The Introduction of Global Collaboration to Pre-Service Teachers: Training Future Global Change-Agents

Aaron J. Sams
Lee Kenneth Jones
Walter Smith

Abstract
By participating in global projects, students learn to communicate, asynchronously or synchronously, through digital tools and media. The project in this article paired pre-service teachers in the United States with primary students, ages 8 to 10, in South Korea. The intent was to expose pre-service teachers to global collaboration projects, and to give them experience with the challenges that come with global collaboration so they can later support their own students in such endeavors. The project was evaluated through an open-ended survey for pre-service teachers (N=19) and results were coded according to the constructs of TPACK (technology, pedagogy, and content knowledge). Results showed that the most impactful aspects of the project were in the pedagogy and technology constructs. Surveys showed mostly positive (n=9) and mixed experiences (n=8) for pre-service teachers. Negative experiences were largely related to challenges with asynchronous collaboration. Future recommendations include developing companion lessons to precede this project, training teachers and students in techniques, expectations, and norms during non-face-to-face collaboration.

About the Authors: *Aaron J. Sams is an Assistant Professor in the Education Department at Saint Vincent College. Lee Kenneth Jones is a STEM Teacher at St Johnsbury Academy in South Korea. Walter Smith is a Retired Professor of Education from Texas Tech University.*

Introduction

Bringing about change in an established institution is extremely difficult. Much has been written about how to best effect change in organizations, and these prescriptions take on various forms. Some rely on a top-down leader-driven approach to bringing about change through a transactional model (Weber, 1947), and others take more of a grass-roots approach bringing change from the bottom up through a transformational model (Bass & Riggio, 2006). Some works focus on relationships within the organization, and others attempt to bring change from outside the group. Although books containing all these leadership styles provide a variety of examples and approaches to change, few seem to try to anticipate and address the need for change before the need arises.

Schools are no exception when it comes to change management, but how to evoke lasting and effective change in schools remains an issue. Any of the aforementioned approaches are reasonable, and most are probably effective to some extent. In fact, the transactional model (Weber, 1947) has been a successful model of change in past generations but has recently been questioned as to whether it remains effective in the development of future leaders (Sarros & Santora, 2001). But what if change agents could be planted in an institution before the need for change actually arises? To truly bring about lasting change in an organization the "next generation of leaders must be trained" (Spiro, 2011, p. 129) and "empowered" (Couros, 2015, p. 99). This study accepts this challenge to bring up the next generation out of a single organization and into a broad community by training and empowering undergraduate pre-service teachers. The tactic described herein approximates values-based leadership put forth by Kraemer (2011). By training pre-service teachers who will ultimately become classroom instructors, the goal is that they will become the agents of change necessary to address needs of the future, and recent studies have confirmed that teachers do function as change agents (van der Heijden et al., 2018) specifically with regard to collaboration (Bush & Grotjohann, 2020) and designing learning experiences at a distance (Lee & Kim, 2021). The hope is that pre-service teachers can be primed and ready to positively alter the culture of their future institution, the school.

Another change that has taken place over the last two decades is both the emergence and integration of technology into both society and the classroom. The sudden influx of such tools has developed a need for training teachers, both pre- and in-service, on how to use those tools to enhance both classroom content and pedagogy. This demand and need for cohesive integration of technology, pedagogy, and content knowledge is now known and referred to as TPACK (Koehler & Mishra, 2009).

Anticipating the need for global collaboration in the rising generation and seeing the opportunity to build and develop TPACK skills through a practical application, this study attempted to train pre-service teachers to become adept at teaching and learning through global collaboration. Once the pre-service teachers become teachers in their own classrooms, they will have the experience and skills necessary to model for their students and their colleagues what effective global collaboration looks like. These exemplars can then serve as the trigger to bring about the institutionalization of global collaboration, not just in one organization, but in any of the organizations where the pre-service teachers find themselves in the future.

