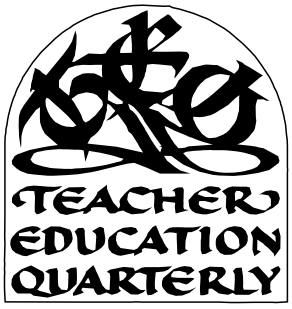

Preservice Science and Mathematics Teachers' Intent to Use Classroom-Based Global Collaboration (CBGC) in Their Future Classrooms

M. Kate York & Rebecca Hite

Abstract

Global education is needed in American K–12 education, yet few teacher preparation programs (TPPs) provide preservice teachers (PSTs) induction on global pedagogies, and less so in math and science. This qualitative case study explored the use of classroom-based global collaboration (CBGC) pedagogies among 12 science and mathematics PSTs in a TPP. PSTs worked collaboratively with other PSTs and in-service teachers from around the world using various synchronous and asynchronous technology applications to research, answer questions, and construct knowledge and products. Ajzen's theory of planned behavior (TPB) was used to analyze their future intent using GBGC as classroom science and math teachers. Findings indicate that PSTs were mixed in their future GBGC intent, citing low self-efficacy and more opportunities for practice in their TPP.

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Introduction

The benefits of incorporating global education elements in K–12 classrooms, specifically through *classroom-based global collaboration* (CBGC) pedagogies, are numerous: increased content acquisition; greater student engagement; and increased soft skills development, including globally minded principles that foster cultural awareness and empathy building (Cummins & Sayers, 1997; Gibson, Rimmington, & Landwehr-Brown, 2008; Kerlin, 2009; Lindsay & Davis, 2013; Merryfield, 2002; Partnership for 21st Century Learning [P21], 2019; Peters, 2009; Riel, 1994; Union, 2011). Classroom teachers may also benefit from participation in CBGC experiences. Prior research has suggested that GBGC-practicing teachers report greater teaching confidence and morale, more positive attitudes toward collaborative learning, increased cultural awareness and appreciation, and greater insight into teaching perspectives (Chitanana, 2012; Copen, 2002; Gibson, Vialle, & Rimmington, 2003). Providing K–12 students with CBGC experiences, though, requires a teacher proficient in their content knowledge, use of instructional technology, and global education (curriculum and pedagogy). To prepare such teachers, there is a strong need to include global education content and pedagogy in teacher preparation programs (TPPs) for preservice teachers (PSTs; Gibson et al., 2008; Markham, 2011; Thomas, 2000).

Multiple studies have looked at the inclusion of globally focused curriculums and experiences in TPP programs. Globally focused coursework and study/teach abroad opportunities are two options that many TPPs elect to offer PSTs (Causey, Thomas, & Armento, 2000; Kirkwood-Tucker, 2004; Zong, 2009). Studies regarding global education elements incorporated as a function of PST coursework have typically focused on outcomes pertaining to the inclusion of multicultural awareness programs and culturally responsive curriculum and instruction during teacher preparation, which have shown mixed results in effectiveness (Derman-Sparks, 1995). Global experiences emphasize interactive, collaborative, and immersive opportunities. PSTs in this context are not simply learning about global others but are engaged in relevant, meaningful interactions with global partners. Some of the most extensive studies in this area pertain to PSTs participating in study and/or teaching abroad experiences. Results generally show positive impacts on PSTs' cultural competencies and teaching and learning practices (Clement & Outlaw, 2002; Kambutu & Nganga, 2008; Pence & Macgillivray, 2008; Walters, Garii, & Walters, 2009; Zong, 2009).

Clearly, including elements of global education in TPPs is beneficial and necessary (Kirkwood-Tucker, 2009). However, a challenge for many TPPs is that often their curricula are replete with state certification requirements; adding (global) content or international study and/or teaching experiences can be challenging to both the TPP and PSTs (Ferguson-Patrick, Macqueen, & Reynolds, 2012) due to funding, curriculum, time, and certification requirements (Walters et al., 2009).

As an intermediate approach to addressing this issue, this study used experiences in CBGCs embedded within an existent TPP course, so PSTs could experience

(and, in the future, hopefully facilitate) "[direct interaction] with other students from around the world in the context of regular classroom instruction" (York, Hite, & Donaldson, 2019, para. 5) using project-based learning (PBL) methods and technology-supported collaborative learning. PBL provides an ideal constructivist instructional pedagogy (Krajcik & Czerniak, 2014) to facilitate CBGC practices. Experiences in constructivist curriculum and instructional methodology during a PST's TPP can transfer into future classroom practice (Dangel, 2011); offering global elements may, too, transfer into future classroom practices. As such, drawing from research indicating that PST exposure to global education elements during their TPP can lead to including global education once in the field (Guo, 2014; Poole & Russell, 2015), this study sought to examine secondary math- and science-focused PSTs' future intent (use) of the CBGC pedagogy taught during their PST program.

Importance of Global Education and Teacher Preparation in Global Education

Often used interchangeably with such terms as *global citizenship*, *international education*, and *world studies, global education* has a variety of meanings: cross-cultural comparative studies, language and geography studies, travel abroad experiences, and even allocations of aid and funding for educational endeavors in undeveloped countries (Becker, 1969; Hunter, 2004; Marshall, 2015). Definitions of global education share commonalities in promoting cultural awareness, multicultural perspectives, tolerance, and understanding, with some definitions (such as that for international education) including a focus on promoting sustained interaction, discourse, and collaboration between individuals from around the world (Roberts, 2007). The emphasis on global education in K–12 schooling is to prepare students for global issues like national security, global markets, citizenship, cultural diversity, and environmental protection (Asia Society, 2006).

