

## ABSTRACT

COVEN, ROBERT MICHAEL. *An Action Research Study of Conceptual Modeling Pedagogy in High School History*. (Under the direction of Dr. Meghan Manfra).

This dissertation focuses on the ways in which conceptual modeling illuminates, supports, and enhances historical thinking; and examines the extent to which modeling can help students get past the misconceptions that form barriers on their way to gaining better understanding. Conceptual modeling is done in four phases—preparation, development, discussion, and deployment—and is designed to give students the opportunity to develop theory and derive meaning from historical evidence. The study asked: the extent students felt the integration of modeling as a pedagogy enabled them to attain concepts and skills central to historical understanding; how students perceived and described the processes involved in conceptual modeling and historical inquiry; and whether conceptual modeling had altered their view of historical inquiry, or on their more general thinking and learning.

This action research study made use of qualitative methods taken from action research methodology. Data were collected from student participants through metacognitive assessments and were analyzed through a multi-stage coding process. This research was conducted in a private high school and the participants, at the time of the study, were former students of the researcher/observer. The research was undertaken to better understand the perceptions students have of the role conceptual modeling plays in the development of what they see as the concepts and skills central to their historical thinking. The study demonstrated how the modeling pedagogy aided students in developing a more complex understanding of historical concepts (Bloom, 1956; Martorella, 1971; Timmins, G., Vernon, K., & Kinealy, C., 2005).

*Keywords: conceptual modeling, historical inquiry, authentic instruction*

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An Action Research Study of Conceptual Modeling Pedagogy in High School History

by  
Robert Michael Coven

A dissertation submitted to the Graduate Faculty of  
North Carolina State University  
in partial fulfillment of the  
requirements for the degree of  
Doctor of Philosophy

Curriculum and Instruction

Raleigh, North Carolina

2018

APPROVED BY:

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Dr. Meghan Manfra  
Committee Chair

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Dr. John Lee

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Dr. Margareta Thomson

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Dr. Tuere Bowles

**DEDICATION**

To Caroline and Madeline, who have seen me through all my trials and triumphs.

To Tom and Carole, too soon departed.

To my students—past, present, and future—the inspiration for my work.

## **BIOGRAPHY**

Robert Coven is in his 23<sup>rd</sup> year of teaching. He received a B.A. in international business relations from U.C. Berkeley, a master's in architecture from U.W. Milwaukee, a master's in the history industrial societies from U. Delaware, a certificate of advanced research and a master's in American cultural history from U. Chicago, and a Ph.D. in curriculum and instruction from NC State. He is interested in improving high school curriculum and ensuring students have agency in their education.

## ACKNOWLEDGMENTS

My sincerest thanks to my committee: Dr. John Lee, Dr. Tuere Bowles, Dr. Margareta Thomson, and especially my chairperson, Dr. Meghan Manfra. Your helpful advice, patient understanding, and necessary prompting eased my labors, enhanced my knowledge, and improved my product.

I extend my gratitude to my employer for providing logistical support, financial assistance, and an environment conducive to Discovery, Innovation, Collaboration, and Excellence.

To the members of S.T.E.P.: you exemplify the engaged scholarship that provides promise for our future.

Finally, to my wonderful friends. They provided the light at the end of the tunnel.

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# An Action Research Study of Conceptual Modeling Pedagogy in High School History

Robert Michael Coven

## Chapter 1: Problem & Purpose

### Problem

There is no acute crisis in history education. Unfortunately, this is not because the situation is good—quite to the contrary—the problems have existed so long that history in schools suffers from a chronic malaise and complacency. In poll after poll, students rate history as their least favorite high school subject (Loewen, 1996). Adding to the problem is the fact that school reform efforts tend to ignore social studies and focus on STEM (Science, Technology, Engineering, and Math) fields.

One of the chief purposes of education is to enable students to understand their world. This wisdom comes from critical thinking applied to knowledge—i.e. the ability to analyze raw data, in its many forms—to effectively determine the meaning and impact of a suggested course of action. For example, in a science class, critical thinking takes place when students gather observations from lab experiments and analyze them in accordance with concepts they have learned through earlier experiences. Historians collect and interpret evidence in analogous ways.

A problem often arises when the focus of education is on teaching rather than learning — the focus being on the teacher rather than the student. Good teaching is important, of course, but it must be in service to learning. A student can truly be said to have learned when they have knowledge that is deep, permanent, transferable, and useful.

Traditional learning is bounded by the teacher's perceptions of the subject and of the students (McDermott, 1993). This results in a predilection, on the part of educators, to teach as they were taught. The tried and (not so) true traditional method of history education remains

dominant in our schools. Despite numerous studies that have shown the relative ineffectiveness of teacher-centered instruction, history classrooms have changed little in the past hundred years. Much of history instruction is still lecture and textbook based, with an emphasis on the memorization of minutiae (e.g. names and dates) (Levstik , 2008; von Borries, 2000; Rosenzweig, 2000).

The modern classroom may have the latest gadgets: SmartBoards™, tablets, and projectors, but the instruction remains teacher centered, textbook based, and focused on covering content (Freyhofer, 2000). With almost universal and ubiquitous access to historical information, the need for this kind of rote learning is obsolete. Teacher-focused, content-heavy, textbook-guided practice serves the interests of administrators, parents, and teachers who seek a well-controlled, standardized, predictable curriculum in which students are asked to memorize and recall a discrete body of decontextualized facts (VanSledright, 2011).

Such rote work only provides the most tenuous grasp of the material; students are not able to translate or deploy what they “know” in different situations. Some “learning” takes place despite, not as a result of, this teacher-centered and positivist model of education. “Those who learn successfully from lectures, textbooks and problem-solving do so because they constantly question their own comprehension, confront their difficulties and persist in trying to resolve them” (McDermott, 1993, p. 297).

Sam Wineburg (1999) contends there is nothing “natural” about historical thinking<sup>1</sup>. Instead, the author says, people are psychologically wired to seek data and viewpoints that conform to their preconceptions. Perhaps this contributes to the cultural strife, born of a binary view of history, neatly encapsulated in the portrayal of those who supported the national history standards of the 1990s as “traitors,” and those that rejected them as “racists” (Wineburg, 1999).

Some students find aspects of a passive education attractive. The traditional pedagogy has clear rules, creating a system in which students learn to play their passive role: isolating and focusing on the material that will be on the test, learning the correct answer, and parroting when called upon to respond (Lévesque, 2008). Such sleepwalking requires little effort. In this way, students can glide through school—busily completing worksheets, taking notes, and repeating hoary platitudes—without the difficulties brought on by complex thought and learning (VanSledright, 2011).

There is a considerable literature regarding the sorts of content that should be taught in the social studies classroom—as content has been at the center of the discussion of curricular standards, e.g. Common Core. Less attention, however, has been paid to pedagogy that will aid students in better developing conceptual understandings and critical thinking skills that will be helpful to them in all their future endeavors (Levstik , 2008).

### **Conceptual Modeling in the History Classroom**

Conceptual modeling is done in four phases: preparation, development, discussion, and deployment. During phase I, “preparation,” the general topic is introduced, basic context is provided, and the development of research questions, and the research itself take place. In phase II, “development,” students—in collaborative groups of 3-4 members— develop visual/diagrammatic models that reflect their understanding of abstract concepts using data drawn from the directed, case-study research they conducted in phase I. In phase III, “discussion,” student (groups) present their findings to their peers and participate in a seminar-style conversation about the concepts and theories manifested in the models. Finally, in the deployment stage, phase IV, students are asked to test their theories and hypotheses by

investigating whether, when looking at additional data, the outcomes align with those predicted by their models.

These phases correspond to the critical thinking traits we seek to instill in students through the process of historical inquiry (Bloom, 1956; Martorella, 1971; Timmins, G., Vernon, K., & Kinealy, C., 2005). These characteristics may be summarized in the following list of habits of mind for historians—the format and style loosely based on an undated list one presented in the “Blueprint for Student Learning,” posted by the National Council for History Education (n.d.):

- Sophistication in verbal, written, and visual expression
  - Development of insightful observations
    - Independent use of the concepts in discourse and problem solving
    - More efficient retrieval of concepts with related ideas and information
    - Ability to deploy conceptual models when dealing with substantially different sets of data
  - The ability to develop better schemas and analogies
    - Ability to identify patterns and anomalies
    - Ability to make connections and comparisons
- Willingness to take intellectual risks
  - More openness to ambiguity
  - Shifting from seeking correct answers to seeking understanding
  - An eagerness to ponder competing theories
    - Engagement with students whose ideas differ

- Ability to build on other students' ideas
- Ability to synthesize opposing views
- More skill and independence in knowing how to learn in this discipline
  - A tendency to approach new problems with better strategies
  - More enthusiasm for the topic and course
  - A stronger sense of purpose in and identification with the discipline
  - Greater reliance on internal motivation
  - Being self-directed and self-correcting

Conceptual modeling was designed to incorporate these academic skills and instill these as habits of mind. Thus students, through authentic instruction, would make the intellectual leap from knowledge consumer to knowledge producer.

This action research study, with its focus on modeling as a means of scholarly apprenticeship, was also designed to investigate student conceptions of the historian's work and the discipline, itself. In this manner, the study was meant to address pedagogical and curricular issues regarding the nature of historical study.

