cultivating students' scientific literacy and citizenship.

Participants' learning about science education

While observing science classrooms, the participants found that Canadian schools differed from Chinese schools with respect to their pedagogical goals and approaches, student engagement, and the teacher–student relationship.

Pedagogy. Participants reported that Canadian education was student-centered and valued students' engagement, kinesthetic activities, and teamwork. The curriculum was designed to be closely connected with real-life scenarios so that students could see how to apply what they learned in their daily life. Canadian teachers used inquiry-based pedagogy to develop students' independent and critical thinking. Participant Y assumed the curriculum content in Canada was simpler than in China before she came to Canada. To her surprise, she learned that Canadian curriculum could be more complicated since it covered more topics than Chinese curriculum. She realized that through various inquiry-based hands-on activities, Canadian teachers were able to make lesson content more accessible and relevant to students. Such learning experience inspired Participant Y to use more hands-on inquiry activities to her future teaching.

Teachers. All three participants pointed out that teachers in Canada had a high degree of freedom to choose what to teach in class and had enough class time to include kinesthetic and group activities. Canadian teachers seldom relied exclusively on lesson plans. They often adjusted their teaching content and strategies to accommodate students' needs. The participants also noticed that there were only 20–30 students in a class. This small class size allowed teachers to focus on each student's individual needs. In contrast, participants reported that Chinese teachers had to teach the specific contents dictated to them by the high-stake exams. Chinese class sizes were significantly larger than Canadian classes, with the number of students in each class ranging between 50 and 70. This made it almost impossible for teachers in China to pay attention to students' individual needs.

Students. Participants L and Y observed that students in Canada were cheerful, open-minded, and often eager to express their opinions in class discussions, which made them distinct from many Chinese students. Participant L referred to Chinese classrooms as a “push-oriented learning” environment, where students are under intensive academic pressure. He also noticed that Canadian students actively participated in class regardless of their exam scores. In contrast, only the students with top marks were willing to interact with teachers in Chinese classes. Such observed differences pushed participants to reflect on the educational and social environment factors that caused low classroom engagement of Chinese students with poor exam scores.

Teacher–student relationships. Participants found that the teacher–student relationship in Canada was significantly different from China. In Canadian classrooms, respectful and democratic approaches were at the center of pedagogy. Students were given opportunities to express their opinions in class. Everybody in the classroom was respectful to each other. Canadian teachers were reported by participants to purposely build such democratic and encouraging environment. They were described as “responsible” and “patient” by study participants since they always used encouraging language and provided positive responses to students. The major difference in the teacher–student relationship could be noticed in the ways how Canadian and Chinese teachers treat the “bad” students (often judged by their low exam scores). The study participants were impressed by how Canadian teachers respect and support students regardless of their academic performance records. Participant L mentioned that Canadian teachers did not judge students based on test scores as they cared about every student. They provided extra attention and support to students with learning difficulty. For those students who lacked motivation to learn, Canadian teachers patiently encouraged them to get involved through diversified pedagogical approaches and activities. In China, teachers and students accepted the concept of “score hero,” which asserts that students who got higher test scores would enjoy extra attention from teachers and have access to more opportunities than their peers. The “bad” students with low test scores were often forgotten or blamed for their lack of learning motivation and effort. Participant L reflected on such difference as follows:

I can feel the students’ happiness and see that they genuinely enjoy the school. Compared with Canadian students, I feel so sorry for Chinese students. Chinese students have to face too much pressure and do not have time to do any leisure activities. They are labeled as “good” or “bad” students based on their test scores. In Chinese classrooms, you can easily notice who are the “good” or “bad” students based on their learning motivation and class participation, while in Canada you cannot. It appears that students in Canadian classrooms can positively express their opinions and engage in activities regardless of their test scores. You can feel they are motivated to acquire knowledge.

Participant Y shared a similar perspective. By listening to the presentations of some graduates from a secondary school, she learned that Canadian students, even though they earned low grades, still had the potential to achieve great success in the future. These students could become successful in the fields that reflect their potentials. Participant Y felt sorry for Chinese students with low test scores since they were often labeled as “bad” students and consequently lost opportunities to access higher education and professional options.