Conceptual Framework

The project to be described below was not designed to address specific learning targets or standards (although they were addressed and met in each location). Rather, the authors developed the project and recruited participants with the idea of creating an experience for pre-service teachers, in-service teachers, and students that would provide them with increased capacity in the growing world of digital, asynchronous collaboration and communication. The fact that it simultaneously addressed classroom standards and needs, while not the focus of the project, was also intentional as it gave teachers (both pre- and in-service) an opportunity to overlay what they are already doing in their classrooms with modern, 21st century skill development. For the project development, three research-based frameworks were used: the need for developing TPACK (Mishra & Koehler, 2006), the importance of promoting change in education through the training of pre-service teachers (Erdogan & Ciftci, 2017), and the modern idea of global collaboration in the classroom (Nugent et al., 2015).

Technological Pedagogical Content Knowledge

In recent history there has been a sharp shift in how teachers approach their classrooms, and this has initiated calls for rethinking the way new teachers are trained. In the early years of education, much of the focus was placed on teacher content knowledge; the more facts a teacher knew, the better they would perform in their career (Shulman, 1986). However, in more recent decades, the focus moved to pedagogical knowledge with the idea that classroom practices in general were more important than content knowledge (Ball & McDiarmid, 1990). However, concentrating exclusively on either content or pedagogy was unsuccessful, as focusing on only one weakened the other, thus diminishing classroom teaching. Shulman (1986) proposed the idea of strengthening both content knowledge and pedagogical knowledge and acknowledging their codependence on one another and training teachers to use one concept to support the other; and thus, was born the idea of pedagogical content knowledge (PCK). Fast forward two decades to find the addition of many new technologies to both society in general and the classroom in particular; and suddenly technology assumed a significant place in the development of a better classroom. At this time, the idea of TPCK (later TPACK) was introduced; a combination of Shulman's (1986) PCK and teaching technology (Koehler & Mishra, 2009). Mishra and Koehler (2006) stressed the idea that the best classroom practice is not simply using technology in the classroom; rather, best practice integrates technology in a way that expands both content and pedagogy. For example, lecturing in front of a PowerPoint presentation is pedagogically no different than standing and lecturing in front of a chalkboard; but having student teams from two countries collaboratively solve an engineering challenge applies technology's power to go beyond content learning to improve students' so-called soft skills like communication (between cultures) and creativity. This improved classroom use of technology is similar to how modern doctors, police officers, and auto mechanics use technology to *improve* their performance, not simply to make their job easier (Ertmer & Ottenbreit-Leftwich, 2010).

Importance of Change through Pre-service Teacher Education

Although change can be brought about in many ways, one means by which an entire community can be impacted is through the educational system. Governments have recognized this fact and use this opportunity as various policy initiatives are enacted through the schools (Marsh & Wohlstetter, 2013; Schneider & Ingram, 1993; Stone, 1989). Although policy is often enacted through schools, the long-term impact of policies effected through pre-service teacher training is only studied occasionally. One such study found that pre-service teacher training is an effective way to impact the skills and mindsets of a future workforce (Erdogan & Ciftci, 2017), hereby demonstrating the impact of change through pre-service teacher training programs. Another study examined how field immersion during the pre-service years can impact the future teacher's cultural awareness (Wiggins, et al., 2007) showing how predominantly suburban white females may be able to reach students more effectively in urban settings. In addition to effecting change in the community, others suggest that projects conducted during a pre-service teacher program and collected in an e-portfolio can easily transition into a professional portfolio once employed (Boulton, 2014), seamlessly carrying over the work done as a pre-service teacher into the in-service professional environment.

Figure 1: *Three step process for preservice teachers to become change agents helping other teachers engage their students in global education.*

While none of these examples directly relates to the project conducted in this study, they all demonstrate the potential impact that robust pre-service teacher training can have on individuals, schools, and communities. They do so by creating "relatively non-threatening conditions" (Fullan, 2011, p. 53) in which the students can freely learn to become global collaborators before embarking on their own global collaboration projects. The goal of this project is studying the first step shown in Figure 1, which is the development of teachers ready to use global collaboration in their classrooms when they become in-service teachers. The long-term goal, though not within the scope of this initial project, is to develop teachers who will later become agents of change in their respective districts and communities by expanding the reach of global collaboration beyond their own classroom walls. This structure is what Fullan calls a "peer culture to achieve deep change" (Fullan, 2011, p. 53) in which improvement is brought about through the development of a collaborative culture, in the case of this study, within a classroom. Fullan goes on to state that motivating change is "practice based, not theory based" (Fullan, 2011, p. 82) implying that for an individual to know how to bring about change they must first experience it in practice.