Implementing quality teacher preparation in global education, including initial training for PSTs, is paramount to achieving that goal. Tye (2009) argued teachers should possess the knowledge base of global systems and issues and develop skills to critically engage with students on these issues. Tye specifically addressed this in terms of K–12 classroom pedagogy, presenting two complementary forms: *descriptive* (knowledge based, or the *who*, *what*, *when*, and *where* of global education) and *normative* (skills based), arguing that both are necessary to develop the whole student. Normative practice, where individuals move beyond the simple knowledge of other by practicing and developing skills for meaningful interaction with others, can only be developed through "significant, long-term, direct personal interaction with people and contexts different from those in which one is most familiar" (Cushner & Mahon, 2002, p. 4). Bickmore (2009) stated many teachers are reluctant to engage in normative pedagogies, likely because of a lack of training or confidence, insufficient campus or district support, or conservative curriculum

policies. Yet, descriptive pedagogy means little if normative pedagogy is absent; knowledge simply becomes knowledge for knowledge's sake. TPPs must include preparation in both pedagogies.

Normative pedagogy also requires PSTs to embrace their own global learning and understanding if they are to adequately support students in global learning. One way is "to improve teacher education so that potential teachers learn about the systems of the world, the skills, the abilities of analysis, and critical thinking" (Tye, 2009, p. 23). PSTs need experiences in global education to "identify cultural differences to compete globally, collaborate across cultures, and effectively participate in both social and business settings in other countries" (Hunter, White, & Godbey, 2006, p. 283). TPPs are a logical location for such PST preparation to support teachers' learning to meet this global education demand.

Considerations in Preparing PSTs for CBGC

Collaborative learning is a constructivist pedagogy that engages students in purposeful discourse, while simultaneously fostering critical social and cross-cultural skills (Fisher & Frey, 2014). The concept of *global collaboration* involves "work[ing] with someone in a location other than your own (typically in another country) to produce or create something" (Lindsay & Davis, 2013, p. 319). It moves the locus of learning about *other* toward genuine interaction with others, which may extend to other content (e.g., science, mathematics), culminating in knowledge and/or product creation.

Engagement with collaborative learning experiences has grown exponentially due to increased technology that supports these collaborations (Resta & Laferrière, 2007). For this reason, collaborative learning now extends far beyond the confines of the classroom or the borders of geographic location. However, teachers who establish CBGCs must also take into account the additional layer of technology-supported collaborative learning (Kreijns, Kirschner, & Jochems, 2003; Kirschner, 2001), given that these collaborations are conducted virtually. Considerations for engaging with international partners include understanding of cultural expectations and norms, language barriers, and technology access, as well as time zones and other technological factors that may influence the level of communication and interaction (Kim & Bonk, 2002; Lindsay & Davis, 2013).

Research-Based Outcomes of CBGC Among PSTs

While limited, studies have demonstrated positive outcomes of including classroom-based global collaboration in PST preparation. Secondary English and social studies PSTs in the United States serving in a tutoring role to university students in Taiwan showed positive gains in their online teaching and learning skills (Cifuentes & Shih, 2001). Lock and Redmond (2006) reported positive ICT outcomes

in an online collaboration between Canadian and Australian elementary PSTs. Online partnerships between elementary PSTs in the United States and Australia revealed an increase in science and math teaching self-efficacy (Gibson, Watters, Alagic, Rogers, & Haack, 2003). Yang, Yu, Chen, and Huang (2014) reported favorable attitudes toward and satisfaction with a cross-cultural collaborative learning experience between educational technology majors at universities in the United States and China. Additionally, content acquisition, an appreciation of diverse educational issues and perspectives, and soft skills development were supported in a collaboration between PSTs in the United States and Australia (Neal, Mullins, Reynolds, & Angle, 2013). These studies suggested that GBGC experiences aid PSTs in content and skill acquisition and provide a viable means to develop PST skills in CBGC.

However, studies specific to elements of CBGC practice within TPPs in the United States that focuses on secondary math and science content areas and research regarding a potential association between PSTs' exposure to CBGC and their intended future use of CBGC in the classroom warrant additional exploration. Given that behavioral intent is a strong predictor of future behavior (Ajzen, 1991), this study served as an initial step in exploring a PST preparation in CBGC and future classroom practice of this pedagogy.

Theory of Planned Behavior (TPB) to Explore Future PST Classroom Use of CBGC

The theory of planned behavior (TPB) by Ajzen (1991) is a widely accepted model used to determine behavioral intent and, subsequently, to predict an individual's (future) behavior. Grounded in the theory of reasoned action (Ajzen & Fishbein, 1980), the current model of the TPB predicts behavior through a construct of a behavioral intention. Behavioral intentions are "assumed to capture the motivational factors that influence a behavior; they are indications of how hard people are willing to try, of how much of an effort they are planning to exert, in order to perform the behavior" (Ajzen, 1991, p. 181). Behavioral intention comprises the individual's (a) *attitudes* (personal beliefs and perceptions), (b) *subjective norms* (social expectations and pressures), and (c) *perceived behavioral control* (ability to engage in the behavior). Perceived behavioral control includes an individual's perceptions about factors that influence the performance and outcomes associated with the behavior. Taken together, the more positive the attitudes and subjective norms toward the behavior and the greater the perceived behavioral control, the greater the *behavioral intention(s)* (Madden, Ellen, & Ajzen, 1992). Collectively, the components (and, thus, the theory) have been shown to be an adequate predictor of future behavior (Ajzen, 1991; Armitage & Conner, 2001).

