

# **Using Lesson Study to Develop Geography Teachers' Capacity to Design and Implement Problem-based Inquiry**

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## **Abstract (50 words):**

This paper reports findings from the pilot phase of a three-year design-based implementation project with middle school geography teachers. Data were drawn from lesson study planning sessions, lesson study research lesson implementations, field notes, and a yearend interview. We explore the curriculum created by the design team before then examining more closely how one teacher enacted disciplined civic inquiry in geography. We conclude by considering what the one teacher's experience suggests about the supports needed by future project teachers to implement and sustain disciplined civic inquiry in geography.

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## Using Lesson Study to Develop Geography Teachers' Capacity to Design and Implement Problem-based Inquiry

### Introduction

National Assessment of Educational Progress (NAEP) results suggest students' knowledge of geography and geographic thinking have changed little over the last decade. In 2014, for example, 8th-grade students demonstrated no improvements on the NAEP geography assessment when compared to 2010 or 1994 results. Three-fourths of 8<sup>th</sup>-grade students scored below the Proficient level in 2014 (National Center for Educational Statistics, 2015). A United States Government Accountability Office (GAO) analysis of NAEP geography assessment results found more than one-half of 8th-grade students reported spending little time (10% or less of total social studies instructional time) studying geography. Due to more intentional focus on tested subjects such as reading, math and, in some cases, science, a majority of states do not even require geography courses in middle or high school (U.S. GAO, 2015). The stagnant NAEP results and decreased instructional time raise concerns about the preparation of American workers to reason spatially, consider ecological consequences of human decisions, or apply geographic information systems (GIS) to solve problems. Employment of specialists in geography is projected to grow 29 percent from 2012 to 2022, faster than the average 11 percent growth for all occupations. One possible reason individuals skilled in geographic thinking are in demand is the increasing recognition that many of today's civic and economic issues demand global understanding, knowledge of how humans interact with and alter ecological systems, and the ability to make sense of massive amounts of data through spatial technologies. NAEP results suggest, however, that the foundation needed for these future jobs is not being provided to American students because they not being prepared as geographically-literate citizens.

NAEP test results and the new demands for skilled workers suggest that geography teachers will likely need support to improve achievement among their students. However, many geography teachers report taking few, if any, geography courses during their undergraduate preparation. Additionally, few professional development opportunities for geography teachers are available (U.S. GAO, 2015). In response to this stagnant achievement and infrequent offerings of geography professional development, geographers have called for geography teachers and researchers to investigate teaching and learning *together* (Huynh, Solem, & Bednarz, 2014). In a report for the geographic education research community and education policymakers, Bednarz, Heffron, and Huynh (2013) provide relevant recommendations for those working to improve geography achievement. We situate our work within this important roadmap by addressing several of the authors' recommendations. We seek to address Recommendation 1, which calls for researchers to identify learning progressions in geography; Recommendation 2, which calls for researchers to examine what constitutes exemplary geography curricula; Recommendation 3, which calls for researchers to examine effective geography teaching; and Recommendation 9, which calls on researchers to build partnerships with educators in diverse contexts and to share findings within the geography education research community.

The current paper reports findings from the pilot phase of The Bridging Divides Project, an ongoing, three-year lesson study professional development project with funding

from the National Council for Geographic Education (NCGE). Due to the very limited scope of the pilot phase, we focus on how our single participant, a middle school geography teacher we call Amelia (pseudonym), enacted disciplined civic inquiry in geography, a curricular framework that might also be described as problem-based geographic inquiry (PBGI). We examine PBGI as an example of disciplined civic inquiry, consider the curricular innovations embedded within our PBGI curriculum, suggest why they should work based on literature in other social studies subject areas, and examine how the curricular innovations discussed were manifested in our pilot year curriculum. We then use pilot year findings to discuss the ways we hope to support future participating geography teachers to do PBGI. We address two research questions: 1) What are the characteristics of a PBGI curriculum? 2) What supports might middle school geography teachers need to implement PBGI effectively? Our goals for the pilot phase of the project were two-fold. First, we wanted to identify and understand the characteristics of a PBGI curriculum. Second, we wanted to learn from Amelia's experience to anticipate and plan supports for the challenges subsequent teacher participants might confront. Because our data are drawn from a single teacher during the pilot phase and not from five or six teachers as is common with a lesson study team, we discuss our findings tentatively and with an eye towards future lesson study iterations.

### **Literature**

The Bridging Divides Project seeks to develop participating teachers' capacities to do disciplined civic inquiry (DCI) with their students. DCI is disciplined inquiry for the purpose of developing critical and reflective citizens (Saye, 2016). Like efforts to engage students in DCI within other disciplines (government: eg., Parker et al., 2011; history: eg., Saye & Brush, 2004), we suggest that geographic knowledge and skills should be used by students to address public issues, thereby giving students important practice addressing the concerns they will confront as adult citizens. Our project seeks to develop participating teachers' capacity to leverage geography as a tool for helping their students make sense of public issues to prepare those students as competent citizens. Scholars have long sought to engage social studies students in the examination of public issues for the purpose of developing citizenship knowledge and skills. Evans, Newmann, and Saxe (1996) suggested that all social studies instruction could be organized around social issues. Doing so would demand that teachers examine content with their students in-depth, review topics within a larger conceptual framework, and give over at least partial control of curriculum-embedded inquiries to students. These demands stem in part from the fact that issues-centered instruction requires students have opportunities to clarify definitions, interpret factual claims, and discuss times when democratic values are in conflict (Oliver, Newmann, and Singleton, 1992). In giving up some control and in calling for students to examine value conflicts, proponents of DCI wish to move beyond the development of students as disciplinary experts. Instead, proponents argue that students should be given opportunities to reason through public issues that are typical of democratic societies. In the case of history, for instance, Oliver, Newmann, and Singleton (1992) argue that examining narrative history for its own sake is never adequate because it loses sight of the democratic purposes of public education. Our project considers this criticism and seeks to align geographic instruction with preparation for democratic citizenship.

Our effort to align geography instruction with preparation for citizenship echoes

similar calls by business leaders within the geographic information systems sector of the American economy and by social studies scholars and leaders interested in developing competent citizens. The Environmental Systems Research Institute, better known as ESRI, the worldwide leader in the development of geographic information systems software, frames geographic inquiry as 1) asking geographic questions, 2) acquiring geographic resources, 3) exploring geographic data, 4) analyzing geographic information, and 5) acting upon geographic knowledge (ESRI Schools and Libraries Program, 2003). ESRI's position that students should act upon geographic knowledge suggests that simply knowing geography is insufficient because knowing divorced from action fails to protect the earth and human society in sustainable ways. Similarly, scholars in social studies education issued the College, Career, and Civic Life (C3) Framework, calling for social studies educators to embed all curriculum and instruction within an inquiry arc. Dimension 1 of the inquiry arc calls for students to develop questions and plan inquiries. Dimension 2 calls for students to apply disciplinary tools and concepts from the social science disciplines of civics, economics, geography, and history. Dimension 3 calls for students to evaluate sources and use evidence in support of claims. Lastly, Dimension 4 calls for students to communicate conclusions and take informed action (National Council for the Social Studies, 2013). Using evidence strategically and taking informed action demands that students become more than purveyors of geographic facts. They must use their knowledge to impact local, national, and global communities for the better.

Among the efforts to engage students in DCI, Saye and colleagues' work in history education and Parker and colleagues' work in government/civics education are among the most established lines of inquiry. In the case of Saye and Brush (1999, 2004b, 2006, 2009), the Persistent Issues in History (PIH) curricular framework for DCI asks students to investigate historical events within the context of social issues so that students gain practice wrestling with questions citizens confront (Saye & Brush, 2004a). With the PIH curricular framework in mind, an elementary history teacher preparing a unit on Indian Removal might ask students to consider the question of whether Andrew Jackson should be honored as a great president. Students might analyze a variety of competing historical perspectives to develop an evidence-based response to the question. To assess students' ability to answer the question, students might participate in a hypothetical trial of Andrew Jackson in which students represent historical actors of various perspectives. As part of the unit, the teacher might also ask students to consider an enduring or persistent question focused on the standards that must be met to give leadership legitimate authority (Brush & Saye, 2003). Discussion of the persistent question thereby helps students better understand other historical and modern events in which similar value conflicts are present (majority rule vs. minority rights). Interpreting and discussing historical artifacts in this example are never the ends themselves, but a means to an end. While using disciplinary tools is always part of DCI, the larger objective is to reason about social questions that persist through time to prepare effective citizens (Oliver et al., 1992; Saye & Brush, 2004a).

