Chapter

Cross-Cultural Experiences of Canadian Science Educators Visiting the Sister Schools in Chongqing, China: A Cross-Cultural Experience

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Abstract

The benefit of cross-cultural learning is two-fold: first is recognizing the practices and foundations that build education in another country. The second is reflecting on the educational practices within one's home country. Cross-cultural learning also allows one to put the practice of education into perspective by having another side to which they can compare their experiences. This research is a narrative inquiry case study of the Canadian perspective and experience of two in-service science teachers who visited sister schools in China. This case study explores Canadian teachers' perceptions of teaching science, what inquiry-based teaching looks like, what equipment aids in the process, and what experiences and teaching methodologies can be shared between Canadian schools and the Sister Schools in Chongqing, China. This research was funded by the Social Sciences and Humanities Research Council (SSHRC) Partnership Grant.

Keywords: reciprocal learning, science education, Canadian teachers, Chinese teachers, inquiry-based teaching

1. Introduction

The benefits of cross-cultural learning are two-fold: first is recognizing the practices and foundations that build education in another country. The second is reflecting on and analyzing the educational practices within one's home country. Cross-cultural learning also allows one to put the practice of education into perspective by comparing methods. "When researchers from two countries collaborate on research involving teaching and learning in two countries [such], research not only provides a researcher with an understanding of science education in another country but also sharpens insights into science education in his or her own country" [1]. In addition, using cross-cultural experiences as comparisons for pedagogical research can help in-service teachers evaluate their teaching styles and philosophies. This reflective practice works to strengthen the practice and effectiveness of educators

in the classroom. Viewing education as a social construct that is not bound by geographical limitations provides educators who may have never had the chance to learn about classroom practices in other countries an opportunity to do so.

This research is a narrative, inquiry, case study of the experience and Canadian perspective of two in-service science teachers who visited sister schools in China. The case study explores Canadian teachers' perceptions of teaching science, what inquiry-based teaching looks like, what equipment aids in the process, and what experiences and teaching methodologies can be shared between Canadian schools and the Sister Schools in Chongqing, China. When looking at China and Canada, there are foundational, curricular, and cultural differences that affect how teachers convey information and how students are expected to learn. This study highlights connections between Canadian and Chinese teachers and teaching practices to identify similarities and differences within the two countries' educational systems and the best practices that can be adopted from Chinese teaching into a traditional, mainstream Canadian classroom and vice versa.

Reciprocal learning is a process that can improve the practices in two areas or countries by introducing one participant's best practices to the other and vice versa [2]. Reciprocal learning is beneficial to both parties, as each side is able to take strengths from outside programs, in order to make connections to their own. For example, due to the Reciprocal Learning Partnership between the University of Windsor, in Canada, and Southwest University, in China, teachers are provided with opportunities to share experiences and learn from one another. This partnership aims to share knowledge, appreciate cultural and educational differences, and learn from one another. By opening the lines of communication and inviting teachers with varying experiences and perspectives into one another's classrooms, educators in both countries can draw upon each other to improve their practice. Specifically, reciprocal learning in science classrooms is important as it provides educators with opportunities to draw upon the experiences of teachers from varying backgrounds, in educational systems with potentially different values [3].

In the context of this research, reciprocal learning can and has occurred between Canadian and Chinese classrooms concerning instruction, planning, and student learning, leading to the improvement of student engagement, lesson delivery, and learning. As a result of a Social Sciences and Humanities Research Council (SSHRC) Partnership Grant, two Canadian science teachers visited Chinese science classrooms to explore and investigate standard Chinese educational practices and compare and analyze findings based on similarities and differences that can be used to strengthen science education in Canada and China. Using cross-cultural experiences as comparisons for pedagogical research can help in-service teachers to evaluate their teaching philosophies.

2. Definition of terms and relevant literature

2.1 Definition of terms

Reciprocal learning is learning that occurs between two parties who learn from one another. In this process, each party is able and encouraged to learn from the other by adopting new ideas that may improve or strengthen their current methods while also sharing core aspects of their practices that may be adopted by the other party to improve their programs.

Canadian teachers are defined as those trained in Canada and predominantly have experience in the Canadian school system. Canadian classrooms are classrooms in Canada governed by the educational laws and mandates of Canada's provincial and federal governments. Similarly, *Chinese teachers* have been trained in China and mainly have experience in Chinese schools and classrooms. Chinese classrooms are those found in China and are governed by the Chinese government's laws and mandates.

*Inquiry-based teac*hing involves teaching lessons that allow students to explore multiple scenarios and make predictions and connections based on their previous learning. Teachers can provide inquiry-based lessons to guide and scaffold student learning, rather than directly telling students the information. While inquiry-based lessons can be carried out across various subject matters, the teachers in this study focused explicitly on its uses and applications in science classrooms.