It is worth noting that before coming to Canada, participants had a belief that science education in North America was more advanced than China. However, after the international exchange program, they realized that each education model has its own strengths and limitations. For example, Participant Y stated that she would not judge which pedagogy was best; she would rather

focus on what skills or abilities she wanted to cultivate. She added that although the Western pedagogy did not provide her with as much guidance as she hoped, it was worth learning. She also commented that “I do not think copying or borrowing superficial activities will work for Chinese education because Chinese teachers emphasize scientific knowledge whereas Canadian teachers pay more attention to hands-on activities.”

Applicable and beneficial Western pedagogy

The placement in Canadian teacher education courses and local school classrooms made the study participants realize that effective teaching should focus on students’ interests and long-term development. The ideas of innovative teaching and democratic teacher–student interactions challenged participants’ original understanding of pedagogy and inspired them to try some innovative activities in their future classes. They noticed that teachers in Canada did not restrict themselves to only one teaching method but rather adopt a variety of student-centered pedagogy such as hands-on activities, group discussions, projects, and presentations. However, even though participants believed Canadian pedagogy was appealing and admired some of the teaching practices they saw, they still believed that there were boundaries between Canadian education and Chinese education that could make it difficult to transfer Western pedagogy to Eastern contexts.

Teaching and learning environment. The study participants were impressed by the resource-rich learning environment in Canadian classrooms and wish to have it for their future Chinese classrooms. Participant L observed that there were a variety of experiment materials and tools in Canadian classrooms, and teachers could perform various demonstrations and arrange many kinds of experiments. In China, however, such experiments were usually done in a location (often called as lab building) shared by the entire school, which limits the amount of time each class could use it. The separation of the lecture hall and the experimental building created great challenges for teachers who wanted to connect experiment and theory in their teaching.

Participant X observed that Canadian teachers posted students’ works on classroom walls. She believed this was a great practice. First, she considered posting students’ works was a recognition to students’ achievements. Students could get a sense of success and become motivated for continuous effort in learning. Second, she thought such practice created additional learning resources for students. Students could learn from peers different approaches and perspectives to do the work. This practice highlights Canadian teacher’s belief in student differences and peer learning. Participant X continued to reflect that posting students’ works was not a common practice in China. The teacher-centered pedagogy determined the classroom as the exclusive domain for the teacher. Occasionally, a very limited number of students’ works may be demonstrated on the classroom wall because they were selected as the “best” works. These “exemplar” works were

selected solely by the teacher against the preset standards. Most students' works remained unseen to the rest of class.

Inquiry-based pedagogy. Participant L expressed that one pedagogical concept he acquired from the exchange experience was inquiry-based learning. He was impressed by how teachers establish a form of active-learning through posing questions and problem scenarios rather than simply presenting the scientific facts. Participant X also emphasized this concept during the interview and illustrated her willingness to apply this pedagogy. She also expressed her concern with the implementation of this approach in China. She pointed out that teachers and students in China focused on test taking. Hands-on activities and experiments were often seen as not necessary or time wasting. Such mindsets coupling with the issues mentioned above about the physical learning environment led Participant X to conclude that integrating this learning style would simply be not pragmatic in the Chinese learning context.

Special education. As mentioned earlier, participants reported that the special education course they audited was an eye-opening event for them. They learned that special education did not take place only for students with physical disabilities, but for all individuals with different learning difficulties. In Canadian school classrooms, participants observed how teachers help students who struggled with reading and writing and described the teachers as patient and responsible. The teachers often slowed the process to allow these students to process the information. Participant Y noted that this was her most impressive learning experience in Canada, and it challenged her conception of how students were categorized by teachers. She reflected that in China, the students with learning difficulty were often unfortunately labeled as "bad" students. Teachers tended to attribute the academic struggle or failure to students rather than to examine how their pedagogical approaches might fail to support students' learning needs. Participant Y noted that the concept of special education in Canada led to a critical change in her attitude toward students with learning difficulty. She promised in her future teaching to "pay more attention to the students who need special attention instead of judging them."