The TPB has been used extensively with PSTs to assess intentions regarding such things as content, technology use, and instructional methods (Haney, Czerniak, & Lumpe, 1996; Haney & McArthur, 2002; Sadaf, Newby, & Ertmer, 2016; Teo &

Tan, 2012). Of particular note are studies addressing PST beliefs and perceptions. *Beliefs* are defined as "psychologically-held understandings, premises or propositions about the world that are felt to be true" (Richardson, 1996, p. 102) and play an important role in determining action. For PSTs, beliefs are influenced by prior personal experience, educational experience, and experience with both content area and pedagogical knowledge (Richardson, 1996). According to Kagan (1992), "a teachers' beliefs usually reflect the actual nature of the instruction the teacher provided to students" (p. 73). For PSTs, beliefs have been found to remain consistent in TPPs; however, Richardson (1996) noted some evidence that individual courses within TPPs may have some positive impact on changing PST beliefs.

Research Question

This study addressed a gap in the literature regarding PSTs' exposure to CBGC as a pedagogical approach and their intent to use it in their future classrooms. Although math and science are often underrepresented in global education compared to social studies and language arts, they do provide a vital context for students to learn about global issues and work with global others (Davies, 2006). This study investigated math and science PSTs' perceptions, beliefs, and intent to use CBGC in their future classrooms using the TPB as a framework for analysis. It did not aim to predict future behavior. Specifically, the study explored the following research question: Using the constructs of attitude, subjective norms, perceived behavioral control, and behavioral intent, to what extent do math and science PSTs intend to plan, design, and implement CBGC in their future secondary mathematics or science classrooms?

Methods

To more thoroughly address the research question, a qualitative interpretive case study approach was used to "describe[e] process(es), individual or group behavior in its total setting, and/or the sequence of events in which the behavior occurs" (Ponelis, 2015, p. 537). An interpretive case study can be leveraged to advance a field's body of knowledge (Merriam, 2009), such as by incorporating GBGC into TPP by providing theory testing (Eisenhardt, 1989) and applying TPB to evaluate behavioral intent (Ajzen, 2011).

This case was bounded by a large, public university in Texas with a well-established math and science TPP. This TPP credentials secondary math and science teachers with an active enrollment of more than 350 students and more than 250 graduates since 2011. The university is unique in that it has no college of education; therefore, most PSTs enrolled in the program are recruited directly from math and science departments. PSTs in the TPP take a series of four field-based courses, in addition to other required lecture courses. These four courses precede their culminating semester-long, in-field student teaching experience. Data were

collected from one of these courses as part of a dissertation study (York, 2017) and accompanying practitioner piece about the students' perceptions of the challenges and benefits of GBGC instruction and instructors' experiences facilitating GBGC for preservice STEM teachers (York et al., 2019). Faculty for these courses consist of former secondary district-level leaders with strong backgrounds in math and science content, methods, curriculum development, and instructional design.

Context of the CBGC PBL Course and Participants

Specifically, this study was conducted in the fourth field-based course of the TPP, which is a 3-credit-hour course requiring 11 hours of middle or high school classroom contact (eight hours of observation and a minimum of three hours of active instructional delivery). The course prepared secondary math and science PSTs in a progressive, constructivist-based instructional format (PBL), while simultaneously growing globally responsive teachers competent in soft skills using CBGC experiences. These collaborations required math and science PSTs to engage in several synchronous and asynchronous global discussions and collaborative projects with international math and science PSTs and in-service teacher graduate students. To guide the instruction and assessment, the course used the Framework for 21st Century Learning (P21, 2019), the Teacher Guide: K–12 Global Competence Grade-Level Indicators (P21, 2014), and an adapted version of the Global Education Continuum (Nugent, Smith, Cook, & Bell, 2015; see Figure 1). Specifically, students engaged in three different types of CBGC experiences, followed by a culminating capstone project.

Experience 1. Groups of PSTs (two or three) participated in a mathematics PBL unit using origami. They uploaded digital images of their creations to the project space within the iEARN global collaboration site (http://www.iEARN.org/) for comment and conversation with other students from around the globe. The purpose of this activity was to introduce math and science PSTs to the PBL lesson format, engage them with academic content, and provide them with a *limited* CBGC experience (see Figure 1).

Experience 2. This involved a multiweek discussion exchange with math and science PSTs enrolled at a university in Belarus. During this *engaged* CBGC (see Figure 1; also facilitated through iEARN), teams of students responded for 6 weeks to education-related prompts co-created by the course instructors at both universities. The team members were different than those in Experience 1 but similarly consisted of two or three students. Students initiated the project by writing poems and making introductory videos of themselves to send to their partners. This activity was followed by a series of discussion post exchanges. These asynchronous discussion activities were supplemented by two synchronous Skype sessions.