Global Collaboration

In a time in which all social, economic, political, and environmental

concerns are becoming increasingly global, the idea of embedding global collaboration in the mindset of educators continues to become more and more relevant. One model of global collaboration is presented as a continuum through which various levels of interaction and collaboration between global partners in Nugent et al. (2015). The collaborative project presented in this paper falls under Limited Communication as defined in this continuum as "some form of direct communication that can be asynchronous, such as via e-mail or a letter; or synchronous, such as a Skype session (interactive audio or video), and typically involves students from a variety of locations reporting their authentic science data, coupled with a communication exchange of some sort" (Nugent et al., 2015, p. 36).

The structure of the project is based on the collaborative process in Lindsay and Davis (2012). This process was implicitly facilitated with the pre-service teachers; however, this project was intended to expose the pre-service teachers to the experience of global collaboration with the intent of collecting their reflections on the process. Consequently, the details of the process were not revealed to the pre-service teachers beforehand. Additionally, the project they worked on was somewhat competitive in nature in that a viable product that could complete a task was the desired end. This approach was adopted to emulate an approach called collaborative competition by Fullan (2011), which is believed to be an essential component of success.

Methodology

This project was developed to provide teachers with what we see as a practical and effective use of TPACK. Along with addressing TPACK skills, the project was developed to seamlessly integrate with current content in the target classrooms. To achieve the goal of efficacy in TPACK discussed previously, the authors did not want to overburden the in-service teachers with something new with which they were uncomfortable. Rather, the overarching goal was to deliver the message that this is just a new way of doing what you are already doing. However, as was pointed out by other authors (Cuban et al., 2001; Ertmer & Ottenbreit-Leftwich, 2010; Lawless & Pelligrino, 2007), the technology component needed to be used to support the PCK.

The authors of this paper are a pre-service teacher educator in Pennsylvania, United States, a STEM instructor at an international school in Seoul, South Korea, and a university professor in Texas. Using the conceptual framework described above, the first two authors collaborated to develop a project that would simultaneously give global collaboration experience to a cohort of pre-service elementary teachers in the United States, two in-service elementary teachers in Seoul, and grade three (nine and ten years old) and grade four (10 - 11 years old) students also in Seoul. This group allowed us to provide proper TPACK training for both pre- and in-service teachers, while simultaneously giving modern global collaboration experiences to a group of elementary students. The following sections describe the designed collaboration.

Settings

This project took place at two separate locations on opposite ends of the globe. One group (the pre-service teachers) were in Pennsylvania, United States, and the other group (the in-service teachers and their students) were in Seoul, South Korea.

South Korea

In South Korea, two experienced elementary school teachers were recruited to

participate in this project along with their students. The two classrooms were a third-grade class with nine students in total, five girls and four boys, and a fourth-grade class with eight students, four boys and four girls. Although their participation was important, none of the in-service teachers or elementary students were part of the actual research and analysis. The school is a private, K-12 international school in a relatively less populated area of Seoul. The students, however, are not just from the nearby neighborhood, but come from all around Seoul, some traveling more than an hour to attend school. The goal of many students enrolled at this school is to attend University in the United States, and so the exposure to Western-style curriculum and to practice with English language is important.

United States

The Pennsylvania participants consisted of 19 undergraduate pre-service teachers at a small private, Catholic, liberal arts college. All the participating pre-service teachers were pursuing a Bachelor of Science degree in Early Childhood Education along with teacher certification in the Commonwealth of Pennsylvania. All the pre-service teachers were white females between the ages of 20 and 26. The undergraduate students participated in the project as part of their elementary science methods course which is required for their major and which is taken in one of their last two years of their academic program. This course was taught off campus at a STEM center housed in a local educational service unit.