### **Purpose**

I have taken as a personal mandate the conversion of passive students into engaged scholars. I choose the term "scholar" not out of pretension, but out of respect for my students. I want them to take their education seriously and to develop confidence in their intellectual abilities. In order to help them become historians, my students need to practice the skills of the discipline—do the things professional historians do. Similar to the work of Lévesque (2008), my study is designed to address whether student engagement in a range of scholarly activities will give them greater understanding of both the nature of history and the analytical skills necessary

to make meaning out of historical data – in other words to develop their historical thinking (Timmins, Vernon, Kinealy, 2005).

To improve my teaching practice, I have looked to adopt and adapt pedagogies that might better serve students in their pursuit of deep, significant, permanent, and transferable knowledge. The focus of this action-research study, conceptual modeling, will be on the ways in which the pedagogy—adopted from physics instruction and adapted for use in the humanities—leads the students to see themselves as scholars engaged in the activities of a historian, when they are engaged in conceptual modeling through data collection and model construction and deployment.

### **Research Questions**

The following research questions guided my study

- To what extent did students feel that the integration of modeling as a pedagogy enabled them to attain concepts and skills central to historical understanding?
- How did students perceive and describe the conceptual modeling process?
- How did students perceive and describe historical inquiry?
- Did students perceive any effects conceptual modeling has had on their view of historical inquiry, or on their more general thinking and learning?

### **Significance**

This study provides a framework to help those involved in the design and implementation of curriculum—particularly people dealing with secondary school history—understand the ways in which students experience the pedagogy known as conceptual modeling. The research fills a sizable gap in the literature. There has been very little exploration done into the use of modeling. While some attention has been paid to modeling instruction in the sciences—where the method was developed—there has been no exploration of modeling in the humanities. In addition to

filling this gap, the research will, it is hoped, lead to further qualitative and quantitative analyses of the pedagogies examined, and that this will lead to better, more authentic, more engaging history instruction.

This action research study focuses on the ways in which students feel conceptual modeling illuminates, supports, and enhances historical thinking; and examines the extent to which conceptual modeling is seen by students as helping them get a fuller and deeper understanding of the topics and the kinds of big questions historians ask about events, people, and contexts. The underlying goal is finding ways for students to acquire knowledge that is deep, permanent, and transferable.

## Chapter 2: Connections to the Literature

### History of Social Studies Education in America: Transmission or Transformation

Teaching is an unusual field. Many educators join the profession out of a sense of service, a desire to give back to the community. Teachers share this “calling” with a number of others: e.g. health care and social workers, clergy, and other public servants. The education of young people gives a special responsibility to teachers: school is the place of becoming. It is where the foundation is laid for who and what we can and will be, as individuals and as a society. That is why education has so many interested stakeholders—students, teachers, administrators, parents, policy makers, and business leaders—all with competing explicit and implicit agendas. This level of interest can, in part, be explained by the influence educators can have on the nation’s most precious resource: its children. As a result, an unusual level of scrutiny marks the profession.

Some fields of study receive more attention than others. Reading, writing, and arithmetic—therefore, English and math—are seen as providing fundamental skills. The sciences and world languages are considered key to success in an increasingly competitive global economy. These disciplines are seen as integral to the careers students will enter upon graduation. Social studies have not been so clearly prioritized. Education constituencies have tried to create a social science curriculum designed to impart skills while indoctrinating students with prescribed values. This has led to social studies practitioners trying to spin a ball on two axes. The result has been a field that bounces from solution to solution, without establishing a consistent goal—an uneasy state of punctuated equilibrium.

This perpetual imbalance and tug-of-war results in an attrition that leaves the discipline weakened by ambiguity and susceptible to outside influence. As a result, social studies is

politically charged and beset by continuous pendulum swings between “patriotic” and “progressive” curricula (Evans, 2010). Interest groups feel that by setting the curriculum for teachers, they can exert great leverage on the content and delivery of a body of material that is central to establishing student values and political beliefs.

Political tensions can, at times, overwhelm discussions of curricula. This tension lies at the root of curricular debates in social studies. Like the theorists, policy-makers, and teachers of the past, we are creatures of our times and world-views: our choice of content and pedagogy should follow from a program built on a clear understanding of why we educate and not one clouded by explicit and implicit (sometimes axiomatic and unconscious) agendas (Eisner, 2009). It is our charge to define the mission of social studies and to develop a curriculum centered on the needs of our students (Tyler, 2009). These two quests form the basis for curricular inquiry in the social studies.<sup>2</sup>

Scholars have presented a number of goals in teaching social studies. Barth and Shermis (1970) offered three broad goals: 1) citizenship transmission—focusing on “obedience to community norms, tolerance of the rights of others, and by rules and laws, etc.” (p. 744); 2) social efficiency, with the idea that the “acquisition of the attitudes and knowledge of social scientists will in and of itself prove sufficient” (p. 747); and, 3) reflective thinking—providing practice “in the skill of identifying social problems, evaluating social data, and making rational decisions” (p. 749).<sup>3</sup> These categories can be further simplified into a binary system with two focuses: means and ends. Social studies teaching tends to seesaw between them—at times, priority is given to the transmission of skills, at other times the concern is the transformation of society (see Appendix A).

The political thrust and parry that marked 20<sup>th</sup>-century education succeeded in throttling and preventing schools from reaching their potential as engines of change. Social studies has been driven by politics and defined by content. To be successful, however, social studies should be pragmatic, focusing on effective means to transformative ends. The goal of social studies should not only help students understand the dynamics of social and political systems—to make them more informed citizens—but to help them develop the broad, transferable, critical thinking skills that will aid students in all their endeavors.<sup>4</sup>

Social studies can help students "recognize relevance, dependability, bias in sources, and adequacy of data in regard to a particular question or conclusion" (Parker, 2008, p. 346) and meet the definition of higher-order thinking by going beyond the information given, to interpret, analyze, predict, deploy, etc.<sup>7</sup> (Parker, 2008, p. 351)<sup>5</sup>. A firm foundation in analytical reasoning—provided by teaching that focuses on multiple perspectives, skill development, and concepts, over the rote memorization of disconnected content—can prepare students to be better citizens, capable of identifying problems, arraying and analyzing relevant evidence, and making rational decisions (Barth & Shermis, 1970).<sup>6</sup> Through proper training, students are empowered to use the methods of professional practitioners to see the connections and larger patterns that are made visible through the authentic practice of multi-disciplinary skills (see Appendix B).

Much attention is paid to the value of education in the abstract, less to means and goals. Modern American education is an enterprise requiring the expenditure of considerable time and money. Our schools are powerful institutions, capable of "changing the behavior patterns of people" (Tyler, 2009, p. 71; Eisner, 2009); so, it is wise to be careful in our choice of curricula. The field of social studies is best used as a method of teaching important and transferable—perhaps universal—habits of mind, conceptual structures, and skills, rather than allowing

students to become mired in the promulgation of trivial content. Imparting analytical skills will prove more powerful than the transitory, ephemeral, and unforeseen consequences of indoctrination, social engineering, and the misapplication of science masquerading as teaching. The aims of education” should be to promote the good and the just by providing students with the ability to understand their world, face unforeseen problems, and create the world they envision (Noddings, 2009; Eisner, 2009; Kliebard, 2004).

### **Background on Concept-based Instruction**

One of the important goals of education is to help students develop habits of mind that will serve them well throughout their lives. Schools provide benefits to individuals and society. A good education can be the foundation for personal growth. More importantly, especially for social studies educators, schools can act as an incubator for good citizenship. To achieve these goals, young people must be provided with the skills and tools they need to make sense of their world and to act as agents of positive change.

### ***Historical inquiry***

We learn by constructing a view of our world. The tools and materials we use come to us from formal and informal sources. Our more ad hoc learning comes through a kind of cultural osmosis—the lessons we gain from our environment: e.g. our family and friends, media, temporal and geographic contexts, and the society that surrounds us. Schooling is the more intentional and formal source.

As more people have gained access to formal schooling, education has become institutionalized as a public utility. School, at least through high school, has become the most important shared experience for young Americans—one that is seen as influencing and framing thoughts and behaviors of the whole society. The impact of schooling has brought considerable

attention to the goals and means of education, from all facets of society. As a result, curriculum and instruction have become contentious subjects.

The debate over educational reform has become mired in a kind of intractable, internecine warfare, pitting proponents of what seem to be antipodal ideologies that are politically and culturally freighted. At the risk of oversimplifying, the progressives (romanticists) ask us to “follow the child” —as Maria Montessori famously put it—and focus on providing engaging and gentle guidance in order to bring out the innate, inquisitive qualities of our young charges. Traditionalists (essentialists) suggest that discipline and content should be our major concerns (Hirsch, 1996). The pursuit of either extreme has led to the faddish implementation of ineffective policies. A sensible course would be to take the good from each—to seek a middle course of well-regulated liberty (Rousseau, 1979) where discipline and freedom peacefully coexist and where students can benefit from the pursuit of both content and critical-thinking skills. Good education relies on a number of interdependencies, e.g. teacher and student, community and individual, math and science, English and history.