Parker, Mueller, and Wendling's (1989) work in government/civics education suggests that students are ready to do the reasoning called for by proponents of DCI, even while they acknowledge that investigating public issues is challenging work. Parker and colleagues' findings show that students need lots of guidance and structure to develop valid, evidence-based claims. They also need practice confronting and discussing the reasonableness of others' claims. Helping students achieve enlarged understandings of the

world around them via the investigation of public issues prepares them for responsible decision-making (Parker, 2001). Parker and colleagues (2013) most recent work considers the place of an issues-centered, project-based curriculum within an Advanced Placement U.S. Government and Politics class, a class whose curriculum has traditionally been highly resistant to change. Parker and colleagues engaged in design-based implementation research in which collaboratively designed curriculum was tested in participating teachers' classrooms. Students in both well-resourced and impoverished settings participated in authentic political simulations and examined contemporary civic issues from multiple perspectives. Participating teachers used these simulations and projects to build engagement and a need to know within students and to develop students' capacities to develop evidence-based claims. Parker's line of inquiry reveals the possibilities of using an issues-centered curriculum that is active and challenging to develop important citizenship knowledge and skills within students (Parker & Lo, 2016).

### **Barriers to the Adoption of DCI**

While civic educators have long argued for inquiry instruction, including disciplined civic inquiry, the classroom instructional practices that might better prepare students for democratic citizenship have not been widely adopted (Saye & Social Studies Inquiry Research Collaborative, 2013). The literature suggests that inquiry social studies instruction has remained rare for a myriad of reasons. Some barriers to inquiry instruction originate more from state, district or school-level factors which indirectly or directly influence the culture surrounding teaching and learning. Other barriers arise because of decisions made by teachers within that culture. In the section that follows, we briefly examine the barriers we believed would impact our study before the beginning of the pilot phase. In the discussion section, we return to these barriers and discuss the extent to which they emerged within the pilot phase and the extent to which unanticipated barriers also emerged.

**Teacher as gatekeeper.** If teachers are to adopt disciplined civic inquiry, they must first believe that investing time and energy in inquiry is a worthy endeavor. As curriculum-instructional gatekeepers (Thornton, 1991), teachers determine the curriculum and instruction students experience and the extent to which their instruction is grounded in research-based principles. Any effort at reform, therefore, begins with teachers. Such efforts must assist teachers in overcoming the cultural and individual challenges they confront when attempting to change their teaching practices. For example, there are immense challenges related to the cognitive complexity of inquiry instruction (eg., Bransford, Brown, & Cocking, 2000). Inquiry teachers must have a rich content knowledge to facilitate inquiry, have a clear understanding of the problem under investigation including what perspectives could be brought to bear on it, and be able to facilitate student learning and thinking subtly. However, if teachers view geography as a set of discrete facts, concepts, or skills to be memorized, operate in a school that prioritizes test preparation through drill and practice, or work in a school system that emphasizes the teaching of reading and math to the exclusion of social studies, they are less likely to engage their students in inquiry of any kind.

**Teacher beliefs.** Factors such as teacher beliefs about what knowledge is valuable (eg., Nespor, 1987) also influence teachers' willingness to adopt inquiry. Barton and Levstik (2003) argue that some social studies teachers know how knowledge is

constructed within their discipline and will represent that knowledge to students while other teachers know how knowledge is constructed within their discipline but prove unwilling to create experiences for students that would require them to construct knowledge. The latter teachers most often believe their primary tasks are to control behavior and cover content. The former teachers more often believe the purpose for teaching their discipline moves beyond coverage and control to education for citizenship. Nespor (1987) suggests that teachers' existential assumptions about their abilities as well as students' abilities and intelligence, views about ideal teaching environments that differ from their present teaching context, and personal feelings towards the course content they teach will all influence the types of experiences they provide to their students.

**Teachers' tolerance for risk.** Teachers' tolerance for the ambiguity and risk typical of the constructivist teaching embedded within inquiry instruction all influence the degree to which they consider and then adopt inquiry in their classrooms. McNeil (2000) argues that many "defensive" teachers control knowledge within their classrooms because it helps them maintain order and control. One strategy defensive teachers use is defensive simplification. Defensive simplification occurs when teachers tell students that lessons will not be difficult or demand a depth of understanding in the hopes of negotiating cooperation from students. Wirkala and Kuhn (2011) suggest, however, that such actions are counterproductive. They argue that the issues or problems embedded within problem-based inquiry activities provide motivation for deep learning. Problem-based learning helps to sequence and scaffold learning for young students in ways that activate prior knowledge and increase cognitive and affective engagement. Simply using problem-based strategies does not, however, eliminate all risk. In the case of problem-based geographic inquiry, geography teachers must understand the content deeply, grasp and teach the ways of knowing and thinking embedded in geography (i.e., spatial reasoning), grasp the complex nature of social issues and how geography might be used to understand and solve them, and be able to structure the learning environment to encourage student engagement with the social issue (Oliver, Newmann, & Singleton, 1992; Saye & Brush, 2004). Such work is complex and involves significant uncertainty as teachers build from students' prior knowledge, navigate students' misconceptions, and provide structure and support to help students address the public issue or problem.

### **Lesson Study as Collaborative Design-based Interventions**

Collaboration between multiple stakeholders has the potential for helping teachers navigate many of these barriers. Findings from collaborative design interventions (Howell & Saye, 2015; Kohlmeier & Saye, 2017; Parker, et. al, 2013; Parker & Lo, 2016) demonstrate that collaboration between teachers and researchers can encourage teachers to apply theory to problems of teaching practice. Lesson study, a recursive process of designing, implementing, reflecting on, and modifying a single research lesson during one academic year (Lewis, 2009), has demonstrated promise in helping teachers overcome obstacles to more ambitious teaching (Kohlmeier & Saye, 2017; Saye and colleagues, 2016; Howell & Saye, 2015; Halvorsen & Kesler Lund, 2013). With lesson study, teachers and researchers often work to establish learning goals and solve problems of practice by examining the theoretical knowledge base (Hiebert, Gallimore, & Stigler, 2002). As lesson study team members collaboratively reflect on evidence of student learning gathered during observations in light of their emerging theoretical knowledge, their views on teaching and

learning are made open to critique and change (Stigler & Hiebert, 1999; Lewis, 2009). As a professional development vehicle, lesson study has a shown promise because it seeks to improve teaching in context, which respects the complexity of teaching as a cultural activity not easily changed via top-down directives.

Bausmith and Barry (2011) argue for the importance of collaborative design-based interventions because they typically attend to the development of pedagogical content knowledge within teachers. To improve student learning, professional development must take place over an extended period, focus on subject matter in context including how students learn such content, and must provide teacher teams opportunities to collaborate in examinations of student learning. Like Bausmith and Barry, geography education researchers argue that "the components and characteristics of exemplary geography curricula" and "the characteristics of effective geography teaching" must be studied (Bednarz, Heffron, & Huynh, 2013, p. 58). Scaffolded lesson study, as we conceive it, results in field-tested instructional materials grounded in a framework for disciplined civic inquiry. It also results in collaborative partnerships that permit public critique of teaching and learning (Howell & Saye, 2015). While work has been done in using lesson study to encourage teachers to adopt ambitious frameworks for teaching history, we are not aware of any studies that examine the use of lesson study to develop teachers' knowledge of problem-based geographic inquiry.

### **Theoretical Framework**

We consider the scaffolded lesson study process to be a form of design intervention (Brown, 1992) or more precisely, design-based implementation research (Penuel, Fishman, Cheng, & Sabelli, 2011), because it seeks to use instructional lessons planned and evaluated by a team of teachers and teacher educators to alter teachers' conceptions of powerful social studies teaching. Design-based implementation research is like the research and development initiatives conducted by a variety of public and private entities (i.e. corporations, military). The idea is to design, test, and refine curriculum innovations through multiple implementation cycles. Design-based implementation research allows time for researchers to test how pedagogical ideas work in a variety of real-world classroom settings and gradually build capacity to effectively scale the ideas up for broader use and evaluation (Penuel et al., 2011).