Experience 3. This included both math and science PSTs and in-service

teacher graduate students enrolled at a university in South Korea. Similar to the Belarusian collaboration, PSTs over a 6-week period responded to education-related prompts co-created by the two course instructors. The same PST groups were used in this collaboration as in the Belarusian collaboration. Asynchronous collaboration was facilitated through an instructor-created wiki during this *engaged* CBGC (see Figure 1).

Capstone project. Students were tasked with individually designing their own CBGC math and science PBL unit for future classroom use, driven by their personal CBGC experience. This was a culminating project with applicability to share with future K–12 classroom students and teachers to promote and involve others in CBGC experiences.

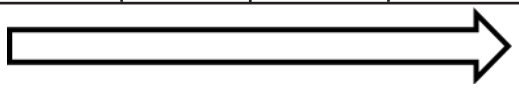
Participant Selection and Sampling Procedures

Each participant was enrolled in the PBL course and eligible to complete their culminating semester-long student teaching placement upon successful completion of the PBL course. Thirteen PSTs were eligible for study participation, and 12 PSTs, including eight women and four men, consented. Seven participants intended to teach immediately upon certification, three indicated they would not, and two were

Figure 1

Global Education Continuum

Adapted from "21st Century Citizen Science" by J. Nugent, W. Smith, L. Cook, and M. Bell, 2015, *The Science Teacher, 82*(8), p. 35. Copyright 2015 by the National Science Teachers Association.

Global Education Continuum					
Global Awareness	Parallel Activity	Shared Data	Limited Communication	Engaged Collaboration	Global Contribution
Least Amount of Collaboration					Greatest Amount of Collaboration
Exposure to other cultures and geographical areas to increase knowledge or perception of a world beyond one's own	Classrooms are separated geographically, yet are simultaneously engaged in the same activity; participating classrooms do not communicate but are aware of others participation	Students from a variety of locations sharing data in some way, but without direct communication between classrooms	Students from a variery of locations sharing information via direct asynchronous or synchronous communication	Students from a variety of locations sharing information; involves moderate to significant levels of communication via direct asynchronous or synchronous communication	Result of collaboration that involves giving back or contributing to the world around you

uncertain. None indicated any previous CBGC experience. In a small case study such as this, each PST was given a randomly assigned pseudonym to preserve anonymity. Table 1 provides a summary of participants.

Data Collection and Analysis

Data were collected from documents, an open-ended questionnaire, a focus group, and semistructured follow-up interviews. Documents collected during the study included electronic discussion board posts and PBL lesson plans created by the participants. The electronic discussion board posts were collected weekly for the duration of the six-week collaborations. The lesson plans were created as a culminating capstone project, which were submitted by participants after the completion of the CBGC at the end of the semester. A semi-structured focus group interview, which included all participants, took place several weeks into the CBGCs, but before their completion. Field notes were taken by the researcher, and the interview was audio recorded and transcribed. A 12-item, open-ended questionnaire was adapted from Yang et al. (2014) and given at the end of the course to assess PSTs' future intent associated with use of CBGCs. Expert review of the questionnaire was conducted by the course instructor, a teaching assistant, and the South Korean partner (professor), all of whom had extensive knowledge of the course, learning outcomes, constructivist pedagogy, and/or global collaboration. Based on participants' questionnaire responses on their intent to complete their student teaching placements within six months and an expressed intent to teach immediately upon completion of the TPP, five participants were selected for a follow-up interview. Among the five, two female science majors and one male math major participated in the interview. The researcher took field notes, and interviews were

Table 1
Characteristics of Preservice Math and Science Teacher Participants

Pseudonym of PST	*Reported gender*	*Reported major and secondary certification area*
Eric	male	math
Cole	male	math
Gregory	male	science
Thomas	male	science
Brittany	female	science
Catherine	female	science
Jennifer	female	science
Leah	female	science
Rachel	female	science
Allison	female	science
Anna	female	science
Elaine	female	science

Note. N = 12. PST = preservice teacher.

audio recorded and transcribed. Member checking ensured accuracy.

This study used directed content analysis processes to analyze the data (Hsieh & Shannon, 2005; Yin, 2014) using a priori coding categories from Ajzen's (1991) TPB. A second round of data coding created subcategories within each of the a priori categories (Erlandson, Harris, Skipper, & Allen, 1993; Merriam, 2009), which were further broken down during subsequent rounds of data analysis. A sample coding schema of the a priori categories, as well as specific aspects and criteria used to code the data, is found in Table 2. Additionally, sample responses for each initial a priori category, in addition to their subcategory designations after subsequent rounds of data analysis, are included. Trustworthiness was achieved through prolonged engagement with the participants, member checking, using varied sources of data (Yin, 2014), reflexive journaling, an established analytical framework and methods, and an audit trail.

Limitations of the Study

This case study served as a focused and descriptive exploration of the intent of future classroom use of CBGC for math and science PSTs within a single TPP at a large, public university in Texas. As it was a case study, direct applicability of the findings is limited to the program itself and other similarly designed programs. It should also be noted that the primary researcher was responsible for curriculum design and implementation for the course used in the study. This provided the researcher with a unique perspective and allowed the researcher to build trust with participants that otherwise might have been more difficult to establish. However, the researcher acknowledges that because portions of the study were epistemological in nature, the data and reflections may be subjective as both the educator and researcher (Reybold, Lammert, & Stribling, 2012); therefore the coauthor, who did not participate in data collection, aided in coding, analysis, and interpretation.