In 1840, Horace Mann complained about the inadequacies of the hidebound methods used for instruction:

The leading, prevailing defect in the intellectual department of our schools is a want of thoroughness,—a proneness to be satisfied with a verbal memory of rules, instead of a comprehension of principles, with a knowledge of the names of things, instead of a knowledge of the things themselves; or, if some knowledge of the things is gained, it is too apt to be a knowledge of them as isolated facts, and unaccompanied by a knowledge of the relations which subsist between them, and bind them into a scientific whole. That knowledge is hardly worthy of the name, which stops with things, as individuals, without

understanding the relations existing between them. The latter constitutes indefinitely the greater part of all human knowledge. (1891, pp. 59-60)

Mann is promoting the deeper, interdisciplinary understanding of history that comes from the inductive analysis of content, rather than the mere collection of information.

Much of history instruction is still lecture and textbook based, with an emphasis on the memorization of minutiae (e.g. names and dates). Such rote work only provides the most tenuous grasp of the material; students are not able to translate or deploy what they “know” in different situations. As Rousseau (1979) noted, children do not retain what they do not understand. They may memorize some superficial aspects, but they are unable to translate what they have memorized to a new context (see Appendix C).

Students often fail to see the forest for the trees, memorizing rules, dates, and names, without the flexibility to apply core concepts and patterns to different contexts. As Bain (2000) explains, [The] “complicated picture of the discipline does not fit a transmission model of learning” (p. 334). Students need to be able to visualize a correct internal image of, for example, how historical forces operate, as their teachers and experts in the field tend to do automatically.

Furthermore, traditional teaching tends to present history as an established narrative, comporting to the values and needs of the present (VanSledright, 2011). As a result, “students tend to have a static, formulaic vision of history. The past is filled with facts, historians retrieve those facts, students memorize the facts, and all this somehow improves the present” (Bain, 2000, p. 337). Locke (1996) suggests a different goal, positing that true education should be seen as “an increase of the powers and activity of the mind, not as an enlargement of its possessions... [That is,] reading furnishes the mind only with materials of knowledge; it is thinking that makes what we read ours” (p. 193).

Progressive educators have suggested changes that would put history instruction more in line with modern cognitive science and the theories posited by those studying motivation (Burenheide, 2007; Damrosch, 2007). More authentic and relevant modes of instruction, it is said, will lead to students being more engaged and motivated—and better-informed in areas that matter (King, Newmann, & Carmichael, 2009). These students will also better develop conceptual understandings and critical thinking skills that will be helpful to them in all their future endeavors. The literature on social studies education supports the use of experiential, or constructionist methods in the pursuit of greater student engagement and conceptual understanding.<sup>7</sup>

The conceptual modeling pedagogy that is the subject of this study represents an attempt to reconcile the discordant positions that have developed—taking the best of traditionalism and progressivism—and giving students knowledge and skills that are deep, permanent, transferable, and useful. The conceptual work done in modeling (Manfra & Coven, 2011) —creates a framework for instruction that prepares students for authentic intellectual work. In their 1993 article, Newmann and Wehlage outline five standards for “authentic instruction”:

1. “Higher-order thinking requires students to manipulate information and ideas in ways that transform their meaning and implications” (p. 9).
2. “Knowledge is deep or thick when it concerns the central ideas of a topic or discipline” (p. 9).
3. Connectedness to the world “measures the extent to which the class has value and meaning” outside the classroom, i.e. addressing “real-world public problems” (p. 10).
4. Substantive conversation measures the extent to which ideas are shared and students are engaged in a dialog” (p. 10).

5. Social support is achieved through “high expectations, respect, and inclusion of all students in the learning process” (p. 10).

A 2009 article, by King, Newmann, and Carmichael, further expands on these standards. The authors begin by defining “meaningful intellectual work” as involving the “original application of knowledge and skills, rather than just routine use of facts and procedures” (p. 44). In this later article, the authors emphasize constructionism, disciplined inquiry, and the value of the work outside of school.

Conceptual modeling provides students the chance to engage in authentic intellectual work (see Appendix D), by following the precepts outlined by King, Newmann, and Carmichael (2009). The authors suggest that students who are engaged in the construction of knowledge (see Appendix E) are more fully engaged in the process of historical inquiry and more likely to develop a deeper and longer-lasting understanding of the subjects they are examining (King, Newmann, & Carmichael, 2009).<sup>8</sup>

Historical inquiry provides its practitioners with a set of tools that is complementary to those provided by the sciences. The subjective variability inherent to the former serves as a counterbalance to the putative concrete objectivity of the latter. History’s greater disciplinary elasticity and ambiguity provides for the kind of “cognitive flexibility” (McClymer, 2009) that marks the most innovative thinking in the field. McClymer (2009) draws a strong contrast between the more free-flowing nature of historical inquiry and the mechanistic rigidity of chemistry, as exemplified in the boundaries formed by the latter’s use of memorized formulae or the details of the periodic table. McClymer (2009) calls upon teachers to make the most of this lack of structure, “to erase the boundaries between pedagogy and epistemology, that is, between studying and doing history” (McClymer, 2009).

What does it mean to “do” history? McClymer (2009) suggests that students need to wrestle with the artifactual and documentary evidence that form the basis of historical inquiry. More to the point, teachers need to direct their students to focus on what is most “interesting, revealing, and/or confusing” about a given artifact or text. For McClymer (2009), history should remain a puzzle—provoking more questions than answers.

Questioning is also at the heart of the work published by Seefeldt and Thomas (2009). For these authors, new media technologies provide greater access to the materials of the past—allowing the creation of a more democratic “framework through the technology for people to experience, read, and follow an argument about a major historical problem” (Seefeldt & Thomas, 2009).

The greater access to information and practitioners, that the Internet provides, affords students the opportunity to more easily collaborate with “librarians, technology professionals, and historians from different fields” in developing lines of inquiry that cross-disciplinary boundaries and traverse space and time. Untrammelled by some of the logistical restraints that previously hampered research, students are better able to access data and scholarship, in order to “form interpretive associations of their own” (Seefeldt & Thomas, 2009).

To “do history,” a teacher should find a way of engaging students in historical inquiry (Barton & Levstik, 2003; Downey & Levstik, 1998; Foster & Padgett, 1999)—perhaps through the use of primary sources. Students develop historical thinking skills as they examine original, historical evidence and develop their own interpretations about the past (Sexias, 1998; VanSledright, 2002; Wineburg, 2001). According to Milson (2002), “The research base has indicated that students learn history most effectively when they are engaged in asking historical

questions, collecting and analyzing historical sources, and determining historical significance” (p. 348).

A variety of heuristic have been developed by educators to scaffold student historical thinking.<sup>9</sup> For instance, Hicks, Dolittle and Ewing’s 2004 article on SCIM-C (Summarizing, Contextualizing, Inferring, Monitoring, and Corroborating) is designed as a tutorial to move students through forensic vetting in five categories: summary, context, inference, monitor, and corroborate. They believe that students, through practice, will internalize these historical thinking skills. A more pessimistic note was struck by earlier theorists. Barth and Shermis (1970) suggest that such inquiry-based and interdisciplinary methods might be difficult to sell in an anti-intellectual society resistant to theory and critical thinking. In the view of Barth and Shermis (1970), Americans are much too ready to focus on the pragmatic, looking for the materially useful and beneficial rather than exploring the more ephemeral world of ideas.

### ***Reflective inquiry***

Despite their misgivings, Barth and Shermis (1970) provide a path to better learning through reflective inquiry. Through this method of learning, students are guided in identifying relevant and significant problems, developing probing questions, making the kinds of connections Locke (1996) outlined—in his, *Of the Conduct of the Understanding*—and examining evidence through the lens of interdisciplinary criteria. According to Milson (2002), “The research base has indicated that students learn history most effectively when they are engaged in asking historical questions, collecting and analyzing historical sources, and determining historical significance” (p. 348). Students develop historical thinking skills as they examine original, historical evidence (Jefferson, 1984; Dewey, 1915) and develop their own

interpretations about the past (Sexias, 1998; VanSledright, 2002; Wineburg, 2001; King, Newmann, & Carmichael, 2009).

Educators and philosophers have long acknowledged the power of this kind of auto-didacticism. As Rousseau (1979) remarked:

We acquire, without doubt, notions more clear and certain, of things we thus learn of ourselves, than of those we are taught by others. Another advantage also resulting from this method is, that we do not accustom ourselves to a servile submission to the authority of others; but, by exercising our reason, grow every day more ingenious in the discovery of the relations of things. (p. 410)

The rewards of authentic intellectual work make it worth the effort. Authentic learning, according to King, Newmann, and Carmichael (2009), takes place when students are able to apply the skills of practicing historians to analyze evidence, and parlay their prior knowledge into developing a clearly articulated and deep understanding of the past (King, Newmann, & Carmichael, 2009). Mann (1891), in his 1840 report to the Massachusetts Board of Education, provides support for this, saying that:

[A] systematic acquisition of a subject knits all parts of it together, so that they will be longer retained and more easily recalled. To acquire a few of the facts, gives us fragments only; —and even to master all the facts, but to obtain them promiscuously, leaves what is acquired so unconnected and loose, that any part of it may be jostled out of its place and lost, or remain only to mislead. (p. 62)

Many of the critical thinking skills called for by Mann and other educators can be found in conceptual modeling. The pedagogy emphasizes the examination of data and reflection on broader themes and bigger questions.