Lesson study, because of its collaborative structure and assumption that teachers can contribute to their professional learning, is grounded in socio-constructivist assumptions about teaching and learning (Bransford, Brown, & Cocking, 2000). Cognition is social within lesson study as team members vocalize planning ideas and evaluate implementation results. Learning is mediated through the team members as they engage in conversations about teaching and learning (Greeno & Collins, 1996). Teacher learning within lesson study results from co-construction of research lesson materials, through conversations about teaching and learning in actual classrooms, and via metacognition following each component of the lesson study cycle. By publicly discussing student learning outcomes following lesson implementations, teachers contribute to the creation of collaborative communities of practice in which broader principles for effective teaching can be interrogated (Stigler & Hiebert, 1999; Howell & Saye, 2015). For example, our single participating teacher worked within the framework of scaffolded lesson study to design problem-based geographic inquiry lessons but doing so also confronted her with research-

based principles drawn from cognitive science research (Bransford, Brown, & Cocking, 2000) and authentic instruction and assessment (Newmann, King, & Carmichael, 2007). Our intention in the pilot phase of the project was to use lesson study to lay the foundation for a much larger collaborative community (Stigler & Hiebert, 1999) that might eventually contribute to additional teachers' adoption of inquiry-oriented geography teaching.

## **Methodology**

### **Design Principles**

Our curriculum design and professional development efforts were guided by specific design principles drawn from cognitive science (Bransford, Brown, & Cocking, 2000) and elaborated by Saye and Brush (2004). We employed lesson study planning scaffolds, grounded in the design principles, and kept the principles in mind when coaching teachers through lesson study curriculum design. These principles center on four main points: learning should be purposeful; learning should be connected; learning should be an active, challenging process; and learning should be structured to encourage success (Saye & Brush, 2004 - see Appendix A for a complete description). In striving to make learning purposeful and connected, we focused on organizing instruction around big ideas within the geography curriculum and on situating learning tasks within real world contexts. We wanted students to reason about complex social problems and apply their disciplinary knowledge to formulate a decision. For learning to be active and challenging, we looked for opportunities to put students in situations where they could construct knowledge with their peers and consider multiple perspectives that would broaden their understanding of the problem and provoke them to perhaps consider their stance in a new light. Finally, we sought to integrate a variety of supports into the research lesson and associated unit to help students build higher-order thinking skills and develop deeper understanding of key concepts. These supports included intentionally designing instructional strategies and assessments to appeal to multiple ways of knowing and communicating.

### **Sample and Context**

We used a purposeful sampling strategy (Creswell, 2012) to recruit a single 7<sup>th</sup>-grade geography teacher from McFarland Middle School (MMS) in a deep south state. MMS is a city school with 672 students, most of whom were White (76%) or Black (18%). The school served grades 6-8 and 35% of the students received free or reduced lunch benefits. Amelia (pseudonym), a young, White teacher in her twenties, had two full years of full-time teaching experience at the start of the pilot year. She completed her bachelor's degree in social science education from a four-year institution in the deep south state, and she was enrolled in a school counseling graduate program at the same institution throughout the pilot phase of the project. Her classroom had a variety of technological resources to include a smartboard, document-camera, desktop computer with projector, and access to a cart of Chromebooks for use by each student.

Amelia reported that geography was not a subject her school prioritized. She suggested that social studies had been deprioritized within the school district and by the state. Amelia's geography course was actually combined with Civics and taught on a semester-long, 90-minute block schedule. Along with the deprioritization of social studies in general, the integration of the two subject areas further decreased the time that Amelia felt she could devote to geography. Perhaps even more importantly, Amelia was not



immune to the struggles typically encountered by early-career educators. She especially struggled to manage her time. During the pilot year, Amelia went through a major life transition, commuted over an hour one way each day, navigated graduate school deadlines, and sponsored a time-consuming extracurricular activity at her school. Not only, therefore, was geography not a subject Amelia's school or state prioritized, but Amelia herself was often stretched so thin as to have little time to devote to preparation for lesson study implementations.

### **Procedures**

The project began in the summer of 2015 with a weeklong seminar. During the first two days, the project geographer, a noted expert in geographic education and geographic information systems, provided lectures on content and geographic technologies while project researchers modeled problem-based learning strategies. Perhaps due to her experience working with teachers in a state geographic alliance, the project geographer made her content lectures interactive and targeted them to the pilot year's content topic - population change. Following the first two days, project researchers and Amelia worked intensively together to design curriculum through scaffolded lesson study. We used scaffolds designed to promote problem-based geographic inquiry that we adapted from similar ones used to develop history teachers' knowledge of problem-based historical inquiry (Howell & Saye, 2015; Saye, Brush, Kohlmeier, Maddox, & Howell, 2007). Each scaffold had a different purpose. We initially used a "framing the unit" scaffold to develop the questions that would serve as the focus of the unit and the associated culminating activity (see Appendix B). Additional scaffolds helped us to effectively sequence lessons in the unit, identify the research lesson, check planning decisions against design principles, and strategically plan areas to observe during the implementation phase. Whenever necessary, we examined PIH network resources and video models to help the team brainstorm powerful learning strategies and design complex, performance-based assessments. These scaffolds collectively ensured the team was able to systematically develop the research lesson and evaluate the effectiveness of its design. During the lesson study phase of the summer seminar, the project geographer moved into a consulting role. When we had difficulty understanding a geographic concept or felt we needed more content knowledge to effectively design instruction, we reached out to the project geographer by phone or asked her questions in person during impromptu return visits.

Lesson study proceeded through a cycle that began with the development of the research lesson for implementation during the summer seminar. The team collaborated to decide upon teaching and learning goals for the lesson and to create the lesson procedures and assessments. Amelia, as the classroom teacher, drove decisions surrounding goals while we helped her consider lesson procedures, strategies, and assessments that might help her achieve these aims. Near the conclusion of the lesson study week, we completed a lesson study observation scaffold. The observation scaffold allowed us to pre-plan the ways we would measure student learning outcomes during research lesson implementations. We concluded the seminar week by devising a timetable for observing the research lesson during the fall and spring of the upcoming school year.

During the school year, following observations of each research lesson implementation, we conducted a debriefing with Amelia to discuss the implementation including learning outcomes among students. We began each debriefing by asking Amelia

to describe what went well, the implementation challenges she confronted, and her sense of how students responded to the lesson. We then very carefully examined student assessment products. We combined all of our reflections to compile a list of changes to the research lesson that would improve student learning outcomes. We decided who would make each change and agreed to make the changes a week or two before the next lesson implementation.

Independent of lesson study, we also collected data to determine the extent to which Amelia engaged her students in authentic intellectual work (AIW) (Newmann, King, & Carmichael, 2007). To capture a best-case example of Amelia's normal teaching and assessment practices, we asked her to submit an assessment task that was among those that proved most intellectually challenging for her students (Newmann, Bryk, & Nagaoka, 2001; Saye & SSIRC, 2013). We then conducted a classroom observation to correspond with the implementation of this task. The comparison observation helped us to gain a glimpse of Amelia's normal teaching practices. By asking her to choose from among the most intellectually challenging social studies lessons she teaches, we hoped to understand whether and how lesson study research lessons were different from her normal practices.

Our use of AIW observations instruments to classify Amelia's pedagogy was different from prior research focused on the efficacy of the AIW model itself. At the time of the pilot phase of the project, we were most concerned with applying established AIW principles to the design of the professional development being offered so that Amelia could begin to imagine her students constructing knowledge through disciplined inquiry to produce products or performances that had value beyond school (Newmann, King, & Carmichael, 2007). It was, therefore, less important to measure changes in Amelia's authentic pedagogy via more extensive data collection during the pilot year. Amelia's AIW scores represented only a small portion of the larger data corpus which included survey data and extensive transcripts of lesson study planning conversations and implementation debriefings. We have therefore chosen not to report her AIW scores in this manuscript. In subsequent years of the project, we will employ AIW instruction and task rubrics at regular intervals to more fully document any changes in practice.