Results

The results of the participants' expressed intent to use CBGC in their future classrooms are mixed. The discussion posts of two groups with their Belarusian partners, while not directly indicating intent, did suggest that some participants were at least thinking about future uses of CBGC as an instructional pedagogy during their personal collaborations. Catherine and Anna, for example, noted that the CBGC experience in the course "has made us more eager and willing to try [global] collaboration in our own classrooms." Similarly, Elaine, Brittany, and Thomas mentioned that "a project that involves students in our future classrooms sharing projects or ideas would bring a new aspect into the collaboration."

At the completion of all CBGCs, four participants indicated that they do intend to try CBGCs in their future classrooms. Anna, Leah, Jennifer, and Brittney all used terms such as *will*, *definitely*, and *do intend* to describe their intent. Leah,

for example, offered an enthusiastic response, saying, "I definitely plan on implementing some form of global collaborative education experiences into my future classroom." Seven other participants, while positive, were uncertain in their intent.

Table 2
Data Analysis Using Theory of Planned Behavior

A priori category from TPB	*Indicators of category*	*Sample responses from PSTs*	*Emergent categories*
Attitude	not-benefits negative feelings or perceptions	Learning a new content can be very *difficult* for a *student*, and adding on the complications of global collaboration could be an additional source of stress rather than helpful in teaching the content. (questionnaire response, Elaine)	non-benefits (K–12 students): math and science content acquisition
	benefits, positive feelings or perceptions	*Content can be implemented* by having both of them work on the same project . . . if there is a country that gets more earthquakes, then "What are earthquakes like," "How does it happen?" . . . use each other as a research tool. (follow-up interview, Jennifer)	benefits (K–12 students): math and science content acquisition
		Multiple *benefits* can result from collaborating with others from around the world on projects, such as . . . practice in teaching/learning strategies. (wiki discussion board, Leah)	benefits (personal): teaching pedagogy
Subjective norm	perceptions of others' feelings, enactments	I'm not sure if my *supervising teacher actually knows* about this . . . (follow-up interview, Jennifer)	important others; supervising teacher
Perceived behavioral control	challenges, concerns, perceptions of preparedness, self- efficacy	I feel like the human connection is *hard* to grasp when it is through iEARN or through some other platform. (focus group interview, Eric)	perceived challenges
Behavioral intent	indication of intent	I could *definitely* see myself, for example, collaborating with a class around the globe on a similar class project. (questionnaire response, Anna)	plan to implement

Note. PST = preservice teacher. TPB = theory of planned behavior.

Their responses were often conditional and used qualifying language, such as *if*, *may*, and *might*. Thomas noted, "If I can incorporate it properly within a lesson, I will implement global collaborative experiences in my future classroom." Similarly, Eric said, "I may look into other countries to see if they use different strategies for teaching a topic. . . . This will obviously take more thought; I haven't thought about it extensively." Interestingly, Gregory indicated that he had no intention of using CBGC in his future classroom, saying, "I don't have any concrete plans to implement global collaboration," although he acknowledged that he did not think it would be difficult to do so and will likely be necessary at some point in the future, as "technology keeps bringing people closer together from remote geographic locations."

The responses for 10 of the 11 participants within either the "do intend" or "uncertain" categories also addressed the level of CBGC in which they might have their future math and science students participate. Nine participants included student-to-student interaction, eight of whom referenced designing projects that could be described as limited collaboration, or direct contact with global partners using asynchronous methods. Leah described implementation of engaged collaborations utilizing both synchronous and asynchronous communication. These limited and engaged collaboration lessons support both descriptive and normative pedagogical development (Tye, 2009).

PST Perceptions of Barriers (and Solutions) to CBGC

Participants were asked to provide a list of perceived challenges, along with possible solutions and workarounds, they would need to consider when implementing CBGC in their own classrooms. These responses provided evidence of the a priori categories of attitudes, perceived behavioral control, and subjective norm, as they contributed to PSTs' perceived beliefs, self-efficacy, and influences of important referents. Responses were subcategorized into perceived self-efficacy and collaboration logistics. Table 3 provides a summary of these emergent categories, discussed in the following paragraphs.

PST perceptions of self-efficacy in CBGC. The most common theme reported involved participants' level of perceived self-efficacy in designing and implementing CBGC in their future classrooms. No participant responded that they felt completely prepared; however, nine participants did indicate that they felt somewhat to moderately prepared to implement CBGC as a classroom teacher. Jennifer, for example, explained that "even though right now I am the student, not the teacher, I actually feel sort of prepared . . . . I feel like I am capable of implementing collaborative education experience [*sic*] in my future classroom with more instruction." Anna responded similarly, mentioning that "since I was able to personally go through what a global collaborative education experience would be like for a student, I feel I am better able to design [an] experience." Seven others provided similar responses. For the three participants who did not feel confident,

all indicated that it was largely the difference between knowing what to do and then actually executing it. According to Elaine, "I have a taste of what it is like as a student, but as a teacher/facilitator, I believe I have much to learn." Eric expressed similar beliefs, saying, "I think you just have to do it; the action comes before the understanding in this case." Leah said, however, that CBGC "seems extremely overwhelming. In theory, it seems brilliant and extremely effective . . . [but with] many road blocks during the implementation process."