## **Conceptual Modeling**

Conceptual modeling is a method that falls within the progressive theoretical framework of social constructionism (Crotty, 1998; Creswell, 2007; Hesse-Biber & Leavy, 2011). This methodology can be aligned with historical thinking. Through the construction of visual representations of mental models, students create meaning and theory (VanSledright, 2011). The social aspect is a product of developing their models—in collaboration with classmates—within a given context of time and place. That is, the kinds of theories students put forth and the meaning they ascribe to events are, in part, determined by the socio-cultural environment in which they do their work.

Conceptual modeling is a pedagogy that responds to the need for authentic intellectual work in the social studies (King, Newmann, & Carmichael, 2009). History is a verbal discipline, one that traditionally uses text as both input and output. But humans are, by nature, visual. Our remarkable brains developed in a pre-literate context, in which we navigated and understood our environment through our senses—mainly that of sight. Our brain is hardwired to see patterns and connections and to recognize similarities and anomalies with incredible speed—thanks to the effectiveness and acuity of visual cognition. The rapidity with which we make these associations—creating mental pictures—is a hallmark of human intelligence and creativity (Ayers, 1999).

The epistemology of visualization and perception lies at the heart of modeling. And that is what makes it so transformative and effective in producing actual learning. The student actually changes her/his worldview and sees the world differently, in a more sophisticated, nuanced way. In effect, the insights that history teachers hope will come with time and experience in studying history, and which have become an almost unconscious yet powerful

force in their own historical thinking, will come about because conceptual understanding and theory generation have been foregrounded to the focus and goal of the class.

### ***Conceptual modeling in the physics classroom***

Conceptual modeling is a constructionist technique borrowed from physics education. Modeling Instruction began when a college physics teacher, Malcolm Wells, discovered that even when using inquiry-based teaching methods, students generally did not exceed a 40% retention rate, as measured on the standardized “Force Concept Inventory” (Hestenes, 2000). He realized that no matter how much the teacher asserted the rules of physics, the students systematically misunderstood them and continued to apply their own, pre-Newtonian, concepts to the experiments and homework problems (McDermott, 1993). Physics teachers who used modeling techniques had retention rates of 60-80% on the aforementioned “Force Concept Inventory” (Hestenes, 2000). These physics modeling practitioners suggest this was likely because students in modeling classes developed their own visual representations of theories, processes, and forces, which enhanced their understanding of the material presented.

In a physics course that uses modeling, students conduct the usual lab experiments, but set out on their path of learning without formulas or textbook problems to solve. Instead, they diagram what is physically happening, and explain their theories to each other. They extract their theory from the data, and then try it out on new problems, predicting what their results will be. In this fashion, their understanding of the physicality of the problems evolves before they encounter the associated formulas. Physics modeling causes students to confront their potentially incorrect preconceived notions and correct them through dialogue with their peers. As they reach consensus on a diagram that represents what really happens, their internal, mental model of the physical world changes to represent reality.

The discipline of physics relies on a set of discrete laws that can be represented visually as models. Therefore, instead of studying formulas (which provide a relatively narrow understanding of the laws on which they are based), students study their own models and the kinds of problems to which they apply. The formulas are also easier to recall and employ because they can be re-derived from diagrams and graphs that make physical sense.

### ***Conceptual modeling in the history classroom***

There are, of course, important disciplinary differences between physics and history. In the typical physics classroom students work toward already established models created to describe the natural world; students in the history classroom must wrestle with the ambiguity of historical interpretation, without the benefit of such laws. As a result, students must make informed decisions about the relative significance of historical evidence, wade through a large volume of resources, look for patterns, and make judgments (not necessarily true or false) about the past. The epistemological differences between the sciences and humanities raise a concern Hirsch (1996) mentions when he suggests that critical thinking skills are domain-specific and not transferable.

A second of Hirsch's (1996) concerns is that an inquiry-based curriculum will not provide sufficient content. Good modeling, however, provides content and concepts. Modeling cannot occur, nor skills and concepts be imparted, without the provision of appropriate material to analyze. Students build and test models with historical data—the better the material, the stronger the model – and they need a basic background in historical context and content to perform proper analysis and theory construction. Therefore, in order to facilitate and guide student work, modeling teachers must be well versed in their fields in order to select resources that are accessible, pertinent, and relatively free of distracting minutiae (Locke, 1996).

The focus of a social studies model is on broad concepts, e.g. theoretical frameworks, forces, and themes—the why, more so than the who, what, where, or when. The latter are still processed by the student, but in modeling this information serves as source material (like lab data) from which to extract underlying processes, forces, or theories. A student who understands, for example, the way the transcontinental railroad in the United States acted as a force of change, of technology overcoming nature, and of transportation as a spur to migration or as a means of exclusion, can see how that the same pattern of consequences occurs with other new technologies, such as the telephone, television, superhighways, and the Internet. Students, through modeling, consider historiographic methods that experts consider: defining and refining their terms, examining the relevance and credibility of sources (Wineburg, 2001), and making use of methods and metaphors from outside the purview of a typical humanities course. Class discussions become seminars of peers, in which all are engaged in examining the models the groups have offered.

The modeling pedagogy applied to the study of history, including the integration of primary sources and group deliberation, culminates in the student presentation of a “model,” or an “external representation” (van Drie, van Boxtel, Jaspers, & Kanselaar, 2005), to describe the historical phenomenon under study. Whereas writing is a common external representation used to move students toward deeper historical understanding (Voss & Wiley, 1997), here students create visual diagrams, in the most simple, general terms possible, to describe their understandings about the past (see Appendix F, G, H, and I for examples of student models) . This step challenges students to begin to see patterns in their world through their study of historical data—economic cycles, for example. In the process of developing a model, students come to recognize patterns that help them make sense of past and present (and provide plausible

guidance for the future). Students come to understand that history is an integrated and interconnected system—influenced by common forces—and not a random set of events.

Modeling's main method of creating this understanding—the construction of explanatory metaphors—is one quite familiar to any English or history teacher. Wormeli (2009) extols the many virtues of learning through metaphors. Through visual metaphors, often drawn from their knowledge from other disciplines, students display their understanding of tell-tale patterns and connections. Students can see the ways in which forces interact, how cause leads to effect, where events overlap, the speed at which epidemics spread, the hierarchy of a class system, and the complexity of trade networks.

Students often use analogies drawn from science—cells, chemical equations, Newtonian physics, complex food webs, natural selection, genetics, etc.—in their models, to help explain historical phenomena and processes. For example, in developing a model on cultural diffusion through trade, a group might draw an image of the semi-permeable barrier of a living cell to represent the combination of free flow and restriction in a particular trade system (Other examples of the kinds of imagery and visual metaphors students use in their conceptual models can be found in Appendix F, G, H, and I). The process of discussing and creating these very metaphors and connections, along with the simplified diagramming, makes abstract concepts meaningful and memorable so that students retain their understandings and can apply them to similar situations.

### ***Conceptual modeling as a visual approach to historical thinking***

Although modeling is designed to provide a simplified, visual representation of a concept, process, or system, this does not mean the method is merely reductionist. In order to help avoid over-simplification, student groups are often given different sub-topics on which to

focus their research and model development. For example, for the Rise of the City class—one of the sources for the findings of this study—each student modeling group was given a different set of cities on which to focus (see Appendix J). This results in a larger scale of complexity—giving the class the opportunity of a deeper and broader view of the historical concept being investigated.

According to researchers, this authentic inquiry motivates and engages students. By giving students the opportunity to ask important questions (Damrosch, 2007) and to construct their own conceptual framework (through modeling), they become engaged participants, internalizing “the historical facts that are often the goal of other [pedagogical] methods” (Burenheide, 2007, p. 57), and able to perceive patterns and transfer their knowledge to novel situations. (McDermott, 1993). Self-derived, visual, and powerful models provide students with a conceptual framework that allows them to understand complex situations. It is, perhaps, ironic that simplification (modeling) can lead to a more sophisticated and nuanced view.

### **Step-by-step Approach to Integrating Modeling in the History Classroom**

The modeling pedagogy is recursive in nature—similar to the way Hesse-Biber and Leavy (2011) present inductive analysis, their: “Dynamic Dance” (see Figure 3.1). In conceptual modeling, as it is implemented in history, groups of three to four students are asked to collaborate on discovering underlying patterns revealed through their analysis of historical data and case studies. A typical modeling unit begins with the kinds of research tasks familiar to any historian. This process of examining primary and secondary materials—analogue to a lab experiment in physics modeling—provides students with historical context and data.

After the collection and preliminary analysis of data, students go through a sifting process—eliminating topics that are tangential or too broad, and deciding what, ultimately, to include.

The central activity of modeling, the construction and visual representation of a concept, is done using two-foot by three-foot whiteboards<sup>10</sup> to prepare a diagram of a theory or concept.<sup>11</sup>

The whiteboards have multiple functions: they provide a medium for communication, establish the scope of the problem, and record insights. Whiteboards are preferred over large sheets of paper or computers because they can easily be erased and revised throughout the thinking process. Whiteboards also provide a convenient size for small group work; three students can easily access and see the board, and all of them can have a certain amount of say in what gets diagrammed. The whiteboard is not considered finished until the whole group agrees that what is on the board represents their conception of the theory or idea being modeled. Group dynamics shift and grow as the students who hold a marker, or the eraser wield power in their search for consensus.