Project description

For this project the students in the third and fourth grade classes began working with the preservice teachers in the United States to design, build, and test rubber band launchers that would shoot ping-pong balls into containers at a predetermined distance. The elementary students were in groups of three to four students working with two to three preservice teachers. Each grouping of students/pre-service teachers was referred to as a *team*. Since the project was completed by the end of November, the theme of an international toy company designing a launcher to sell at Christmas was used. The teams were engineers from Korea and the United States, each building a launcher that could be made and sold in both locations. Proper safety training and rules for working with projectiles were provided and followed at each location. This project was modeled after a similar one done by Davey, et al. (2009) in which preservice teachers from the United States worked with elementary students in Australia to design and build edible lunar vehicles.

The parameters of the project were intentionally kept simple and open-ended so as to give teams the opportunity to design their own unique launchers. The first requirement was that each team build identical launchers in both the United States and Korea. This required teams to discuss and then select only materials that were readily available in both locations and kept with the theme of an international toy company that is looking to build and sell the same device in two locations. The remaining two requirements were that teams had to use size #32 rubber bands (maximum of 20 per device) and needed to be able to launch into a bucket on ground level 3.0 meters away.

After teams had been formed, the preservice teachers created a kick-off video that introduced the project to the students in Korea, highlighting the goals, the rules, and the target outcome. Next a single shared Google Doc was created for each team (and shared with the classroom teachers and authors) and each group began with an exchange of biographies of each team member and their sharing initial ideas. Then

over the course of about three weeks the teams communicated via a combination of their Google Doc and Google Hangouts (video chatting) to share ideas, progress, problems, and solutions. The school in Korea used G-Suite for education and all teachers and students had Google accounts. The college where the pre-service teachers were enrolled used Office365, so each of them used a pre-existing Google account or created a new one so they could more easily communicate with the students in Korea. Although it is not always possible with global collaboration projects like this, despite the 13-hour time difference since the course in the United States was an evening class, video conferencing was also an option since the morning session of the elementary school aligned with the evening class in the United States. At the end of the project, each team had two identical launchers, one in the US and one in Korea. To conclude the project, the entire group (pre-service and in-service teachers and all students, as well as the authors) met via video conference to simultaneously show off and test their launchers.

Results

Upon completion of the project the pre-service teachers were administered a survey containing 20 open-ended questions in which they were asked to reflect upon their experience and respond to the open-ended questions. The open-ended questions were then coded, and emergent themes were created. After the initial themes were categorized, each theme was coded based on TPACK categories: technology (TK), pedagogy (PK), and content (CK); along with all combinations thereof: TPK, TCK, and PCK. Codes that did not fall into any of the TPACK categories were noted as X. The TPACK codes were then counted based on responses coded per category. Once coded, the results were assessed to determine which themes were most common in the responses. All pre-service teachers (N = 19) responded to the survey. See Table 1 for total counts in each category. A Chi-square analysis of adjacent knowledge categories shows each category is significantly different than each adjacent category ($p < 0.005$)

Table 1: *Categories of pre-service teachers' TPACK responses*

Knowledge Categories	N
Pedagogical	252
Technology	114
Technology/Pedagogical	85
Content	61
Pedagogical/Content	17
Technology/Content	0

27 comments were counted as not addressing TPACK.

Successes with Collaboration and Construction

After the survey comments were coded and analyzed, the results indicated the students reported the most successful experiences as being the collaboration process and construction of the actual ping-pong ball launchers. The undergraduate students in Pennsylvania seemed to enjoy working with the primary students in Korea. Positive comments are listed in Table 2.

Table 2: **Positive comments about the collaborative experience**

"Working with and successfully completing a project with such wonderful children from across the globe!"
"The students in Korea brought me the most joy during this project. Each time they communicated with us they were so happy to be working on something that "older kids" were working on as well. It made me proud to know that young students can do something and struggle, the same way that college students can do something and struggle."
"The ability to work with students in another part of the world on a project because I never thought that would be possible."

Struggles with Collaboration and Communication

Review of the results demonstrated two main ways in which the pre-service teachers struggled with this project: collaboration and communication. Interestingly, collaboration was also one of the elements that was highest in the success category. Comments regarding these challenges are found in Table 3.