PST perceptions of collaboration logistics in CBGC. Eleven participants discussed determining the type and level of collaboration as a challenge. They indicated that while high levels of collaboration were desired, it also increases the complexity of design and implementation. Eric expressed that with synchronous activities, "you get to see other people's personalities and just be in the moment. You're face-to-face with them, so you get to experience a little more than just reading what they have written." However, Allison and Gregory indicated that increasing the level and expectations of the collaboration contributes to the difficulty. While five PSTs preferred synchronous activities, citing the increased human connections that can be made face-to-face, they voiced that time zone differences and global partner schedules might make planning synchronous activities more difficult. Coordination of synchronous communication and activities with global partners was

Table 3
Frequency (in Order) of PSTs' Perceived Challenges of Implementing CBGC

Perceived challenges	*No. of participants*	*Percentage of participants*
Self-efficacy		
Confident	0	0
Somewhat confident	9	75
Not confident	3	25
Collaboration logistics		
Type and level	11	92
Language issues	10	83
Planning and organization	8	67
Frequency	8	67
Perspectives of important referents	8	67
Curriculum alignment and pedagogical preferences	7	58
Technology	6	50
Collaborative learning perspectives	4	33
Establishing global partners	2	17
Global partner commitment	2	17
Instructional time involvement	1	8

Note. N = 12. PST = preservice teacher.

perceived as a daunting, yet not insurmountable, prospect.

Ten participants mentioned language barriers as a potential challenge. Catherine indicated that in her future classroom, students would have to be patient, although other PSTs noted that CBGCs are easier to conduct now with online translators and programs to create subtitled videos. Additionally, Allison and Leah both mentioned that they would personally benefit from and like to try communicating in their global partners' native languages.

Planning and organizing a CBGC was viewed as a concern for eight participants. Establishing clear timelines, providing explicit directions and objectives for students, and instilling high expectations for student participation were listed as necessary but challenging to orchestrate in a successful CBGC.

Six participants noted selecting appropriate technology to facilitate communication between the global partners as vital to successful CBGC implementation. Two participants, Allison and Rachel, expressed the need for both CBGC teachers to have access to and familiarity with these technologies.

Seven participants indicated that designing and engaging in CBGCs that incorporate and align with curriculum requirements and pedagogical preferences could be challenging. Several struggled with conceptualizing how to use CBGC to facilitate content. As Elaine expressed, "learning a new content can be very difficult for a student, and adding on the complications of global collaboration could be an additional source of stress rather than helpful in teaching the content." Allison also raised concerns about varying curriculum scopes and sequences, while Thomas pointed to potential content standard differences between the partner classrooms. However, two participants provided possible solutions for effectively incorporating math and science content into the collaboration. Anna noted including having a jointly created plan and product between global partners that accommodates for different content and pedagogical needs, and Thomas proposed seeking input and feedback from colleagues as to how best to merge CBGC with classroom math and science content.

Four participants noted their personal experiences and preferences with collaborative activities, in general, during their educational careers. Some PSTs, like Cole and Eric, found previous collaboration experiences extremely positive. Others, like Allison, found collaboration "challenging" and specifically that "communicating with a partner can be hard." These same participants also noted multiple issues that either did or could present themselves when working in collaborative groups, such as poor communication, group conflict, unequal distribution of responsibility, and unequitable assessment measures. The issues with collaborative learning facilitation were projected to their future K–12 classrooms, where Cole and Eric subsequently noted that "as teachers, managing collaboration is important to ensure that it is positive for all students."

Eight participants also provided some perspectives related to the social influences, pressures, and acceptance associated with CBGC by important referents.

Jennifer, in discussing the potential use of CBGC in her upcoming clinical teaching semester, noted the influence of those in a supervisory role. Jennifer said that she is "not sure if my [supervising] teacher actually knows about this or if we're the first generation [to do] this." The knowledge, perceptions, and beliefs of influential others, such as administrators, colleagues, parents, or other stakeholders, were not mentioned directly by any other participants. However, seven of these eight participants did note the importance of the perceptions of students regarding CBGC. They were concerned about generating and maintaining student interest in the collaboration. Catherine, for example, mentioned students' open-mindedness toward others as a possible challenge. Eric worried about students not seeing the relevance of the project, saying, "If they don't want to learn math . . . what is different about a global collaboration that's going to make them want to do that?" Additionally, Allison and Elaine brought up the minimal work mentality, where students might simply engage in the least amount of collaboration necessary to meet the requirements of the partnership.

Additionally, all participants discussed the frequency of CBGC: Five participants said that CBGCs should be incorporated yearly, three participants were in favor of three or more CBGCs each year, two participants suggested that three to four collaborations between 6th and 12th grades would be ideal, and two participants were undecided. However, eight participants mentioned the challenges associated with the frequency of collaborations, all of which were linked to the other challenges discussed in this section, including time, maintaining student interest, curriculum needs, and planning and organization.

Finally, participants mentioned several other potential challenges to implementing CBGC. Cole was particularly concerned about the amount of instructional time involved in developing and implementing CBGC-based activities, while others focused more on establishing global contacts (Eric and Gregory) and eliciting commitment and follow-through from the global partners (Eric and Jennifer).