The teacher provides the student groups with a set of heuristic tools to aid in the model construction process. These study aids give students a framework for understanding the often cyclical nature of a civilization's of development (Appendix K); the subfields of history (outlined under the acronym, EPICS, which stands for Economic, Political, Intellectual, Cultural, and Social)—in which students may observe the complex interaction among a variety of causes and effects (Appendix L); and some of the powerful forces that move historical events (Appendix M).

As each group develops their models, students are pushed to engage with their peers, to discuss and explain the rationales behind their ideas and arguments—sometimes addressing metacognitive topics like process, theory, and abstraction—and, perhaps most importantly, to listen to the ideas of others. As students draw, they are compelled to explain their reasoning behind their work. Inconsistencies are revealed, requiring revisions to the diagram, but also to

the student's initial idea. At this point, students often revise their diagram to reflect their developing conceptual framework, the "forest" that they have extracted from the "trees" of the materials they have collected in their research, as facilitated by the teacher. The drawing represents the "shape" of their idea. In examining historical case studies, students might diagram the forces acting on a character or historical figure, or depict a pattern seen in events and their consequences. The best diagrams are clean, with simple, clear shapes representing perceived forces, relationships, and patterns. The models are simplified and abstract representations that students can manipulate, mentally or actually, to depict different situations or to be applied to other contexts. The goal is not to create a work of art or representational cartoon but to offer a visual tool for discussion (see Appendix F, G, H, and I for examples).

During the model construction process, the teacher engages in what has been termed "Socratic hovering." This refers to the practice of the teacher moving from group to group, querying the students about their ideas and the elements of their model design, and facilitating deeper thought. This interrogative mode requires some finesse, as the teacher is meant to provide guidance without taking control of the process.

The intellectual exchange that occurs is an important component of critical thinking. In the presentation phase, students explain how their diagram represents the theory that their group has developed. Some groups will have well-developed theories and diagrams, while others will be less encompassing and may even contain errors of analysis and judgment. The group discussion exposes these inconsistencies, not to find fault, but to account for differences and missing or incongruent elements—using these comments to aid in the recursive process of theory construction. More importantly, students once more revise their internal model to something that

will be useful to them. As students gain confidence, they learn to separate themselves from their work, allowing for greater insights.

The students generate a brief one-to-two-page analytical essay at the culmination of a modeling unit (see appendices N, O, and P for examples). This essay, written after the presentation phase, allows students to reflect on and connect to the work of their peers—allowing for the kind of complex collaboration often missing when thoughts, via the typical paper, are transferred only between teacher and student. Thus, enhanced connectivity is made possible by the shared process of model development, analysis, deployment, and presentation.

The summative essay provides an additional vector for authentic historical inquiry and the dissemination of knowledge. The practice of writing adds a further layer of scholastic rigor to the conceptual modeling process, as well. By the end of the trimester, each student has developed the equivalent of a three-to-five-page research paper and has made use of key skills related to historical inquiry, e.g. the selection of a topic, development of research questions, collection and analysis of relevant data, construction of a conceptual framework, presentation of a well-supported and logically argued theory—in a seminar setting of critical engagement with peers—all on the way to a summative self-reflection. In their analytical essays, students make use of the knowledge they gained in all phases of the conceptual modeling process to create deep, permanent, useful, and transferable understanding (see Appendix L).

The objective of modeling is to engage students in the development of disciplinary skills, the construction of knowledge, and most important, to help them through the barriers that prevent them from taking a firm hold of important concepts. In so doing, modeling is a means of imbuing students with habits of mind that will serve them in all their pursuits as thinking individuals. As Wineburg (2001) states:

High school students can know a lot of history but still have little idea of how historical knowledge is constructed. It is doubtful that teaching these students more facts . . . would help them [understand history] better . . . when they remain ignorant of the basic heuristics used to create historical interpretations. (p. 84)

Conceptual modeling pushes students to go beyond the superficial. Modeling is, at times, painful for students because they must grapple with ideas instead of simply writing down what the teacher says. Students are asked to seek clarity from ambiguity, to discern patterns, pose their own questions, wrestle with presumptions and misconceptions, and ultimately to create theory and meaning. Modeling helps students create new language to express new thoughts. But they need encouragement as they struggle to find meaning within material that baffles them. This confusion is not a problem but a necessary step that students must go through in order to change their mindset. They must discover and construct theoretical frameworks, not have it handed to them for memorization, as the latter does not lead to permanent change in the student's view of how the world operates.

In modeling, there is no single correct answer, nor one way to arrive at a solution. This puts process above product—favoring mastery over performance. The models, and the discussions that follow, push students to seek insight from self-reflection and from their peers. For learning—a deep understanding of concepts combined with transferable skills—to take place, students must believe that the tasks set before them have value—to themselves and others. They must also believe that both the process and product have importance and utility (Burenheide, 2007; Damrosch, 2007). As Locke (1996) states, we should “make the child comprehend (as much as may be) the usefulness of what he teaches him and let him see by what he has learned that he can do something which he could not do before” (p. 125). Developing theory through

modeling is challenging, but the challenge makes the success sweeter (James, 1922). Theoretical modeling engages students in a way that the material takes on relevance and immediacy it simply cannot attain in a textbook and lecture environment. The research, analysis, and presentation proved students with practical experience in doing authentic historical work.

When students feel competent at completing a valued task (Wigfield & Eccles, 2000),<sup>12</sup> they tend to do a better job of availing themselves of productive metacognitive strategies (Schunk, et al., 2008). These improved strategies have been shown to correlate with better academic performance overall by helping students attribute their success with the modeling method to stable and intrinsic factors (Schunk, et al., 2008). As prior success is a component of a positive self-concept, success leads to positive expectancies for similar tasks in the future and may also lead to greater enjoyment of particular tasks and disciplines, i.e. task-value (Burenheide, 2007; Damrosch, 2007). Thus, success breeds success—a positive, self-fulfilling, self-perpetuating recursive cycle leading to even greater achievement (Hirsch, 1996).

The modeling pedagogy, in addition to emphasizing authentic, hands-on experiences for students, encourages students to interact, collaborate, and develop consensus-based representations of their understandings. Students build on one another's ideas—a cross-pollination that is at the crux of collaboration. In historical education this means that students are working in groups to engage in historical thinking. Often this may lead to controversy and debate, but ultimately helps students develop not only deeper understandings (longer term memory), but also skills we associate with civic engagement (Dewey, 1915; Hess, 2002).

In modeling, done properly, students engage as equals, teaching and being taught by each other. As Locke (1996) suggests: “When anyone has learned anything himself, there is no such way to fix it in his memory and to encourage him to go on as to set him to teach it others” (p.

137). High school students may not be as capable as adults at viewing history through multiple lenses or have all the content knowledge necessary for in-depth analysis, but they can be moved toward a more complex view of history (Dulberg, 2005). The historical thinking (VanSledright, 2011) that is fostered by the construction of conceptual models allows participants to come to an understanding of important historical concepts and pushes students to confront the deep, historiographic issues that form the core of the discipline. As the students create meaning from the analysis of historical data, issues such as the varying interpretation of evidence—as a product of context and bias—contrasted with the commonalities of forces seen in multiple times and places, provides students with insight into the nature of history as a field of study (Sexias, 1998; VanSledright, 2002; Wineburg, 2001; King, Newmann, & Carmichael, 2009).

The development and presentation of models challenge students to begin to see patterns in their world through their study of historical data. They begin to recognize, for example, migration patterns, cultural trends, political cause and effect, and economic cycles. In the process of creating a model, students often develop a metaphor to depict the patterns with which they make sense of past and present (and provide plausible guidance for the future). Students come to understand that history is an integrated and interconnected system—influenced by common forces—and not a random set of events. All of this becomes part of a student's transformed worldview.

### Chapter 3: Research Methods

I chose to examine modeling in consideration of the largest pedagogical change I had made in my classroom practice. What I term “conceptual modeling” was introduced to my classes in 2009. This innovative teaching method was adopted from physics instruction and adapted to the humanities (Coven & Hamilton, 2009). I was in active conversations with my colleagues in the upper school at Private Suburban Day<sup>13</sup> regarding conceptual modeling, from our introduction of modeling in the humanities in 2009 until 2015, when staffing changes put the group in hiatus. During that six-year period, we met for at least one-hour per week to observe, examine, analyze, and provide feedback with the aim of making improvements to this modeling method.

In 2011, Meghan Manfra and I co-authored an article on modeling: “A digital view of history: drawing and discussing models of historical concepts.” (Manfra & Coven) This article was the result of a qualitative analysis of approximately three years of modeling practice in my classes. The purpose of the article was to provide a snapshot of then current modeling instruction in the humanities.

One outgrowth of these internal studies was an initial, quantitative pilot study, conducted in the spring of 2013 (See Appendix Q for aggregated variables) and designed to provide background for further research. The intent was to use the results to help me focus on the significant questions that might prove fruitful. The questions for this pilot study focused on the components of modeling—e.g. collaboration and research—and to what extent these procedural aspects were valued by students. The results appeared favorable toward the pedagogy, particularly in comparison to more traditional methods of instruction—textbook, lecture,

multiple-choice questions—and the power of the group model development and presentation phases.