Successes of implementation

In their first year of school teaching, all participants believed that student-centered classrooms were ideal learning environments because they increase students' interest, promote their involvement in class activities, and encourage them to express their opinions. To achieve such engaging environment, participants applied some strategies such as science storytelling, news discussion, and hands-on activities that they learned from the RLP. They welcomed students' questions in class and never dismissed students' questions by stating that they would not be covered in exams.

When Participant Y implemented the inquiry-based teaching approach in her teaching, she found that it was more time-consuming than she had anticipated. Given the teaching-to-test environment in China, this created a challenge to her. To address this issue, Y asked students to do some inquiry-based projects at home and share outstanding works in class. This was proven to be an effective approach in the competitive atmosphere in Chinese schools. As most students liked to compete with each other and strike to outstand from other students, they were motivated to complete this work and perform well. In this way, Participant Y took advantage of the competitive atmosphere of Chinese schools to expand inquiry-based learning to outside classroom. Participant Y once observed that a Canadian teacher asked students to build a Plasticine model of chromosomes to help them develop conceptual understanding of chromosomes. She adapted this activity in her classroom. However, she had her students create a paper-cut model instead of using Plasticine, which was not available in her school.

Participant Y also saw the value of integrating presentations and group discussions into her teaching. She admitted that this attempt was proven to be challenging but offered a number of benefits. Group discussions provided Y with more evaluation tools than other teachers in China would typically have. Where most teachers had to wait until test scores came in to know about student learning, group discussions allowed Y to immediately determine what information students understood and what information they struggled with. This gave her critical data that outlined which parts of her lesson were less effective and what materials she needed to go over again. This also encouraged students to develop social and communication skills, which was a unique opportunity for her students who were usually compelled to remain silent and attentive in China's teacher-centered classrooms. When implementing the approach of students' presentations, Y faced another challenge. There simply was not enough time for each student to do their own presentation due to the large class size. To solve this dilemma, she opted to assign group presentations. This further encouraged the development of students' social and conversation skills while fostering peer-to-peer learning.

Participant L optimized the Chinese lecture-based pedagogy by integrating question-and-answer sessions into each lesson to encourage students to think critically about the content he taught. In China, students are concerned about how their peers perceive their intelligence. Consequently, most students are reluctant to speak or ask questions in class for fear of losing face if they get the answer wrong or ask a question that other students have already known the answer. To overcome this issue, L incentivized the question-and-answer session. Students who answered or asked questions received participation marks, which improved their grade and overall academic standing. He was successful in this effort as students did not want to lose marks for not participating and fall behind other students in the class.

It is interesting to notice that Participant X wrote that certain Western pedagogy was simply not applicable in Chinese classrooms in her reflective journal. However, she later reported that she had adopted the pedagogy in her classroom and had successfully modified it to accommodate her students' needs. Such a case indicates this participant's active thinking and rethinking of what they experienced in the program. From her initial rejection of Western pedagogy to later adaptation of it to her classroom demonstrates a clear case of cross-culture learning.

Challenges with implementation

Although education reform has been called for quite a while, the participants still expressed their frustration and dissatisfaction with the current test-oriented paradigm that pushed them to prepare students for tests. Even though they were passionate about promoting changes in education, they often felt helpless and lacked a clear pedagogical direction due to the conflicts and incompatibility between Chinese and Western pedagogy. They identified three major barriers to their efforts in applying what they learned from the RLP: students, colleagues, and parents.

Students. When the participants tried to shift from teacher-centered to student-centered approaches, they found that the shift was difficult to implement as students were resistant to the change. Because their students in China were socialized to accept teacher-centered pedagogy and subordinate their cognitive process to their instructor's authority, they were not equipped with the tools required to think independently. Thus, even though the participants encouraged students and gave them opportunity to express their opinion during the class, students remained reluctant to do it. The traditionally silent students did not actively respond to teacher's questions, which made it difficult to continue with the student-centered pedagogy.