## Data Sources

**Entrance survey.** Amelia completed an initial entrance survey at the beginning of the project. In the survey, Amelia provided demographic details, information on her professional experience, an explanation of her teaching philosophy, and contextual information about her school setting. We used the survey as a starting point for understanding Amelia's goals as a social studies teacher.

**Seminar.** During the summer seminar week, both researchers independently maintained field notes in readily available journals. We captured quotes from Amelia in our journal as often as possible and noted our impressions of Amelia's experience. Over lunch and at the end of each seminar day, project researchers met to expand our notes and to discuss our impressions. Whenever we were working on lesson study planning scaffolds or engaged in pre-planned discussions of any kind, we used a digital audio recorder in conjunction with field notes to capture conversations between team members. We subsequently transcribed these recordings which document many hours of lesson study planning and reflection.

**Observations.** As during the seminar, we used field notes during the research

lesson implementation to facilitate discussion during the debriefing and subsequent revisions. We also video recorded research lesson implementations and debriefings. These recordings helped us to bridge the geographic divide between the first author and second author. The first author was not present during research lesson implementations or debriefings, which occurred during the school year in fall and spring semesters. The recordings also served as a digital record of the lesson and allowed both researchers to independently transcribe and score research lesson implementations using AIW rubrics.

**Final Debriefing.** At the end of the pilot year, following the second research lesson implementation, the second author conducted a semi-structured interview with Amelia that extended beyond the traditional implementation debriefing to include more holistic questions about the impact of the project on her thinking (see Appendix D). This final debriefing occurred on the second day of the research lesson implementation and was preceded by a debriefing on the prior day that focused exclusively on lesson outcomes. During the final debriefing, the second author probed for deeper meaning and asked unplanned questions when additional information was needed to understand Amelia's experience (Patton, 1987). The debriefing was video recorded and subsequently viewed by the first author before being independently transcribed and analyzed.

### **Data Analysis**

We used qualitative, descriptive techniques including content analysis and analytic induction (LeCompte & Schensul, 1999) to analyze the data types described above. We began analysis by creating a master data spreadsheet in Microsoft Excel that allowed us to list all the data sources and to notate when both researchers had independently transcribed and coded each source of data. The entire data set represented a lesson study case record for a single teacher and included all of the data noted above. When the initial processing and coding was complete, we met via video conference to discuss our coding schemes. We discussed differences in our interpretations and came to consensus about emerging themes. Following the initial video conference, we then independently searched the entire data set for examples and non-examples of the themes we agreed were significant. Initial categories were subsequently collapsed into fewer categories, their parameters refined, and key evidentiary examples were chosen from the data corpus.

### **Ethical Dilemmas in Design-based Research**

Before examining our findings, we find it prudent to remind readers that Amelia entered our project as a novice teacher with limited experience designing or implementing inquiry instruction but with a stated desire to increase her use of inquiry. It should not come as a surprise that Amelia wrestled with how to lead students through a problem-based geography unit for the first time. We also recognize that Amelia did not share all of our assumptions about effective teaching and learning and therefore admire her willingness to engage in intensive professional development with two researchers that would likely cause her to question her views on teaching and learning. As former classroom teachers ourselves, we empathize with the time constraints Amelia confronted and appreciate her willingness to collaborate. We feel duty bound, however, to explore the difficulties Amelia confronted when implementing problem-based geographic inquiry so that we might better help future teachers within the project. That said, we do not wish to convey that Amelia was anything less than a dedicated professional still learning how to

guide her students' learning.

## Findings

### PBGI Curriculum (RQ 1)

**Unit design.** In this section, we describe the PBGI unit on population change the lesson study team conceptualized and then partially designed. We also highlight the design principles we believe maximize students' ability to engage in disciplined civic inquiry (DCI) effectively. Broadly, speaking, we planned the unit backwards, meaning that we began by establishing clear transfer goals before determining the evidence we would need to collect from students to determine if students could indeed transfer their learning to a new context (Wiggins & McTighe, 2011; Saye & Brush, 2004). In the planning phase of lesson study, we worked together to formulate a persistent issue and central question to guide construction of our unit (see Table 1 below). To capture the complexity of population change as a topic, we tailored our unit central question to allow for consideration of problems associated with both population growth and decline. The unit central question is an important part of the overall PBGI unit design for several reasons: 1) the question forces students to address a common misconception that challenges associated with population change only result from exponential population growth; 2) the question requires students to engage in evaluative work and demands that they formulate a reasoned decision about what they think should be done about the problems identified during the unit; 3) the question calls for students to engage in ethical reasoning since some policy options might be considered more appropriate than others based on societal values; and 4) the question is also manifestation of a larger persistent issue. By answering the central question, we hoped to position students to address similar, complex social problems in which the welfare of a society is being questioned or debated.

Table 1: Unit Framework

Unit Topic	Persistent Issue	Unit Central Question	Unit Culminating Activity
Population Change	What actions are justified in the interest of the welfare or security of the community?	What policies best address the challenges created by population change?	Student groups persuasively present an assigned country's perspective at an International Conference on Population Change. Following presentations, students deliberate about the policies that best address changing global populations.

Once we were satisfied with the big questions that would serve to organize our unit, the lesson study team brainstormed a culminating unit activity. Our goal with the culminating activity was to provide students with an opportunity to research the problem of population change in a specific country and then have a forum to share their knowledge and debate policy alternatives. We decided to loosely base the culminating activity on actual population change proceedings held by the United Nations on a regular basis, The International Conference on Population and Development. In the first phase of the project (the culminating activity preparation lesson), students gather population data on an assigned country and use the ESRI Story Map platform (ESRI, 2016) to create a Story Map

report for an audience of delegates attending the simulated UN conference. The report details population challenges facing the country and actions the society might take to change its demographic outlook. During the conference day of the lesson, the students deepen their understanding of the problems facing the various countries by hearing brief presentations from country representatives before collectively deliberating about the best policy options for addressing the challenges created by population change.

Having decided upon a culminating activity, we next planned a unit grabber and subsequent lessons that would support learners and prepare them for the simulated population conference (see Table 2 below). The first lesson of the unit is an experiential population growth grabber activity that introduces students to some of the basic principles and consequences of population change. The activity begins with the teacher placing students in a confined space in the classroom and asking them to act out a series of hypothetical tasks (i.e. eating breakfast, going to work, taking a family member to the hospital) with specified physical movements. Each action is intentionally designed to be uncomfortable due to the crowded nature of the space where students interact. After each task, the teacher shares statistics on a hypothetical country experiencing rapid population growth. For example, when the students “eat breakfast” in the confined space, the teacher describes the percentage of underweight children in the hypothetical country (which is loosely based on a real country). During the debriefing, the teacher pushes students to consider what it would be like to live in a country with a rapidly growing population but then flips things around by asking students how the challenges might be different were the hypothetical country experiencing rapid population decline. This discussion culminates with the teacher sharing the central question and previewing the culminating activity to provide a roadmap for students regarding what is to follow in the unit. The remainder of the lesson includes a short overview of basic population terminology to set up the next lesson on the Demographic Transition Model (DTM).

Lesson two was designed to help students understand the purpose of the DTM and characteristics of countries at each stage. Amelia designed a lecture and practice handout to help students learn how to read the trend lines on a graph of the model and explain why a country might be at a particular stage given demographic information. The lesson concludes with a review game to reinforce basic content knowledge. The research lesson, which will be discussed in greater detail in the next section, is in the middle of the unit. It includes instruction on population pyramids and an interactive slide lecture to help students begin to understand, in a visual way, the problems often associated with population decline and rapid growth. During this lesson, we wanted students to make connections between the problems identified in the lecture and the population pyramid shapes. The fourth lesson further develops students’ understanding of the problems of population change through an analysis of three case studies (France, Singapore, and China). In the first part of the lesson, students participate in a class discussion that focuses on how governments attempt to manage population change through various policies. Then, students complete a response group activity by examining the three cases in small groups. Each case activity includes background information (a reading or video) and discussion questions. The teacher facilitates the response group strategy by guiding students through alternating periods of small group discussion of the cases and whole class discussion. The goal of the strategy is to maximize participation and ensure students hear a diverse range of opinions and perspectives on the various population policies explained in the cases.