Discussion

Collectively, positive attitudes of CBGC focused on benefits for teaching (pedagogy) and math and science content learning, although that was also viewed as negative. Studies have found that numerous soft skills are supported in K–12 classrooms through CBGC (Gibson et al., 2008; Roemer, 2015). Yet, how to integrate these affordances into math and science content varied. In fact, half believed that global collaboration could make learning math and science content *more* difficult for students.

Perhaps most telling were participants' levels of perceived self-efficacy (see Table 3). Self-efficacy plays a large role in exploring perceived behavioral control because it directly assesses an individual's perceived ability to perform the behavior (Ajzen, 2002; Bandura, 1977). Although having experienced the CBGC personally and then

been tasked with designing a CBGC lesson, no participant expressed a high level of self-efficacy (e.g., self-confidence) in implementing CBGC in their future classroom. This finding is significant, as teacher self-efficacy has been empirically linked to teachers' choices in instructional practices (Tschannen-Moran & Hoy, 2001). Increasing PSTs' self-efficacy is necessary if they are to use novel methods like CBGC.

PSTs' responses also provided insight into their perceptions of the subjective norm. Clearly, the subjective norm within the class was high, as global collaboration addressed specific learning outcomes within the course established by the instructors. Otherwise, it would call into question the purpose behind engaging in CBGC within the course. Scott (2005), for example, found that mathematics PSTs' beliefs and perceptions toward teaching and learning were, in part, shaped by both peers and "professional friends" already in the K–12 classroom. Scott noted that PSTs perceived their peers' and professional friends' knowledge and beliefs as valuable, because "their advice is situated in the present moment, and it represents authentic contexts" (p. 85). Given that the global partners were also math and science PSTs in TPPs of their own, it is reasonable to conclude that their actions, perceptions, and beliefs expressed during the collaborations had some level of influence on the participants' perceptions of global collaboration. Regarding future practice, PSTs are heavily influenced by supervising teachers during their student teaching and by administrators, colleagues, students, parents, and other stakeholders once they are in their own classrooms (Marble, Finley, & Ferguson, 2000; Webster et al., 2012). The perceptions and beliefs of these important referents could significantly influence teachers' intent to use CBGC (Supovitz, Sirinides, & May, 2010) by contributing to the "perceived social pressure to perform or not to perform the behavior" (Ajzen, 1991, p. 188). This may look very different from the subjective norms experienced in the TPP.

Many of the participants saw benefits to including these experiences with the TPP; however, even with the expressed benefits, the results were split as to participants' future intent. Only four participants indicated that they do intend to implement global collaboration in their future classrooms. The other participants were uncertain, at best, with one indicating that she had no foreseeable intentions. These responses are not surprising, as novice teachers face a multitude of challenges and adjustments the first few years in the classroom (Davis, Petish, & Smithey, 2006; Stansbury & Zimmerman, 2000). Veenman's (1984) work noted eight perceived problems of new teachers: discipline, motivating students, dealing with individual differences, assessing students' work, relationships with parents, organization of class work, insufficient and/or inadequate teaching materials and supplies, and dealing with problems of individual students. Current literature has only reaffirmed these perceptions (Fantilli & McDougall, 2009; Goodwin, 2012). The perceived challenges associated with global collaboration, which factor into the participants' perceived behavioral control, may only be compounded by the perceived challenges associated with being a new teacher.

In sum, a PST's intent to use global collaboration in their future classroom may be negatively influenced if it is perceived as a hindrance to student learning or if the benefits of using global collaboration to support math and science content acquisition are not explicit. This is important, as an abundance of evidence suggests that constructivist, inquiry-driven pedagogies better support student learning, especially in math and science content areas (e.g., Meyrick, 2011; Schroeder, Scott, Tolson, Huang, & Lee, 2007). While soft skills development should be a desired outcome of CBGC, it cannot be the only learning outcome if teachers are to adequately prepare K–12 students in math and science subject areas. Figure 2 is a model that illustrates the findings of this study mapped onto the TPB, indicating that establishing the relevancy of CBGC in both math and science content and soft skills for PSTs is necessary for their future classroom use.

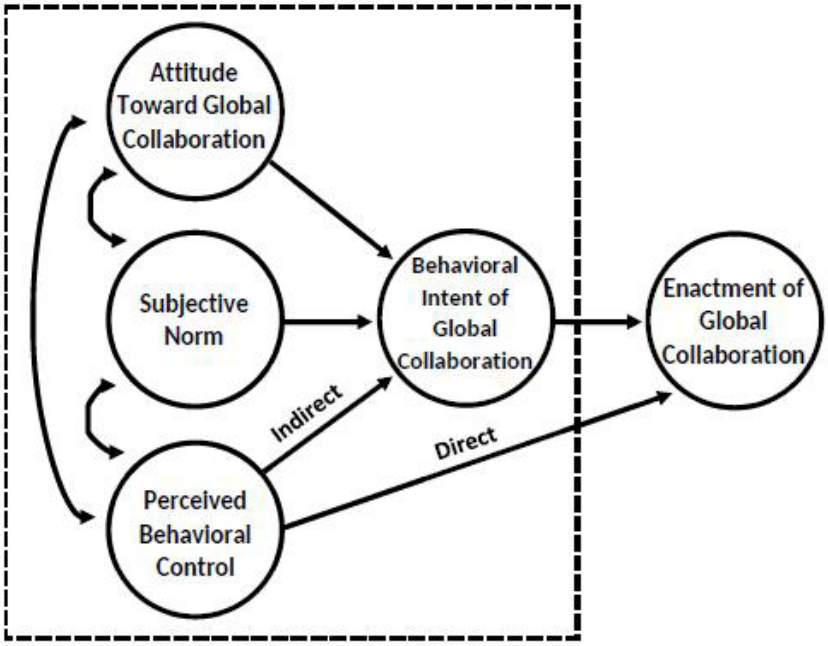
Conclusion, Recommendations for Practice, and Future Research