However, my research took a slightly different path and I ended up not using the pilot study as a source for my research questions. The research questions came more directly from the metacognitive assessments I had been giving my students as part of my school-approved professional development.

### **Research Questions**

The following research questions guided my action research study:

- To what extent did students feel that the integration of modeling as a pedagogy enabled them to attain concepts and skills central to historical understanding?
- How did students perceive and describe the conceptual modeling process?
- How did students perceive and describe historical inquiry?
- Did students perceive any effects conceptual modeling has had on their view of historical inquiry, or on their more general thinking and learning?

### **Method: Action Research**

My research questions address student constructs related to their understanding of their learning of disciplinary concepts and skills through the conceptual modeling pedagogy. I chose the action research method as it is well matched to study student responses to the conceptual modeling method. Both action research and conceptual modeling follow from a constructionist position that people make meaning out of patterns discerned through their subjective experience of a given context.

Therefore, I chose a qualitative, constructionist methodological framework to guide my research. Social constructionism<sup>14</sup>—the interpretive community to which action research

belongs—is a philosophical stance that posits, “meanings are negotiated socially” (Creswell, 2007, p. 21). What Hess-Biber and Leavy (2011) define as “social constructionism” meets the criteria of action research. They portray this stance as one in which meaning is drawn from the participants’ viewpoint and that, “[r]ather than starting with a theory (as in postpositivism), inquirers generate or inductively develop theory or pattern of meaning” (Creswell, 2007, p. 21). Constructionist researchers see their work as subjective, and take into account the idea that their values, experiences, and context will inform their interpretations, and those of their participants. This type of research suits the pedagogical objectives of the study.

I have chosen to pursue an action research study to further probe my own teaching practice and its impact on students (Mills, 2011). This action research method looks to those most closely involved in day-to-day education—student, teacher, caregiver, etc.—to engage in research in order to gain insights into the elements of education and to effect positive reform (Mills, 2011). The action research methodology calls for teachers to become more involved in defining their craft and model a more democratic form of school authority (Mills, 2011).

In important ways, action research coincides with the conceptual modeling pedagogy. As in modeling, social constructionism lends itself to the kinds of discoveries and interpretations of meaning—tenets of constructionism—that can result from inductive reasoning and recursive analysis (Hesse-Biber & Leavy, 2011; Rust & Clark, 2007; Creswell, 2007).

The criteria by which action research should be judged are, in essence, those inherent to any good research plan and appear in many works focusing on inquiry. There are, however, five major elements particular to an action research project. (Rust & Clark, 2007). First and foremost, the teacher must make a commitment to the task; that is, they must take “a professional stance centered on inquiry” (p. 5) and self-reflection, with the further understanding that the study will

require considerable time and pose professional risks. Second, action research takes place in a natural setting, like a classroom (Bilgili, 2005). In such a location, the researcher should direct her/his attention to gathering and analyzing data—in the constructionist sense, making meaning out of experience. Data should be collected from sources, directly related to the subject of the study and should arise from classroom practice e.g. samples of student work, surveys, and self-reflective writing. The analysis is a process—like that found in conceptual modeling, of finding patterns, sequences, and other kinds of relationships. (The authors add the publication of findings to this stage, as well.) Rust and Clark's (2007) third element calls for practitioners to respond to the research by implementing suggested improvements into their practice. Fourth, the teacher should carefully craft his/her study in ways that will address issues important not only to the participant-researcher, but to a larger educational community. As a result, one of the most challenging and most important elements of action research is framing good questions. The research questions employed to guide the study are usually open ended. Finally, the fifth element can be seen when the researcher begins again—posing new questions that lead to further research. Thus, pivoting toward the beginning of a new action research cycle<sup>15</sup> (Anderson, 2004).

I have chosen this constructionist and interpretivist approach—i.e. action research—because I believe the construction of understanding, through the recursive analysis of the perceptions of participants—the subjective and contextual manner in which people make meaning—is the best way to know and understand less-traveled areas of inquiry. Conceptual modeling is one such area. There is little or no literature on this pedagogy.

## Process

Creswell (2007) suggests there are four basic methods of data collection in qualitative studies: observation, survey, interview, document and audiovisual materials analysis. More specifically, in light of my choice to use the action research method, I selected a collection process that reflected my pedagogy and classroom practices (Mills, 2011). Therefore, I chose to focus on metacognitive assessments with prompts designed to elicit self-reflective writing. These kinds of evaluative assessments have been a standard part of my teaching, to further my professional development. In line with the precepts of action research, these student evaluations allowed me to make positive changes in my classroom practice (Koshy, 2010). As a side benefit, such practices have been shown to increase student engagement and understanding (VanSledright, 2011).

In the spirit of action research (MacLean & Mohr, 1999), my students aided in the design of an initial survey protocol (Appendix R) which, due to the changed nature of my research, was not used. The students I asked to help me in this endeavor were familiar, on an introductory level, with action research through our work in the STEP (Shifting the Educational Paradigm) club I sponsor at my school. The club regularly discusses educational research, particularly pertaining to pedagogy effectiveness, and has sponsored three conferences on teaching and learning for area teachers, university faculty, and secondary and post-secondary students.

The discussions I had with my veteran-modeler, STEP students, focused on crafting questions that would elicit student responses to modeling and the discipline of history. This discussion of what should be included as descriptors, and why, is an example of the kind of critical thinking my project is meant to engender.<sup>16</sup>

One product of this collaborative work was a brief—4 questions in 2 sections—qualitative and focused metacognitive assessment instrument (finalized March 2015); the one that was used with my PATH classes, for this study (Appendix S). This assessment was developed as part of my on-going professional development process. A second, longer and more-detailed six-question metacognitive assessment (Appendix T) was also used for this study. It was given to veteran modelers; students who had been but were no longer enrolled in classes I taught using the conceptual modeling pedagogy. Many of these students were also members of STEP.

### ***Potential limitations of action research***

Action research can be a powerful methodology, but it has limits and drawbacks. The first of these is the time commitment. Teachers often do not have adequate time to perfect their lessons, let alone take on the considerable commitment of a research program. Collaboration—i.e. teacher research groups—is given as one means to reduce the burden (MacLean & Mohr, 1999). This project has a more limited form of collaboration, with students acting as informants.

The often-qualitative nature and small sample size of action research, limits the scope of the investigator's conclusions. While, for a teacher, a single classroom can sometimes seem the world in whole, this is obviously not the case. So, the conclusions drawn from action research findings apply to the case at hand.

### ***Potential benefits of action research***

While the findings of action research are rarely generalized beyond a given classroom, this kind of research can still bring educational reform (Bilgili, 2005). Action research adds self-reflection and progressive change to the common research goals of explication and discovery.

Action research is characterized by a desire for curricular reform and instructional change. This can mean bringing change to (at least) a single classroom, but it can also mean something larger: social justice reforms. Anderson (2004) provides a testimonial to the power of action research, from the perspective of a high school teacher:

It isn't just what we learn from our [research] projects. It's an attitude about teaching.

When we have a problem in this school, we don't just sit around and complain about it anymore. We face up to it. We ask the question. We collect information. We solve our problem. In a way, we've taken control of our professional lives. (Reed, 2007)

Action research empowers teachers, providing them opportunities for greater engagement in the development of policy and enlarging the scope of their work.

Practitioner research assumes that teachers are scholars, by profession and by calling, and should be fully engaged in research. We owe it to our students to practice what we preach: ask questions, seek answers, engage with and continue our learning (MacLean & Mohr, 1999; Rust & Clark, 2007). To not devote considerable attention to research, as an essential component of our professional lives, risks further demeaning our status and effectiveness as teachers (Rust & Clark, 2007; Reed, 2007; Anderson, 2004). As MacLean and Mohr (1999) clearly state:

As long as teachers don't conduct research and don't take an active part in professional life, they are not viewed as people who need the time to think, reflect, and research.

They continue to be seen as knowledge users, not knowledge makers. (p. 133)

As conceptual modeling seeks to make students producers and not mere consumers, so action research provides them the opportunity to be policy-idea generators and change makers. Action research is an explicitly democratic approach. This is one of the reasons I sought student collaboration.

MacLean & Mohr, (1999), put forth their belief that teaching can be improved by broadening control and authority in the classroom and, as a result, engaging parents and students and giving voice to those usually left unheard. By having the students collaborate on action research, as well as instruction and the classroom environment, they become more than bystanders to their own education. Giving power to students poses risks, e.g. the teacher losing or being perceived as losing control, but the spreading of power creates a more equitable and engaged classroom (MacLean & Mohr, 1999).

### **Framework of Courses**

A significant portion of the data for this study were collected from metacognitive assessment taken by students enrolled in a course taught under the aegis of the Social Sciences Department— “Rise of the City—during the winter trimester of the 2015-16 academic year. This course—described in Appendix U—was part of the department’s PATH (Passages across Themes in History) curricular initiative for ninth and tenth grades (Appendix V). The chief innovation was to replace the two-year world history sequence with a series of trimester-long electives. Instead of taking year-long world history surveys covering pre-history to 1500 CE (ninth grade) and 1500 CE to modern (tenth grade), students were offered chronologically, geographically, and thematically-based courses from which to choose. They are elective in the fact they have some choice over which course they might take, but students are required to take these courses—three in their freshman year and three as sophomores. It was hoped that the choices offered in PATH would allow faculty to focus on their strengths and students to follow their interests.