2.2 Literature review

Canadian and Chinese schools have different teaching models, but something can be learned from each of these models. Cross-cultural learning allows one to put the practice of education into perspective by comparison. As Aldridge and Fraser [1] reported, "when researchers from two countries collaborate on research involving teaching and learning in two countries, such research not only provides a researcher with an understanding of science education in another country but also sharpens insights into science education in his or her own country (p. 102)." This literature review will explore several differences and preferences, including teaching styles, the dynamics of Chinese and Canadian classrooms, and the use of inquiry-based teaching practices in science classrooms.

2.2.1 Science education in Canada and China

Science education in Canada places a large emphasis on problem-solving skills and using technology effectively to understand and decode problems [4, 5]. Specifically, the Ontario curriculum recognizes that while not all students will become scientists, the principles of scientific literacy and understanding media are core skills that are transferrable to numerous professions [4, 5]. In recent years, Canadian science education has also made attempts to decolonialize its science curriculum, by including opportunities to learn and acknowledge the teachings and knowings of Indigenous Peoples in ways that become meaningful to a greater population of students [6].

Science education in China aims to develop competent citizens that have a high level of scientific literacy [7]. As of 2011, the Ministry of Education in Ontario [7] outlined four key methods that would be employed to reach these goals:

1. Extending Science Learning Time;

2. Integrating Engineering and Technological Content into Science;

3. Phase Based Learning Progressions; and

4. Using Big Concepts [7].

There are some key similarities in the underlying values and goals for science education in both Canada and China. The remainder of this literature review will seek to

explore the nuances, similarities, and differences in the approaches and methodologies employed to reach these educational goals.

2.2.2 Teaching styles and classroom design

Research found that many Chinese science educators view exam performance as one of the most important factors in determining good teaching [8]. In addition, they tend to equate good classroom teaching with fostering good conduct and learning attitudes, compared to Western teachers who aim to promote an interest in learning.

It was reported by Chen [9] that science education in China tends to be teacher-centred, focused on theory and exams, and supplemented by homework problems. This information closely aligns with many of the teacher participants' interview responses and contrasts with many of Canada's current educational views. Many Canadian classroom teachers are moving toward teaching models that are more learner-centred and focus on learning more holistically, offering several options for learning and understanding topics. Inquiry-based teaching is one such method of curriculum delivery. Chen [9] also reports on the importance Chinese educators place on developing engaged students who become lifelong learners. The research also notes a shift in some Chinese middle school teaching practices to student-centred classes and lessons that align with values present in Canadian classrooms.

2.2.3 Inquiry-based teaching

Inquiry-based teaching is a practice that has become more common in classrooms over the past 20 years [10]. However, Orpwood and Souque [11], on behalf of the Science Council of Canada, were producing work involving deliberate inquiry wherein deliberations of policymakers and inquiry of researchers were being consulted to create a science curriculum that reflected the learning needs of the students, as early as 1985. In the inquiry-based teaching model, the teacher is no longer the source of the knowledge but rather a facilitator and guide of the student learner's discovery [10], which aligns with constructive learning theory that encourages students to think critically and creatively.

As of 2011, the Ministry of Education in Ontario identified four key teaching elements using an inquiry-based approach:

1. Student engagement and focus;

2. Student communication, explanations, and reflections to share learning;

3. Student exploration and investigation; and

4. Student analysis and extension of thinking, further supporting this student learning model [12].

2.2.4 Professional development and collaboration in teaching

Professional development is a vital tool in the growth and learning journey of teachers and their teaching practices. As teachers become more experienced, they tend to participate in more professional development seminars but place a lower-level value on collaboration [13], despite the known benefits of collaboration among

educators. Collaboration is more highly regarded by teachers and educational staff members who voluntarily choose to do so, as their belief systems value working together and sharing viewpoints [14]. Rigler [15] states there are many benefits to international professional development and collaboration. In being awarded opportunities to become fully immersed in Chinese classrooms, there were chances for meaningful collaboration, further understanding of the teaching practices in other countries, discussions, lesson development, and creating global learning opportunities for students. Additional research also finds collaboration, specifically in a Reciprocal Learning Program, leads to positive effects for students and teachers, including deeper respect for culture, understanding global citizenship, and a greater appreciation for varying teaching practices [16].

Reciprocal learning across international boundaries has been shown to benefit teachers in both countries. In addition to professional development seminars and opportunities, professional learning communities where educators can engage with and reflect on the differences in educational systems allow for the strengthening of teacher performance and personal practical knowledge [17].

3. Purpose and methods

3.1 Purpose

This research aims to highlight the connections between Canadian and Chinese teaching practices to identify similarities and differences within the educational systems of Canada and China. Such research will identify best practices in Chinese classrooms and teaching adopted within traditional, mainstream, Canadian science classrooms.