Through the analysis of the cases, we wanted students to begin to grapple with policy options for dealing with the problems presented by population change. The final two lessons engage students in the previously described culminating activity research and the culminating activity itself. This part of the unit was conceptualized during lesson study and partially developed, but never actually implemented in Amelia's class.

Table 2: Lesson Sequence

Lesson Topic	Major Strategy
Lesson 1: Unit Grabber and Introduction	Experiential Activity
Lesson 2: Demographic Transition Model	Lecture and Practical Exercise
Lesson 3: Problems Presented by Population Change	Interactive Slide Lecture
Lesson 4: Strategies for Dealing with Population Change	Response Group Activity
Lesson 5: Culminating Activity Preparation	Small Group Investigations
Lesson 6: Culminating Activity	UN Conference Simulation

**Research lesson.** As we brainstormed the research lesson, Amelia was eager to try out the instructional strategies and technology we had demonstrated during the summer seminar, particularly since we agreed that we wanted to eventually have students use Story Maps (ESRI, 2016) for the culminating activity. Amelia suggested we use an interactive slide lecture strategy. She thought the strategy would appeal to what she described as visual learners and provide an opportunity to test whether it could be used to build students' geographic literacy, develop students' interest in the unit central question, and increase students' overall motivation to learn. Our project geographer also thought that it would be interesting to use Story Maps as a vehicle for instruction, in addition to its more traditional use as a tool for generating a product (as in the culminating activity). As a result, our slide lecture was built into a Story Map template to allow the teacher and students to be able to see a picture and its relative position on a world map.

The research lesson begins with a review of the Demographic Transition Model (DTM) and a short discussion to reorient students to the unit central question. The class then watches a video from Population Education that visually depicts, on a world map, how population has changed over time starting with 1CE and moving through time until the present. The video serves as a springboard for discussion on global population trends and their implications for the future. The introduction of the research lesson culminates with students considering the lesson focus question: "What problems are related to population change?" The next phase of the lesson was designed to help students envision how population pyramids can be used to better understand a country's demographic profile and the problems it might be facing. The teacher introduces the purpose of population pyramids and then models how to interpret a local example at the county level and one representing Burkina Faso - a country that best exhibits the characteristics of Stage 1 of the DTM. After discussing the two examples, the class transitions into an application phase where students work in pairs to complete a handout with four population pyramids.

Students must analyze each pyramid, make a judgment regarding where the country might be on the DTM, and identify factors that might contribute to the shape of the country's population pyramid. The teacher debriefs this activity by having volunteers come to the board to place each pyramid at a stage on a poster-size drawing of the DTM before publicly justifying their chosen placement. Any errors in placement are corrected afterwards during a short PowerPoint presentation that further reinforces what students should have learned from the activity.

The next phase of the lesson was a five-slide interactive lecture designed to deepen students' understanding of the lesson focus question. It includes two pictures depicting problems associated with rapid population growth, two pictures focused on problems associated with population decline, and a slide that links to an interactive web graphic that allows students to track the rate and direction of migration across various regions of the world. With each image, we scripted out the content the teacher would need to share with students. We also planned an interactive strategy to engage learners in close interpretation of the picture. For example, after noting details contained in a picture of a crowded commuter train in India, students are asked to write down a couple of questions they would like to pose to a specific individual of their choosing (shown in the picture) to elicit more information about what is going on in the scene. The teacher then calls on students to share their questions and uses the ensuing discussion to draw out content that relates to the lesson focus question. On the final slide, students work in pairs to interact with the migration website and record their observations. The teacher uses this activity to remind students that migration trends can also have a significant impact on a country's population, an important new idea that ties into the subsequent lesson on strategies for dealing with population change. The lesson concludes with an application task that requires students to initially interpret a population pyramid and list potential problems the country might be experiencing. Once students have this information, they are asked to select an image, from three choices provided beside the pyramid, which illustrates a plausible problem facing the country based on its population pyramid. The pictures depict a group of senior adults at the market, a group of adolescent boys with assault rifles, and a large, extended family. This task is challenging because the students must infer a problem from each picture (i.e. the market picture might suggest a rapidly aging population) and select the choice that can be supported by data from the population pyramid. In this case, the pyramid shows a large youth population that tapers off substantially as people reach their 20s and 30s. The most plausible problem in this country is unrest and violence as youth struggle for resources and opportunity in an area where the average life expectancy is very low. Students work in pairs on this task to connect what they learned from the slide lecture to their understanding of population pyramids and the DTM.

**Unpacking the design principles.** As mentioned previously, our planning decisions in designing the research lesson and unit were guided by certain design principles that were embedded in our lesson study process through the use of planning scaffolds. In this section, we discuss how our unit and research lesson reflect the use of these design principles. The first principle states that learning should be purposeful, a concept that is typically manifested in problem-based units by having students consider an authentic question in a complex, meaningful way. Our unit and research lesson are tightly focused on the real-world issue of population change. We problematize this topic by having students not only reason about the stereotypical problem of exponential population growth, but also

the problem of population decline (which students do not anticipate). Students also consider the problem at multiple levels of scale (national, regional, global), which helps them to develop a nuanced understanding of this issue. For students to build an in-depth understanding, learning must also be connected, the second design principle. This design principle is accomplished by ensuring all aspects of our unit point towards preparing students to be able to represent a country's perspective during the culminating activity faithfully. Each lesson is designed to build students' understanding towards this goal, with early lessons focused primarily on building foundational knowledge and later lessons geared towards the analysis of policies or strategies used to address rapid population growth or decline. When learning is purposeful and connected, students are theoretically more likely to construct a usable model of the problem landscape and reason more effectively about the civic problem (Saye & Brush, 2004a).

The third design principle states that learning should be an active and challenging process. This principle is exemplified in our curriculum by a variety of student-centered instructional strategies to include the frequent use of group work. A complex topic like population change evokes multiple perspectives on the nature and severity of the problem and which policy options, if any, are the most reasonable or appropriate. In our unit, students work in groups to become “experts” on an assigned country's population trends and problems and then represent this country's views in the simulated UN conference, which serves as a deliberation focused on the central question. Students are challenged in their expert groups to work through conflicting views regarding what should be done to address the population problems confronting their assigned country. When they transition to the simulation, students are forced to envision the problem from multiple vantage points and socially construct, with members of the class, recommendations for dealing with global issues related to population change. The active process of deliberation and defending a position with evidence during the simulation allows students to develop a deeper understanding of the issue.

Of course, simply designing challenging and active lessons is not enough to ensure students develop the requisite knowledge and skills needed for disciplined civic inquiry. Learning must also be structured in a way that encourages success. This final design principle is of vital importance and is incorporated into the population change unit and research lesson using activities that appeal to multiple intelligences and using strategic scaffolds. For example, the research lesson uses a slide lecture strategy to appeal to visual learners while the grabber lesson includes a good deal of movement and hands-on instruction. Students are also assessed in a variety of ways, including a complex culminating unit project (StoryMap report and deliberation) that includes authentic roles designed to allow students to communicate their understanding through speech, writing, and visuals. These design choices maximize the potential for learners to demonstrate at least some success on the objectives related to the larger unit. To further promote success, we intentionally designed a variety of scaffolds such as graphic organizers (i.e. research lesson slide lecture graphic organizer) and practice exercises (i.e. the pyramid structures handout from the research lesson) to build student competence and confidence throughout the unit.

### **PBGI Implementations (RQ 2)**

Having described the PBGI curriculum we created and the associated research



lesson, we now turn our attention to the second research question which focuses on the supports middle school geography teachers might need to implement PBGI effectively. To address this question, we first discuss some of the challenges that Amelia encountered in teaching the research lesson during the pilot year and the modifications that the lesson study team made between Implementations 1 and 2. Our goal is to explain how we applied the design principles to collaboratively make curriculum changes and to then discuss what these changes reveal regarding the types of supports geography teachers might need in future design cycles. Design rationales, or "accounts of the decisions teams make and the reasons for their decisions," (Penuel et al., 2011, p. 335) are included in this section to improve the quality of our design-based implementation research. As our project transitions into full implementation with more teachers, we hope to provide more complex accounts of problems of practice, including the solutions arrived at by a larger group of participating teachers. We organize our analysis around two key moments in the research lesson implementations - students interpreting population pyramids and their analysis of images within the interactive slide lecture.