At the top layer, these courses were designed to fit the school’s mission and strategic vision:

[Private Suburban Day] will create learning opportunities that are flexible, personalized, and relevant. We will cultivate self-directed and bold life-long learners who make meaningful contributions to the world. All to create a learning community committed to discovery, Innovation, collaboration, and excellence. ([Private Suburban Day] website, “About Us,” n.d.)

I designed courses to fit the schools mission and the department’s new curricular framework. The courses were also developed to support my constructionist and interpretivist philosophical stance (see Appendix W for the epistemological framework). At the core of this idea is the intent to engage students in the authentic processes of historical inquiry (see Appendix D). In so doing, students come to understand the deeper patterns of history; revealing the underlying systems and forces that drive human interactions. I believe the construction of understanding, through the recursive analysis of the perceptions of participants—the subjective and contextual way people make meaning—is the best way to know and understand less-traveled areas of inquiry. This is a viewpoint that promotes the idea that inquirers should “generate or inductively develop theory or pattern of meaning. . . [r]ather than starting with a theory (as in postpositivism (Hess-Biber and Leavy, 2011, p. 21)).

For the data collection period, the winter trimester of the 2015-2016 academic year, I taught a PATH course on urban history entitled, “Rise of the City.” (See Appendix U for course description.) I had 49 students among the three sections of this class. The course was planned around five units, with each unit corresponding to a two-week focus on a sub-discipline of history: Economic, Political, Intellectual, Cultural, and Social (EPICS—see Appendix L). In this way, students were given the opportunity to view history through a variety of intra-disciplinary lenses. In addition, students were provided guidance through two other heuristic tools, one that

provided a cyclical view of history (Appendix K) and one that provided a schematic of “Forces in History,” (Appendix M) all of these aids were meant to stimulate their analysis. Each unit was designed to last approximately two weeks (a schematic of the scheduled phases appears in Appendix X).

### ***Initial week of course***

The goal of the first week of the course was to introduce students to some of the more abstract and fundamental principles that would underlie their work. Pursuant to this, I presented a week-long set of lectures as a way of establishing a general framework for research, concept and theory development, and subsequent discussion. My presentations were not specific to the content of the course, nor did they provide a description of modeling. Rather, as I do at the beginning of all my courses, I focused on concepts of taxonomy and epistemology that are key to the kind of inductive historical inquiry they were to practice.

Each section of the course was taught using the conceptual modeling framework. Following standard modeling procedure—as modeling is meant to be a collaborative enterprise—the participants were broken into five to six groups of three to four members each. Each group was supplied with a two-foot by three-foot whiteboard and a set of dry erase markers; the materials they would use to construct their models.

### ***Modeling schedule: week one***

In the first week, the students, in their pre-assigned three-four-person groups, were asked to conduct research on topics appropriate to the theme of the course and within the framework of the sub-discipline of history (i.e. EPICS) under study. Students were asked to choose a topic of interest, using the same thematic and disciplinary parameters. Although, for training purposes, in the first unit, I assign the topics. In all cases, I aid the students in the selection of topics and

research materials—insuring the students can find the necessary materials, that the topics are within the stated parameters, and that the topics allow for intra-group connections and collaboration.

While researching, the students are also formulating research questions and interpreting their findings. At the end of the week, following four, 50-minute periods of in-class research and analysis—they are expected to do part of their research and analysis out-of-class, as well—the groups are asked to develop and create their models, taking into account the research and analysis of each of the group members. Images of these whiteboard models, with extended, descriptive captions are posted to the WikiProject for that unit, so that they are available, for the next phases of the process, to the class as a whole.

***Modeling schedule: week two***

The second week is given over to group presentations and the final seminar. Each group is asked to make a 5-10-minute presentation of their whiteboard model, highlighting evidence used to derive their thesis and the ways in which images drawn on their boards convey their argument. The group's peers are given 10-15 minutes to question the presenters—seeking clarifications and probing the thesis, evidence, and argument as depicted in the presenting group's model. The summative seminar caps off the second week. The students are seated in a circle, each group with their model (whiteboard) in front of them and are directed to use this 45-minute block to search for connections—and striking disconnects—among all the models.

As the final part of the unit, students are then given four days to craft and submit an individual response, providing their take on the totality of the unit (see Appendix Y for further guidelines provided to students). In these brief, 250-500-word essays, the students are asked to make use of material from their own research, analysis, and group model, the models of the other

groups (available to them on the WikiProject), and the proceedings of the seminar. In this way, students are provided the opportunity to verbalize the main lessons learned—about historical patterns and history as a discipline—to better understand the concepts discussed.

<i>Course</i>	<i>Unit</i>	<i>Activities</i>	
Rise of the City Winter 2015-16	Economic	Week 1: Research and model development	
		Week 2: Presentation and summative analysis	
	Political	Week 1: Research and model development	
		Week 2: Presentation and summative analysis	
	Intellectual	Week 1: Research and model development	
		Week 2: Presentation and summative analysis	
	Cultural	Week 1: Research and model development	
		Week 2: Presentation and summative analysis	
	Social <sup>17</sup>	Week 1: Research and model development	
		Week 2: Presentation and summative analysis	
	The timing on this summary is approximate. It does not take preliminary instruction into consideration and assumes the time spent on each unit will be equal; this is usually not the case.		
	This schedule holds true for the other courses I teach.		

### **Data Collection**

Since 2012, I have conducted a recursive form of action research in all sections of my conceptual modeling classes. This research was undertaken as part an administration-supported program of self-study. All teachers at Private Suburban Day, as part of professional development, are asked to evaluate their own teaching. After I was exposed to the action

research method, I felt that it best suited the assessment of conceptual modeling and my teaching philosophy.

I used metacognitive assessments to collect my data. I chose two types of groups as my target participants. One group consisted of former students—veteran modelers, many of whom were also members of STEP. The members of this group were given a self-reflective, six-question assessment (Appendix T). The second group was made up of students then enrolled in my winter 2015-16 course, “Rise of the City” (Appendix U). These students were asked to complete a four-question guided self-reflection, designed to elicit student perceptions of modeling and historical inquiry.

In order to assess how student perceptions changed over the course of a given trimester, the metacognitive assessment given to students enrolled in one of my conceptual modeling classes and designed to elicit student understanding of both conceptual modeling and the discipline of history, was collected at the beginning and toward the end of each of the trimesters. The breakdown of the metacognitive assessments, representing data collected in three different trimester-long courses, given from December 2015 to November 2016, is summarized in Table 3.2.

<b>Participant Response Rates to Metacognitive Assessment</b>					
<i>Round</i>	<i>Date</i>	<i>Term Phase</i>	<i>Students in Classes</i>	<i>Students Completing Assessment</i>	<i>Response Rate (%)</i>
M1	12/07/2015	B	49	48	98
M2	01/26/2016	T	49	37	76
U1	03/31/2016	B	54	35	65
U2	05/22/2016	T	54	16	30
C1	08/17/2016	B	49	48	98
C2	11/07/2016	T	49	25	51
Totals Across Dates:			304 <sup>18</sup>	209	69
Averages Across Dates <sup>19</sup> :			51	35	69
<i>NOTE.</i> B=beginning of term; T=roughly 2/3 of the way through the term.					

In total, there were 304 students enrolled in these December 2015 to November 2016 PATH courses. The metacognitive assessments were voluntary and had an average response rate of 69%—a total of 209 of the 304 students enrolled—with a range of 30-98%. The lower numbers for the end-of-term metacognitive assessments might be due to survey fatigue—the students are asked to take up to six school-wide surveys, at around the same time as my metacognitive assessment—in support of the school-wide interest in improving all sectors of the school. The proximity to school breaks and vacations may have also been a contributing factor.

A portion of the data collected for this study were drawn from student self-assessments in December 15, 2015 and January 26, 2016 (the beginning and end of winter trimester, 2015-16) (Appendix S). I chose to analyze the data from the first course, “Rise of the City,” designated as M1 and M2 (Table 3.2 provides response rates for these metacognitive assessments). A brief review of the data from the other four—U1, U2, C1, and C2—suggested that the results would prove to be very similar and therefore redundant.

The initial, December data collection for the “Rise of the City” course (M1) was done prior to the first modeling unit—to elicit the preconceptions of the students, particularly those

new to conceptual modeling. There was an almost perfect, 98% response rate for this initial assessment. The second, late-January metacognitive assessment of the trimester (M2) was given at a time the students had completed at least two, full modeling units. This later student self-reflection provided a way of assessing metacognitive changes that may have resulted from greater exposure to the conceptual modeling pedagogy. Coming near spring break, the metacognitive assessments had a lower response rate of 76%.