Table 3: **Comments about challenges faced in the collaborative experience**

"The lack of constant communication. Also, the difficulty of negotiating with the students on certain parts of the design and materials."
"I was most frustrated with the students not being willing to change their mind on how to create the ping-pong ball launcher. They assumed that we were going to make those changes and they did not seem eager to change theirs other than adding tape instead of glue."
"The inability to communicate via video every time."

Abilities as Change Agents

The final question the undergraduates were asked on their questionnaire was to evaluate the extent to which the pre-service teachers could serve as change agents in their future teaching roles. Specifically, they were asked whether they believed they could provide leadership in helping others coordinate a similar project that incorporated elements of TPACK and global collaboration. Of the 19 respondents, 13 agreed and 6 strongly agreed that they could do so. No respondents indicated that they disagreed or strongly disagreed with the statement.

Discussion

Based on the coded and categorized responses, most of the responses were technology and pedagogy related. This trend is confirmed by the responses that were categorized as being a combination of categories with TPK, which was a combination of the two highest incidence categories, being the highest. This result seems to indicate that the most impactful elements of the project related to technology and pedagogy. This analysis does not reflect whether those comments reflect positive or negative experiences, but additional sentiment analysis could be conducted to do so. One specific question did address student

perception of the overall experience, either positive, negative, or mixed. Of the 19 undergraduates who participated in this project nine reported the experience as being positive, two reported it as a negative experience, while eight noted a mixed experience of both positive and negative elements. Notably, the two students who reported the negative experience were also the same individuals who worked with the students mentioned above who were inflexible in their design ideas.

Training for Asynchronous Collaboration

Since collaboration was rated both as a success and as a struggle by the students, further analysis of the responses seemed necessary. Upon further examination, the comments seemed to indicate that the successful collaborative experience was related to the act of collaboration with primary students in another country. Whereas the negative experiences related to collaboration stemmed from frustration with the actual logistics of the collaborative process. Since this project was the first experience these students had ever encountered with asynchronous global collaboration, it comes as no surprise that they struggled to manage the logistics and their expectations of the realities of such a project. Some students even reported their desire for explicit training or instruction in how to best work in an asynchronous collaborative environment. Although the students requested explicit instruction, it could be argued that this project and reflective exercise did, in fact, function along these lines. If this is the case, then this project could serve as a training mechanism for future asynchronous global collaboration.

Future Research

If this project were to be repeated, a more rigorous study could accompany it. Specifically, a pre-test/post-test evaluation about teacher self-efficacy to be change agents in global collaboration could be administered to better measure the effect of the project on the pre-service teachers. Additionally, a TPACK evaluation measure could also be administered to measure changes in the three TPACK categories through a validated survey, rather than through qualitative measures used in this study. Finally, since communication seemed to be the greatest challenge for success in completing the task, additional research could include comparing two groups of undergraduates engaging in different communication protocols to determine which is most effective.

Further Recommendations

This study was a first attempt at institutionalizing global collaboration at an undergraduate institution in the teacher education program with the intent that the student teachers would implement global collaboration into their future classrooms. The results show that additional work is necessary at the front end of the project to establish communication techniques, expectations, and norms among both parties in the collaboration. This finding is consistent with the recommendations found in Lindsay and Davis (2012). Further attempts at institutionalizing global collaboration should include explicit instructions in communicating through a variety of digital means.

The second recommendation comes in establishing collaboration expectations that are agreed upon by both parties. In this study, the undergraduate students in Pennsylvania were tasked with introducing the project to the primary students in Korea. During this the pre-service teachers focused primarily on defining the task and agreeing upon using Google Docs as the primary

communication platform. By failing to establish how decisions would be made regarding the modification of any agreed upon plans for the ping-pong ball launchers, the undergraduate students became extremely frustrated when the primary students modified the project. Establishing criteria for agreeing upon modifications could help alleviate future challenges in this regard.

Finally, despite the undergraduate students' reported frustration, most of the students expressed interest in pursuing global collaboration in their own classrooms. This seems to indicate that projects like this, despite any challenges, are a positive experience for pre-service teachers and could result in similar global collaborations happening in their future classrooms. A follow up study with these students, or other students who have had a similar experience, could help determine the extent to which projects like this in an undergraduate class carry over into the future classrooms.

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