**Interpreting population pyramids.** During both research lesson implementations, Amelia encountered challenges in helping students to interpret population pyramids effectively. The quote below, from the debriefing of Implementation 1, summarizes the challenge the lesson study team confronted:

Amelia: "When I started explaining [the population pyramid] to one group, *I got mixed up* for a minute and I had to go back and that's when I told them wrong. Because it is hard. When you first glance at [the pyramids] and you have a huge birth [rate], but there is also a huge 30-year-old [population], you are going to think it is a high birth rate right there. It is kind of confusing, so I know they had to be confused too. So...*I just didn't expect it to be that hard* once you got started talking about it, because it looks like it should be simple to read." [emphases added]

Population pyramids were not a part of Amelia's course before this project, which made it difficult for her to be able to anticipate areas students might find confusing. The changes we made to the curriculum were guided primarily by the idea that problem-based instruction should be *structured* to support students in achieving learning outcomes related to our goal of preparing competent citizens. As we reflected during the Implementation 1 debriefing, we realized that students needed more time with this content before considering problems associated with population change in greater depth. Amelia suggested splitting the research lesson into two blocks, with the interactive lecture starting on the second day. We also identified specific aspects of our scaffolding that could be improved. We noticed that students were struggling to describe the demographic profile of a given country (i.e., the younger population, the childbearing population able to contribute economically, and the senior population no longer involved in economic activity). This difficulty made it challenging for students to classify countries according to their stage in the Demographic Transition Model and consider potential problems facing the country. We reviewed a population pyramid example shared by the project geographer during the summer seminar and noticed how lines were drawn across the example to divide the pyramid into thirds according to whether the population of was of childbearing age. This adaptation seemed like an effective visual way to scaffold students and help them to extract key details in the population structure better. In Implementation 2, we had students draw these lines on the population pyramids as they worked with the population structures

handout. Amelia was pleased with this change, as her debriefing comments following Implementation 2 indicate:

Amelia: "It really helped though, just something as simple as doing the lines across (delineating young people, reproductive age, and seniors by having students draw lines on the population pyramids).

Researcher: "You think it did this time, compared to last time?"

Amelia: "Oh - completely. Yeah, that made a world of difference and that was just something simple that we should have probably thought of to begin with, and then just didn't."

Amelia also developed a PowerPoint presentation after the first implementation that was intended for use when debriefing the population structures handout activity. It provided visual scaffolding by placing each population pyramid example from the handout on a slide, with the associated characteristics of the appropriate DTM stage listed on the side. These two changes helped students, but students still struggled to make important distinctions between similar population pyramids during the spring implementation. The students were inconsistent in their ability to correctly identify demographic imbalances shown on a given pyramid and connect them to potential problems the country might be facing. We realized, from our final debriefing, the importance of explicitly teaching students the pyramid shapes (pyramid, inverted pyramid, hydrant, etc.) to help them figure out if a country's population was relatively stable.

**Problems of population change.** Another goal of the research lesson was to use a Story Map to visually engage learners in a slide presentation that would build understanding, empathy, and geographic literacy, including the goal of enhancing students' mental maps of various parts of the world. The interactive slide lecture strategy requires selection of powerful images that are used by the teacher as a vehicle for student-centered analysis and discussion that also builds content knowledge. During Implementation 1, Amelia struggled to determine the best time to employ an interactive strategy (i.e. when to have students "step into the picture" to role play) and how to strategically interject content for maximum impact. On the positive side, however, students seemed interested in the pictures and were eager to provide input during the discussion. To improve the lecture, we devised a series of teacher scaffolds to go with the five slides of the presentation (see Appendix C for one example). Grounded in work with historical photographs done by Callahan (2015), the scaffolds were designed to lighten the cognitive load of leading this type of discussion by providing a concise and visual review of the relevant content, a series of guiding questions, and suggestions for incorporating the interactive elements. The scaffolds were also designed as a reminder to ensure that the details associated with each slide were always connected back to the big picture - how each image illustrates specific problems associated with rapid population growth or decline.

The slide lecture was not as effective as intended, even with teacher scaffolds in place, because the discussion with students strayed from its intended big-picture focus and stayed at a superficial level. During Implementation 2, Amelia started the lecture by having students study the picture quietly for a couple of minutes rather than frontload information about the slide as she did during the first implementation. This positive first step had the potential to guide the class towards productive inquiry but was not supported by further steps to set the tone for serious discussion of the content in the slides. Students didn't seem to fully understand the purpose of the slide lecture strategy (it was novel to them), and as a

result, the discussion became an opportunity to make silly or off topic comments that forced Amelia to attend to management issues instead of probing student comments more deeply. The quote below illustrates how the lecture steered off course from the very beginning:

T: If I asked you to tell me, see this little kid right here.... (points to the picture)

S1: (interjects before Amelia is finished) He is not paying attention.

T: He is not paying attention?

S2: It is Carmen (making fun of another classmate, likely someone frequently off task).

T: Carmen... (Amelia laughs). That was pretty funny. Sorry. (Class laughs and takes several seconds to calm back down)

T: What are some problems little Carmen has in the school room?

S3: Focus.

T: Why do you think little Carmen might have some problems focusing?

S4: Distracted.

T: What could make him distracted?

S4: Something over there.

T: He could be distracted because there are so many people in the room. (T continues posing questions with the "Carmen" theme.

The "inside" joke of Carmen became more of a distraction as Amelia played off the comment and the discussion progressed. Rather than focus strictly on the image itself, students were also thinking about the real Carmen in the classroom. At a later point in this same discussion, Amelia had students mention challenges the students in the picture likely faced and also answered questions based on the picture.

T: Why are they [the African students in the image] pretty much all wearing the same clothes? Like half of them are...

S1: Because they're all from the same tribe.

S2: Tribe? (laughs)

T: That could be just their way of dress there. So, it could be maybe the school uniform, or maybe their poverty, that is just how they dress. It [the teacher scaffold] doesn't necessarily say why they are all wearing the same clothes.

The final statement from the quote above shows how Amelia tended to rely, at times, on the scaffold we created after Implementation 1 as a tool to help her guide students through understanding the portions of the lecture for which she felt less familiar. As Amelia transitioned to the portion of the lecture she took the lead in creating, she was able to more flexibly provide specific details related to the image, but her questioning often failed to elicit substantive discussion of any particular idea, even despite preplanned questions on the scaffold. The slide for this part of the lecture depicted a massively crowded commuter train in India. The interactive strategy required students to create one to two questions to ask a person from the image to help the class gain a better understanding of the circumstances surrounding the image. However, rather than allow students time to examine the picture and thoughtfully develop questions (perhaps individually and then with a partner), Amelia rapidly enacted the strategy in the following way:

T: Now we are going to do the same thing again with this picture, except I...

(hesitates) want you to ask a person a question - Ok - So if you see this... I want you

to analyze this picture, ok, I want you to notice everything that is in it. Really look at it. And then we are going to pick somebody and you are going to ask them a question.

S1 (interrupting T): This isn't India, this is Mexico! (Several students laugh)

S2: They are Indians.

T: This is, um, the Indian railway...(temporary aside as students disagree and Amelia gets students focused again)

T: Ok, (calls on a student), who will you ask?

S3: Um, that little creepy guy!

T: What question are you going to want to ask him?

S3: Well like, is he scared he is about to fall off the top of the train?

T: (restates) If he is scared that he is going to fall off the top of the train?

Ss: Which one? Can you point him out?

T: Come up here, point him out. (Student comes to the board to point out the person in question.)

S6: That little creepy guy (laughs).

T: ...So what is [your] question?

S3: Like, is he scared he is going to fall off the top of the train as he sits on top?

T: Ewww, yes, alright. Now, do you want to know why he is sitting on top of the train?

S3: Yes.

T: Alright. Listen to this. It is estimated that in the Indian Railway... there is about 23 million people per day that are passengers on this route (continues with information).

T: Alright what question would you ask?

S7: Why are they all men?(Conversation continues)

T: The women actually ride on a different car.

S8: That is not fair.