PSTs' attitudes toward classroom-based global collaboration were generally

Figure 2

Path Model for the Theory of Planned Behavior: CBGC and PST Intent

Adapted from "A Comparison of the Theory of Planned Behavior and the Theory of Reasoned Action" by T. J. Madden, P. S. Ellen, and I. Ajzen, 1992, *Personality and Social Psychology Bulletin, 18*(1), p. 4.



positive. Participants provided numerous positive examples of how experiencing global collaboration allowed them to grow personally as future teachers. The benefits they personally experienced from the collaborations, coupled with the perceived benefits of including global collaboration activities for their future students, contributed to the favorable responses from almost all participants. Additionally, the subjective norms within the course, comprising primarily instructor perceptions and expectations and, to a lesser extent, the perceptions and expectations of peers, were supportive of these practices (although participants did note concerns about future important referent knowledge and perceptions of CBGC).

However, while the participants expressed interest in global collaboration, fewer than half indicated strong intentions to implement this pedagogy within their future classrooms. First, participants struggled to make connections between CBGC and the math and science content they need to teach. Emphasizing math and science content facilitation and acquisition through CBGC is important to establishing relevancy; participant responses indicate that attempts during the course to explicitly marry content and methods were not successful. Second, lackluster intent may be attributed to weaker perceived behavioral control assessed through participants' perceived challenges of using global collaboration. Although participants provided some possible solutions, the list of perceived challenges that the participants generated was lengthy. Notably, none of the participants felt completely confident in their ability to design and carry out global collaboration, as the participant's perceived self-efficacy was deficient. The mediocre results of behavioral intent may have less to do with the value the PSTs see in using this constructivist pedagogy and more to do with simply needing additional support and resources from the TPP in this area. This might further increase behavioral control.

While this study addressed behavioral intent of implementing CBGC, it did not attempt to use those findings to predict behavior. The predictive power of the TPB model is based on conditions remaining the same between the time of the expressed intention and the time the behavior is enacted (Ajzen, 1991). Accordingly, "intervening events may produce changes in intentions or in perceptions of behavioral control, with the effect that the original measures of these variables no longer permit accurate prediction of behavior" (Ajzen, 1991, p. 185). Many factors influence PSTs once they leave their TPPs and enter the profession as actual teachers. The influence of the supervising teacher during student teaching, district and campus cultures, peers' and leaders' teaching philosophies, and policies and regulations may or may not be compatible or hold consistent from the TPP to the in-service teacher classroom.

These variables can have tremendous impacts on attitudes, subjective norms, and perceived behavioral control. Just as important, they may directly impact the PSTs' actual control. Such items as policies, money, time, access to resources, and the priorities and mandates of those in leadership positions serve to either enhance or inhibit a teacher's ability to perform certain behaviors. According to Ajzen (1991),

no matter how strongly an individual's behavioral intent and perceived behavioral control toward the behavior, conflicting actual control will mitigate the enactment of the behavior.

Longitudinal studies conducted on PSTs periodically as they advance in their careers would help determine the long-term influence of CBGC on their beliefs and add to the body of literature on the lasting impacts of teacher preparation. While behavioral intent is generally a strong predictor of behavioral action, longitudinal studies are needed to formally explore this connection for CBGC (Richardson, 1996). Following PSTs into the field and seeing how they incorporate global collaboration activities into their K–12 classrooms would provide additional evidence of the relevance and usefulness of including these experiences in teacher preparation coursework, along with providing information on how to better support these teachers with CBGC once they have their own classrooms.

Finally, even though the PSTs' intent to enact GBGC was mixed, the importance of TPP experiences must not be understated, as the training PSTs receive does influence their future classroom practices (Darling-Hammond, 2002; Darling-Hammond & Baratz-Snowden, 2007). TPPs cannot control what happens after PSTs leave the program; the very best they can do is provide PSTs with quality training in researched-based pedagogies and perspectives in the hope that it will transfer to effective classroom practice. As Eric noted,

> I feel like [the TPP] gives me something more, gives me the maximum amount of tools to use in my classroom. I may never use global collaboration in my classroom, but it is good to know. I may never do a PBL-style lesson, but it is good to have in my arsenal of teaching styles. . . . The more we know them, the more we can incorporate a little bit of that into our teaching. . . . [The TPP] is not a mundane program. It's very dynamic, and that's what I like about it. . . . I think that is really good, so definitely [the global collaboration] was a good thing to do.

Providing PSTs with a wide variety of tools, including constructivist pedagogies and elements of global education, will only serve them better in the increasingly connected world and diverse classrooms in which they will teach.

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