3.2 Methods

The following subsections outline the participants and procedures engaged in order to obtain the data that was analyzed for key and emerging themes.

3.2.1 Participants

In this narrative inquiry case study, the participants were two in-service science teachers from a local Windsor school board. Purposeful sampling was used to select these two individuals from all qualified individuals interested in participating in the Reciprocal Learning Project. These teachers visited science classrooms within the Sister Schools in Chongqing, China and observed science teachers and practices within science classrooms. For purposes of confidentiality the following pseudonyms were given to the teachers: Teacher A and Teacher B. Teacher A is a male science teacher who has been a Canadian classroom teacher for 15 years. Teacher B is a female science teacher who been a Canadian classroom teacher for 3 years.

3.2.2 Procedure

Two in-service teachers were allowed to observe science teachers and classrooms in Chongqing, China. These teachers were provided with opportunities to attend Chinese classes, meet students, and speak with Chinese educators to learn more about their

classroom and education style in China. Once the teachers returned to Canada, they were individually interviewed and asked questions related to their definitions of student engagement, if and how inquiry-based teaching practices in China compared to those in Canada, and what types of learning equipment were available in classrooms.

4. Results and discussion

Qualitative data was obtained from participating teachers who were individually interviewed upon returning from their visits to secondary science classrooms in Chongqing, China. The interviews were transcribed and sent to participants to member check, amend, and approve their final responses before analysis. The interview data were coded and analyzed for general, common themes. Four main themes emerged: inquiry-based lessons and teaching opportunities in Canada and China, types of available equipment for lab experiments, benefits to Canadian science classrooms based on Chinese practices, and benefits to Chinese science classrooms based on Canadian practices. Each of the four themes are discussed in greater detail within this section.

4.1 Inquiry-based lessons and teaching opportunities

Both of the interviewed teachers perceived greater opportunities for inquiry-based lessons and teaching within Canadian classrooms. However, previous research within the Reciprocal Learning Project suggests no significant difference in inquiry-based teaching applications in the two countries [18]. In this current study, teachers attributed these perceptions to the smaller class sizes within Canadian classrooms and the increased availability of classroom spaces and lab equipment to students and teachers. One significant note was the effectiveness of the inquiry-based teaching practices that were being implemented in Canadian classrooms. Teacher A noted that even though many teachers are using or attempting to use inquiry-based teaching practices within their classrooms, the overall success of these endeavors has not been measured. It is unclear with current measures and assessments if inquiry-based practices are useful to students and how inquiry-based lessons are standardized among different classrooms.

Additionally, there are teachers in Canadian schools who do not utilize inquiry-based teaching methods. Teacher B noted, she witnessed mainly Chemistry classes which consisted of

> *"The teachers just providing lectures to the students...and the teachers would ask students questions on the board or have the students finish equations for them. The teacher would experiment [at the front of the class], and then the students will all be sitting at their desks watching. I was told that the students will have a lab maybe a couple of times a year but very infrequently, and they would have to go to a different classroom to perform the lab."*

The frequency of laboratory experiences for students brings up interesting questions about the lab equipment and space available to students in Chinese classrooms.

4.2 Types of available lab equipment

When asked about laboratory equipment availability, both teachers felt they had access to the necessary equipment to run safe and effective lab experiments in their

Canadian classrooms. They also noted that it was relatively easy to borrow, share, or purchase the necessary equipment if the equipment was not available within their respective schools. In the Canadian teachers' experiences, there was also adequate space within classrooms, in the form of wet labs and dry labs, for students to conduct laboratory experiments. The Canadian perception is that increased lab space gives students and teachers more opportunity to engage in inquiry-based learning practices.

In addition to physical space, Teacher B noted Canadian classrooms had complete sets of glassware and access to enough reactant chemicals that classroom demonstrations were easier to present. The classroom setup itself was also conducive to demonstrations and hands-on laboratory experiences due to the number of students in the class and the physical space, including a lab bench for the teacher and various lab stations around the classroom for the students. Canadian teachers reported that they witnessed some classroom demonstrations while in China and heard that Chinese students also had opportunities to conduct laboratory experiments during their courses, just more infrequently than Canadian students, with the significant limitations being time, space, and availability of large volumes of material.

4.3 Benefits to Canadian science classrooms based on Chinese practices

One of the Canadian teachers' views of best practices is consistency in planning and lesson delivery within Chinese schools and classrooms. Teacher A, who visited the Sister School, noted,

> *"Every lesson is coordinated like a massive, massive synchronized swimming meet. They [the Chinese teachers] all teach at the same time, so they all work on the lessons together."*

All of the Chinese teachers who were teaching the same course worked together to create course content and create lectures and activities common for all students, regardless of the teacher. This level of consistency could help Canadian students within multiple sections of a course, as the curriculum is the same, and students should be learning the same content across sections. Teacher A also noted,

> *"Their [the Chinese teachers] teaching is like an art form in the sense that there are very, very prepared and they are going from a script, and they work together and they collaborate, and it's amazing."*

Given the opportunity, co-planning can also help teachers, especially those who are either new to the practice, new to teaching the course, or more experienced educators looking for new ways to disseminate information and impact student learning. Many teachers within Canadian school systems partake in co-planning opportunities, but it is not mandated in the same ways as Chinese schools.