S9: It is like the Railroad Titanic! (everyone laughs)

As the excerpt above illustrates, the class was not prepped on the purpose of the interactive strategy and, as a result, the questions and comments focused more on areas of immediate curiosity rather than the intended goal. Amelia appeared to feel most comfortable discussing the nuances of the picture and never actually addressed the broader national demographic implications associated with the crowded trains. Two missed opportunities that might have allowed Amelia to explore the wider implications occurred later during the same lecture segment. A student says: "I would ask the driver...how fast or how slow the train can go with all those people on it?" Amelia acknowledged the question and moved on. Another student asked: "Do you think the train ever stops and breaks down?" Amelia responded to this question by confirming that the trains break down and asking, "How would you feel if you thought you were going to be late going to work?" She then described a story she had read about a woman docked a day's pay for being late. In both these instances, Amelia could have discussed how inefficient trains cause the national economy of India to suffer or how people on the trains getting injured on a daily basis stresses the public health and public safety infrastructure. Based on Amelia's narrow focus, the class ultimately emphasized ways to fix the train system. However, the intent of the slide was to have students better recognize the severity of the

problem of rapid population growth and how it might prompt governments to engage in policymaking intended to influence the *size of the population*. Based on the experiences of Amelia during Implementation 2, we believe our interactive slide lecture scaffolds were only partially successful in improving Amelia's ability to focus on broader problems associated with demographic shifts for reasons we will discuss in the subsequent section.

### **Discussion**

We have described how aspects of this lesson evolved during the pilot year because of the lesson study process. Our focus so far has been on changes that were made to the instructional materials and lesson processes to enhance student learning. As we continue our examination of the second research question, we now consider how the revisions that were made relate more broadly to challenges Amelia encountered when enacting a PBGI curriculum. Our goal is to reflect on Amelia's experience during the pilot phase of the project in light of literature previously explored so to determine how we might better support project teachers as they work to adopt disciplined civic inquiry in geography during future iterations.

### **Defensive Teaching and Content Knowledge**

As we have noted previously, guiding students through an inquiry of any kind requires substantial content knowledge. When teachers do not have that knowledge, McNeil (2000) suggests that they are prone to teaching defensively to maintain control. Amelia tended to simplify and at times trivialize the problems depicted in slide lecture images to an extent that students failed to truly wrestle with challenges posed by changing demography. Amelia's limited geographic content knowledge made it challenging for her to lead students through in-depth examinations of population pyramids or images depicting problems associated with population change. While the project geographer used her time to introduce Amelia to reading population pyramids and the Demographic Transition Model and the lesson study team worked diligently to account for the cognitive demand placed on the teacher through teacher scaffolding, these efforts appeared insufficient for Amelia as an early career educator. She needed more sustained contact with in-depth geography content to be comfortable teaching it. However, we were encouraged that Amelia demonstrated a strong grasp of content within research lesson elements she designed and that she recognized multiple opportunities to improve scaffolding meant to structure student learning. To address difficulties with content knowledge in subsequent iterations of the project, we believe a multipronged approach will be necessary. We intend to lengthen the summer seminar to give the project geographer more time to explore content with future project teachers. We believe, however, that more time alone will be insufficient. We intend to coach our project geographers to create even more opportunities for participants to process and apply geographic knowledge and skills during their sessions so that the teachers themselves can improve their own geographic literacy. Lastly, we will seek to give future project teachers increasing control of curriculum design given that Amelia seemed most comfortable with those elements of the research lesson she developed.

### **Cognitive Demand and the Role of Scaffolding**

Amelia's inexperience with inquiry often led her to underestimate the cognitive

demands that PBGI places on teacher and students. Amelia failed to effectively deploy the scaffolding built into the research lesson to help students do disciplined civic inquiry, perhaps because she was stretched incredibly thin professionally and was unable to devote sufficient time to her research lesson preparation. Indeed, Amelia admitted she was unprepared to scaffold students as they attempted to interpret population pyramids during Implementation 1 because she underestimated the cognitive demands of doing so. In another instance, Amelia failed to effectively use preplanned questions for images of population change designed to help students link the images to the broader consequences of population change. We believe that Amelia needed a deeper understanding of how the structure embedded within the research lesson could be employed to assist students in doing disciplined civic inquiry and to overcome some of the cognitive demands placed on teachers leading inquiry. Yet, we were encouraged by Amelia's predisposition for using performance-based tasks as well as her willingness to offer concrete suggestions for improving the scaffolds within the research lesson. In subsequent project iterations with future teachers, we hope to reveal the underlying rationale for structuring learning. We assumed too much about Amelia's understanding of scaffolding and failed to deeply explore examples of scaffolds that have proven helpful for students doing problem-based inquiry in various social studies subjects. In subsequent years of the project, we hope to use seminar days to more deeply investigate how students can be supported to do PBGI with more strategic scaffolding.

### **Pedagogical Strategies to Develop Civic Competence**

Amelia did not immediately accept or articulate a civic competence mission for the teaching of geography which is not surprising given her status as a novice teacher. Amelia suggested that she took an "activity-oriented" (Wiggins & McTighe, 2011) approach to her teaching that focused on keeping her students actively engaged. While the lesson study team sought to structure each lesson so that it drove students towards larger questions surrounding appropriate demographic policies, Amelia missed several opportunities during the research lesson to guide students to more deeply consider how the content and pedagogical activities might support their development as competent citizens. Amelia did express some excitement during the seminar at the prospect of being able to link her civics curriculum more tightly with the geography portion of her course by orienting instruction around social issues. If the research lesson implementation was any indication, however, she may have remained unsure about the purposes to which she should put her geography teaching. Amelia did explicitly connect the research lesson to the unit central question, for example, but she seemed uncertain about how to link that central question to larger citizenship goals such as the ability to weigh competing policy options or the ability to empathize with diverse peoples. We believe future project teachers will need more specific examples of how teachers can link discrete geographic tasks to preparation for citizenship. One means to accomplish this goal is to explore existing PIH video cases in which veteran teachers consider the citizenship implications of their content and pedagogical choices.

### **Conclusion**

Civic educators (Saye, 2016) and geography educators (Bednarz, Heffron, & Huynh, 2013) both acknowledge the need for classroom studies that investigate the barriers to implementing challenging instruction like disciplined civic inquiry so that we can better

understand how to encourage teachers' efforts to do it well. We view our work as a first step towards accomplishing that objective within a geography education context. Our pilot study afforded us the opportunity to design a PBGI curricular exemplar that will be used to guide future professional development sessions as we move to full implementation of the project with additional teachers. We look forward to working with these teachers to overcome the challenges associated with PBGI and to the potential for developing more examples of exemplary curricula through lesson study. We are encouraged by the work of Bocala (2015) and others which suggests that as participating teachers gain more experience with lesson study, they become more willing to embrace their roles as curriculum designers engaged in the difficult work of challenging students. We look forward to engaging with teachers in observing classroom instruction, not solely for the purpose of picking up tricks of the trade, but for the purpose of directly assessing the impact of curriculum innovations on student learning. As our work evolves over time, we hope to better understand how students come to learn challenging geography concepts and how teachers might better support students in learning those concepts.

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## Appendix A - Design Principles

Learning should be purposeful

- Authentically situated in real-world situations
- Engaging; worth knowing
- Oriented around fundamental, ill-structured societal questions & values that call for decision and action
- Deep, sustained focus on meaningful content

Learning should be connected

- Organized around big ideas; key concepts
- Integrated into larger webs of meaning (expanding schema)
- Links between past and present; cause & effect
- Skills and dispositions are learned in the context of applying knowledge to authentic problems

Learning should be an active, challenging process

- Knowledge is socially constructed; a process of negotiating multiple truths
- Understanding past or present social reality involves model-building
- Bounded rationality limits individual ability to perceive complexity of social reality
- Importance of dialogue, discourse, deliberation for model-building & critical reasoning
  - Collective rationality
    - Uniqueness of individual experiences and perspectives in discussion give broader insights not available to solo thinkers
    - Defense of perspective/conclusions deepens understanding of issue and one's own position

Learning should be structured to encourage success

- All individuals are capable of higher order thought if supported
- Appeal to multiple ways of knowing & communicating
- Scaffolded to support deep, rigorous thinking
- Models provided for exemplary performance
- Collaboration to use peers as resources for understanding
- Sufficient time is allocated for serious thinking

Citation: Saye, J., & Brush, T. (2004). Promoting civic competence through problem-based history learning environments. In G. E. Hamot & J. J. Patrick (Eds.), *Civic learning in teacher education* (Vol. 3, pp. 123-145). Bloomington, Indiana: The Social Studies Development Center of Indiana University.