Colleagues. In China, new teachers often need to get approval of their instructional plans from the academic directors or the designated experienced teachers. Study participants had difficulties convincing their elder colleagues of new pedagogical approaches they proposed. For Participant X, the cross-culture experiences significantly influenced her attitude toward education. She was inspired to make changes to Chinese education and was frustrated with the situation she faced. She lacked the ability to promote change and implement the pedagogical approaches she learned because she was young. Her views and inputs were often dismissed. This was consistent with Participant Y, who noted that both peers and administrative staff were equally resistant to multi-assessment approaches and student-centered pedagogy. Still, in the follow-up interview, Participant X expressed her commitment to applying what she learned from the RLP in the context where it was possible to do so.

Parents. With respect to Chinese parents, their primary concern was their children's ability to gain admittance to highly ranked schools. Because parents did not understand the value of different pedagogical approaches and the importance of critical thinking, their only measurement of their children's success was test scores. Parents considered test scores as the indicator of their children's ability to perform well on the standardized tests and a guarantor to secure admission to university eventually. This made them resistant to anything outside of China's traditional teacher-centered approaches and exam-oriented assessments. Any regression in student test grades could be seen by parents as a failure on the part of the teacher. Participants reported their fears about the pressure from parents and hesitated to move away from the commonly accepted pedagogy in China in many cases.

Discussion and implications

The current study was designed to explore three questions: How did the exchange experience influence participants' understanding of science education, what new pedagogical concepts did participants learn, and what successes and challenges did they experience in China when implementing what they learned? There was clear evidence that through the RLP, teacher candidates developed a deeper understanding of diversity and intercultural sensitivity and learned how to critically compare and reflect on teaching pedagogy from other cultures. The RLP positively shaped their attitudes toward education and significantly improved their ability to apply and incorporate new pedagogy and skills into their teaching approach in the Chinese classroom. In other words, participants' intercultural competence was significantly enhanced in all its three dimensions: attitude, behavior, and knowledge. The study also found that transformative learning was essential to reshape teacher candidates' perceptions and behavior and enhance their intercultural competence.

RLP as transformative learning

Mezirow (1991) outlines four main cyclical processes inherent in transformative learning: experience, critical reflection, reflective discourse, and action. We will discuss how these four aspects took place in the RLP.

Experience. Tennant (1993) notes that not all experience can facilitate transformative learning. To ascertain if a learning experience is transformative, it is important to identify whether the learning is simply adding knowledge or if it fundamentally challenges the learner's perspective. When using this measure to gauge the study participants' experiences, it is clear that they engaged in transformative learning. In China, they had constructed their own education perspectives based on the teacher-centered and exam-oriented pedagogy they grew up with. When they were placed in a

distinctive education system that implements student-centered pedagogy, they found the new experiences could not be simply added to their prestructured education perspectives but rather challenged it.

Critical reflection. Reflection is a cognitive process that requires questioning underlying beliefs and assumptions. It involves the assessment of the assumptions implicit in beliefs (Mazirow, 1991). Although all reflection implies an element of critique, critical reflection here refers to challenging the validity of presuppositions in prior learning. Individuals are critically aware of their own presuppositions and willing to challenge the established habitual patterns of expectation. In this study, the exposure to student-centered pedagogy allowed the participants to understand how Canadian teachers adjusted their instruction based on students' needs and how this approach could promote students' learning engagement. Such experience challenged participants' education perspectives and caused them to question whether teacher-centered education could fit for all students' needs as they had once experienced and assumed. Where they had once assumed that students' poor academic performance was due to their own laziness or low ability, they now realized that the pedagogical approach might be the fault for not addressing the unique learning needs of each student.

Reflective discourse. Reflective discourse is defined as a "dialogue devoted to searching common understanding and assessment of the justification of an interpretation or belief" (Mazirow, 1991, pp. 10–11). Learners weigh evidence for and against the argument and critically assess assumptions. Reflective discourse can occur in one-to-one relationship, in group, or in formal educational settings. After engaging in observational learning, the participants in the current study engaged in reflective discourse. When being placed in Canadian education context, study participants shared their educational perspectives with local teacher candidates, school teachers, and other participants. In these discourses, they offered their critical reflection with others. Such reflective discourse allowed other people's perspectives to shape the discourse and introduced elements that an individual may not have been able to conceive of while considering a new concept from their pre-conceived mindset. In this study, reflective discourse often led participants to the stage of brainstorming around the question about whether or not student-centered pedagogy fits the Chinese context and how they could implement it.