Finally, Teacher A noted that since the lesson plan developed for each Chinese science class is so detailed, pinpointed, and well-planned, there is more time for teachers to monitor and assess the students while in the classroom, rather than frantically trying to fit in the course material, leading to more opportunities to collect pieces of data that can be used to triangulate assessment practices. A significant difference that could impact lesson delivery is that Chinese students are in school for an extended time each day compared to Canadian students. From a time standpoint alone, there is more time to assess and monitor students, specifically while in the classroom.

4.4 Benefits to Chinese science classrooms based on Canadian practices

One of the main best practices reported by Canadian teachers that can be shared in Chinese classrooms is implementing a greater focus on student collaboration and providing opportunities for students to work together, share ideas, and learn from one another. It was noted that while Chinese students spend a great deal of time problem-solving and developing the skills and knowledge outlined in the curriculum and necessary for future academic success, they do much of this work independently. Chinese students could benefit from more opportunities to collaborate with others and learn about different thought processes and strategies. Teacher A felt

> *"The biggest thing missing in Chinese education classrooms, science classrooms, but all classrooms probably, is the level of feedback they receive during the learning process. I don't think the feedback is enough…and the response that I got from the Chinese teachers is… there's just too many people. That this is what we have to do."*

Teacher A stated it seemed like Chinese science classrooms were filled with a sense of urgency to learn as much as possible, as fast as possible, as independently as possible. One of the standout features of the Chinese classroom that differed from Canadian classrooms was the idea of self-study, which encompassed three or four hours of studying at the school each night. In addition, the Canadian teacher's understanding was that students were not allowed to talk, whereas Canadian classrooms tend to encourage dialog and collaboration among classmates.

5. Final considerations

5.1 Conclusion

In conclusion, Canadian and Chinese science classrooms can gain valuable insight into best practices from one another. Both Canadian and Chinese science classrooms can take steps to focus on inquiry-based lessons and teaching and an increased level of consistency in the delivery of such practices. Since lab equipment is available to students and teachers in both countries, it would benefit students and their learning to provide more lab experiment opportunities. Collaboration between Canadian and Chinese teachers concerning types of experiments would also be beneficial. One main takeaway Canadian science classroom teachers can learn about planning and the shared teaching processes used by teachers in Chinese science classrooms. Conversely, Chinese science classroom teachers can learn from students' collaboration activities and opportunities within Canadian science classrooms.

5.2 Implications

The teachers' interviews and experiences within this study prove that Canadian and Chinese educators can share their experiences and perspectives to give the students a more well-rounded learning experience in secondary science classrooms. Canadian teachers shared that a greater focus can and should be placed on the consistent collaboration of teachers who teach the same courses to provide consistent lessons and course content no matter what teacher is presenting the material, as educators do in Chinese schools and classrooms. They also shared that Chinese

science teachers may want to encourage greater collaboration among students to increase their ability to work together and solve problems as a group. This practice may lead to improved understanding by considering other individuals' viewpoints and processes in their class. This research speaks to the significance of educators from different countries, cultures, backgrounds, and learning experiences sharing to create better learning opportunities for students in their respective classrooms, schools, and countries.

5.3 Limitations and future work

One of the major limitations of this study was the sample size of the participants. Only two Canadian teachers visited the sister schools in China and provided an analysis of their experiences. They were not in China for an entire semester, but rather a shorter time, so they could only view a snapshot of science education in China rather than the overall program experienced by the students. Furthermore, Canadian teachers have an understanding and comfort within their school system that they likely do not have within the Chinese school system. As such, in both Canada and China, the classroom experiences were viewed through a Canadian teacher who went through a Canadian school system and continues to teach within that system.

Reciprocal viewpoints were not directly obtained in this study. Still, through other portions of the Reciprocal Learning Project, the views and experiences of Chinese science educators have been received and shared. Given the opportunity, Chinese educators have shared they enjoyed having opportunities to engage students in real-world learning outside of the classroom [19]. Continued comparative research is a promising avenue for future research.

Further work in this area could implement changes within Canadian and Chinese classrooms based on reciprocal learning visits and suggestions from teachers in different contexts. Results will be presented at conferences and in peer-reviewed journals to increase the number of inquiry-based teaching and learning opportunities for students and teachers within Canadian and Chinese contexts.

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Conflict of interest

The authors declare no conflict of interest.

Notes and thanks

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