**Appendix B - “Framing the Unit” Lesson Study Scaffold**

**PIH Planning Log: Conceptualizing Instruction- Framing the Unit**

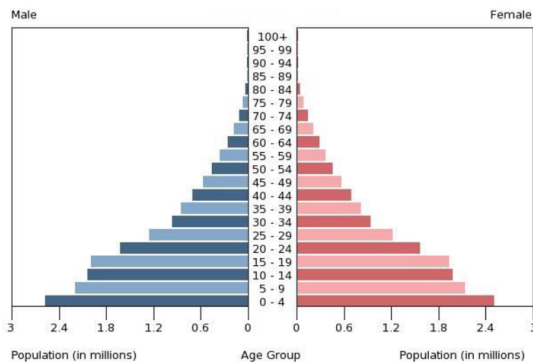
Name \_\_\_\_\_

<b>My Content Topic</b>	<b>The Persistent Issue</b>	<b>The Topic-Specific Central Question</b>	<b>The Culminating Activity</b>
<p><b>What is a topic that is rich and significant enough to deserve in-depth treatment?</b></p>	<p><b>What is the broad, recurring issue that might serve as a focus for organizing content related to my topic?</b></p> <ul style="list-style-type: none"> <li>• Does my question apply to a number of topics across time?</li> <li>• Is this question evaluative and ill-structured?                             <ul style="list-style-type: none"> <li>○ Would people disagree about the answer?</li> <li>○ Could evidence be offered for at least two different, defensible answers?</li> </ul> </li> <li>• What values are in conflict that make this a persistent, troublesome issue?</li> </ul>	<p><b>What is a more specific question that requires students to make a specific, evaluative judgment for which they will have to use knowledge gained from activities in this unit?</b></p> <ul style="list-style-type: none"> <li>• Does the question relate directly to the broad, persistent issue?</li> <li>• Is the question sharply focused so that students it calls for a clear student decision that they must defend with evidence?</li> </ul>	<p><b>What will my students do at the end of the unit to answer the unit central question?</b></p> <ul style="list-style-type: none"> <li>• Is the activity authentic? Is it something people might do in the real world?</li> <li>• Does the task clearly address the central question?</li> <li>• Have I planned for both individual and group accountability?</li> <li>• Is there a public performance that requires defense of position before peers?</li> <li>• Have I accounted for multiple intelligences so that all can contribute and demonstrate knowledge?</li> </ul>

## Appendix C - Selected Lesson Study Research Lesson Materials

### Understanding Population Structures

Directions: Read and interpret each of the population structures below. Take notes based on the prompts provided to the right.

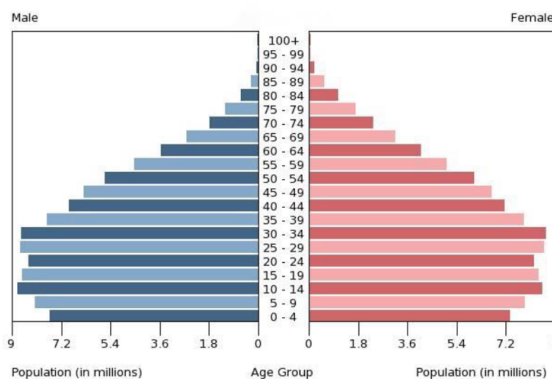


#### Notes:

1. Birth trend:
2. Death trend:
3. Male/Female comparison:
4. Which age group is dominant? (young, middle, old?)
5. DTM Stage?
6. What might cause a country to have a pyramid of this shape?

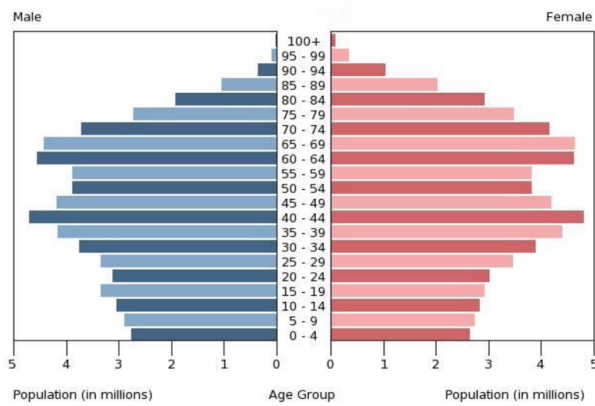
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#### Notes:



1. Birth trend:
2. Death trend:
3. Male/Female comparison:
4. Which age group is dominant? (young, middle, old?)
5. DTM Stage?
6. Why do you think this country has a different population pyramid than the country above?

**Population Structures (cont.)**



**Notes:**

1. Birth trend:
2. Death trend:
3. Male/Female comparison:
4. Which age group is dominant?  
(young, middle, old?)
5. DTM Stage?
6. What else can you say about this country based on the shape of its pyramid and DTM stage?

**LFQ:** What problems are presented by population change?

**To the Instructor:** Have students analyze this picture by working through the discussion questions. Then, provide students with additional details about the image, filling in gaps in their understanding. Finally, conclude by having two students “jump into” the slide to role play the two people pictured in the image.

What do you see in this picture? Where was it taken?  
 The buildings look like a factory or a factory complex because they share a similar brick pattern and there is a road connecting the buildings. There seems to be a parking deck in the image but it has trees growing through it so it has probably been abandoned for a while. The image suggests it was taken in a very poor country but was in fact taken in Detroit, Michigan in 2011. There are two people walking down the center of street who seem to be wearing all black. It could be that these people are criminals who might not want to be seen or that they are a part of a group that likes to wear black.

This image was taken in Detroit, Michigan in 2011 at Packard Motors Plant. When the auto industry collapsed, people left Detroit in huge numbers. Without people to pay taxes, the city could not maintain its roads, bridges, buildings, and industrial parks, which made even more people want to leave.



What do you think happened at this auto plant?  
 Detroit used to be the home of America’s car manufacturing industry. In 1950, Detroit was the 4<sup>th</sup> largest city in the USA. The auto industry, however, began moving to the suburbs. The result was that many people left the city. Within 50 years, Detroit lost ½ of its population. This picture specifically shows Packard Motors Plant. It was once considered the most modern industrial plant in the country. The plant was responsible for making luxury cars.





Role Play: What are you two people doing here?:  
 To help students hear the arguments again and to assess student understanding, bring a pair of outgoing students to the front of the room. Ask the students to “step into” the picture as the two people walking down the street. Acting as a reporter on the scene holding a microphone, ask the students questions like these below:

1. What’s your name?
2. Why are you here? What are you doing?
3. Where is everyone else?
4. Who caused all this damage? What happened here?

**Interactive Slide Lecture Graphic Organizer**

Unit Question: What strategies best address the problems presented by population change?

**Lesson Focus Question** for today: What problems are related to population change?

	Picture	Rapid Growth or Decline?	Problems associated with rapid growth or population decline
Slide 1			
Slide 2			
Slide 3			
Slide 4			

Migration Patterns (Slide 5) – What did you learn while interacting with the global migration flows graph?:

### Appendix D - Final Debriefing Question Script

1. In this lesson, we use a problem or question to organize instruction. What do you think of this?
2. How do you feel this lesson went compared with the last implementation in the Fall?
  - a. What went well?
  - b. Where did the students struggle? Why did they struggle?
  - c. What changes do we need to make to improve student learning?
  - d. How does this lesson compare to other geography lessons you might teach?
3. What do you think the students will remember the most from this lesson?
4. What is your level of confidence in teaching the concepts associated with this lesson/unit? 1- Very unconfident; 3= confident; 5 = highly confident
  - a. Why?
  - b. What would it take for your score to increase?
5. Do you have any ongoing objectives from this lesson that you will carry forward to remaining units? [Alternatively, does this lesson/unit support any broader goals you might have for the course? If so, how?]
6. Have you experienced or observed any unanticipated benefits from this project? [This could be for you or your students.]
7. What have you personally learned from your involvement in the study this year? How can we support your professional learning goals in the future?