Action. Action is the final component of the transformative learning process. Learners may take "immediate action, delayed action or reasoned reaffirmation of an existing pattern of action" (Mezirow, 2000, p. 24). This is also an ongoing process that requires the learner to critically reflect on their new actions and engage in reflective discourses to determine the value of their new approach and consider possible improvements. In the follow-up interview, study participants

addressed the value of student-centered pedagogy and multiple assessment approaches and expressed how they customized what they learned from the Western student-centered pedagogy to fit into the Chinese context. In other words, their learning from the exchange transformed their action in teaching. The RLP was indeed a transformative learning experience for them.

Implications

Our study indicates that journal writing can be an effective tool that promotes continuous and ongoing critical self-reflection and engagement, which is essential to transformative learning. Reflective journal writing provides learners with a mechanism through which they can describe their experiences and begin to use reflective and critical thinking processes to extract deeper meaning from those experiences. This can help teacher candidates in cross-culture programs to critically self-reflect on what they learn and how they can apply it. Future international exchange programs should keep reflective journals as a compulsory component. In addition, transformative learning requires a long-term investment before one sees significant benefits. If international exchange program participants are not confident in new pedagogy, they should not reject it outright. The reflective discourse will help them to make a final decision, which may be different from their original one. To achieve the long-term effects, this study suggests teacher candidates keep writing reflective journals after completing their cross-cultural international exchange programs and, if possible, remain in contact with host school teachers for the purpose of continuing critical reflective discourses.

Inquiry-based teaching has been proposed for a quite long time in China, but it has not become a norm in the schools where participants taught due to the often cited issues including large class size, lack of class time, and exam pressure. Our study participants offered some ways to get around these challenges such as assigning inquiry-based homework and encouraging questions and discussion in class by changing assessment approach. Their determination for pedagogical change was inspired and fueled by what they experienced and learned from the RLP. This provides evidence that teaching reform requires the change of teachers' beliefs. Few hours of workshop will not make teachers change the way they teach. A profound process of learning, experiencing, and constant reflection is necessary for changes in teaching practice. International exchange program is one way to achieve this.

Conclusions

Our study provides evidence that RLP is a transformative learning experience. RLP offered great opportunities for Chinese teacher candidates to experience Western pedagogy and critically reflect on what they have developed before and on what they learned. Although study participants faced a number of challenges when applying inquiry-based teaching in Chinese classrooms, each of them created innovative modifications that allowed them to successfully incorporate it in their lessons. If

China intends to stay competitive in the global market of education, it is critical to implement a pedagogical model that promotes critical thinking. The transition to such a model will be a long process. China's postsecondary institutions should take advantage of the benefits offered by cross-culture international exchange programs. Deardorff (2009) argues, interculturally competent teachers need to develop not only knowledge of other perspectives but also deeper personal understanding of the appropriateness of the behavior and communication. Derwin (2016) points out that "the most important aspect of interculturality is that it can only happen through interactions with another person, which has an influence on how we think, behave, perform, present ourselves, and so on" (p. 72). Along with many scholars (Cushner & Mahon, 2009; Merryfield, 2000; Sleeter, 2007), we would argue that if we are concerned about intercultural education, intercultural experiential learning should be a component of every teacher education program.

This study collected data through interviews, reflective journals, and portfolios while participants were placed in the international exchange program. Data about their transformative action were collected only through interviews. Future research can observe participants' teaching practice and ask them to write reflective journals for more comprehensive analysis about their behavioral change.

Contributorship

This paper was developed based on an international exchange program in science teacher education supervised by George Zhou and Yuanrong Li. George Zhou was responsible for theorizing and structuring the paper and responding to the reviewers' comments. Peiyu Wang participated in drafting the paper. Tian Liu, Junyi Zhang, Chenyin Fu, and Shue Wu were graduate assistants who participated in data collection and analysis.

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