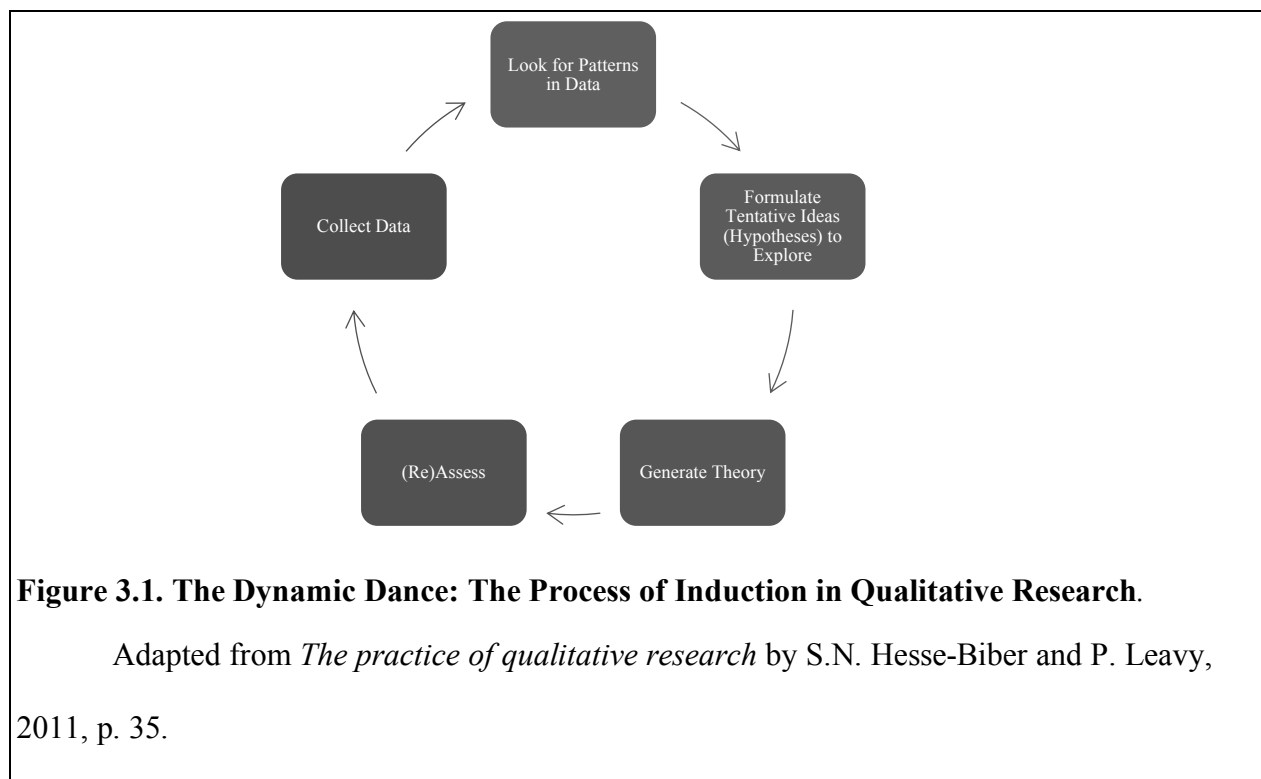
### **Data Analysis**

Data analysis was conducted in line with the constant comparative method. (Hesse-Biber & Leavy, 2011; Creswell, 2007) This recursive technique would have allowed me to make changes as I collected my data. However, as the questions were the result of honing previous versions and designed for open responses, it proved unnecessary to make changes to my data collection methods, once the metacognitive assessments had been finalized. For my analysis of the historical inquiry and modeling-focused surveys, I used a multi-stage coding approach (Hesse-Biber & Leavy, 2011; Creswell, 2007). I began with open coding, sifting through the data and creating segmented categories. After this, through a version of pile sorting, I engaged in axial coding.

I began the coding sessions by reading through the metacognitive assessments. I sought to conduct this initial reading without preconceived notions of categories or other schema. After this initial reading, I began a phase of focused analysis, and coding—a means of better discerning emerging themes (Hesse-Biber & Leavy, 2011; Creswell, 2007). It is during this process that a taxonomic schema of my initial findings emerged. (Appendix Z)

At this stage, I was looking for patterns that linked categories and subcategories as I sought an understanding of process. Once I had gone through multiple rounds of focused

coding, I moved to develop the themes that emerged from the data. For this, I needed to aggregate my categories into a larger framework. The patterns and themes I discovered through the inductive process of “The Dynamic Dance” (Hesse-Biber & Leavy, 2011) became the base of my analytical framework (Fig. 3.1).



Within the data analysis framework provided by Hesse-Biber and Leavy (2011) I followed a coding strategy offered by Huberman and Miles, as outlined by Creswell (2007). Among the features of the Huberman and Miles (Creswell, 2007) strategy that were used are: the writing of marginalia and reflective passages in notes, the use of codes that denote observed patterns and themes, a count frequency of codes, and the making of contrasts and comparisons. A recursive cycle (Figure 3.1), or spiral, like that shown by Creswell (2007, p. 151) are apt metaphors for this analytical procedure (Hesse-Biber & Leavy, 2011).

## **Trustworthiness, Ethics, and Limitations**

The careful gathering and analysis of data is in service to the goals of action research, bringing positive change to the classroom and, perhaps, beyond. Teachers are curious and skeptical. Questions come as a natural part of our work—so does a desire to improve education. The repeating cycle of action research gives us a way to progress. The action research methodology gives educators a better way to reflect on their teaching, providing them "a chance to document, discuss, reflect on and analyze their own practices" (Bilgili, 2005, p. 51)—and reflective practitioners make better teachers (MacLean & Mohr, 1999). The process provides teachers ample opportunity to discover not only what their students think, but how. Knowing how cognition works brings teachers a long way to finding methods that better match the way students learn (MacLean & Mohr, 1999).

### ***Trustworthiness***

Trustworthiness is an issue with all research. But qualitative research has long been in the shadow of its positivist, quantitative cousin. Those in more objective and positivist disciplines, such as the physical sciences, criticize qualitative studies as lacking in rigor: validity and reliability. Initially, many qualitative researchers, e.g. LeCompte and Goetz (1982), responded to this objectivist critique by following para-quantitative procedures and using terms that paralleled those in positivist research: internal validity, external validity, reliability, and objectivity (Creswell, 2007).

There are established guidelines to assessing the validity of a quantitative study. These include an examination of the methods used, for evidence of researcher or measurement bias. Trustworthiness in qualitative research is not so straightforward. As there is no pretense of objective truth, and there is an underlying belief in the contingent nature of meaning, the

reviewer must look to more subjective measures. (Hesse-Biber & Leavy, 2011; MacLean & Mohr, 1999)

Hesse-Biber and Leavy (2011) identify three general criteria for judging trustworthiness in qualitative research: craftsmanship, communication, and pragmatic proof. The first criterion refers to the care taken by the researcher to establish credible findings, e.g. thorough research, examination of contrary evidence, etc. “Communicative validity” can be established by assessing the thoroughness of the researcher’s give-and-take with peers. The last criterion, “pragmatic validity,” looks to see if significant action was taken as a result of the study; for example, a reviewer can look to see if the research led to a subsequent study, or to the adoption of an innovative instructional method (MacLean & Mohr, 1999).

Qualitative researchers can make use of well-established techniques to help insure trustworthiness. The trustworthiness of this kind of study can be bolstered through the use of collection and analysis processes like triangulation: "the use of different methods or gathering data or collecting data with different samples, or at different times, or in different places—to compare different approaches to the same thing" (Bilgili, 2005, p. 27). Another example of triangulation, is member checking, in which the participants examine the transcripts—in order to insure accuracy and fidelity (Hesse-Biber & Levy, 2011; Creswell, 2007; Merriam, 2002). Some of these practices, like member checking, are inappropriate or unavailable when data is collected anonymously, e.g. through the metacognitive assessments used for data collection in this study. As the answers to the metacognitive assessments are self-reported, the researcher can assume the participants words reflect their meaning.

In addition, by drawing the data from the conceptual modeling veterans and from different times and sections of the “Rise of the City” class, the research provided better

opportunities for constant comparison and analytic induction. The use of multiple sources is helpful in confirming, or invalidating patterns and themes that emerge from the data. Such recursive analysis serves well the interests of qualitative inquiry (Hesse-Biber & Levy, 2011; Creswell, 2007; Merriam, 2002).

Dependability is provided through, among other measures, recursive analysis and coding (Creswell, 2007). The process is flexible enough to allow for the emergence of new patterns and themes, and the correction of erroneous assumptions, over the course of the research and analysis. For example, as previously stated, there were changes in the metacognitive assessment questions asked, as a reflection of understandings gleaned from the pilot study and from consultation with STEP members who were also veteran modelers. Additionally, coding adjustments were made during the analysis process.

In qualitative research, the investigator looks for common themes (in Alasuutari's terms, a "rule") in the data collected from multiple sources. The greater the corroboration, the more likely the explanatory model and thesis are correct (Alasuutari, 1995; Hesse-Biber & Leavy, 2011). Even if correct, the implications that come out of such a study are limited in scope. The nature of action research makes it difficult to generalize beyond the field of inquiry—the context: the particular classroom. As such, action research usually makes no claim to generalizability.

Any social researcher, even those with a positivist stance and more "objective," quantitative methods, must deal with bias. But because the investigator is, at least in part, the subject of an action-research inquiry, special attention must be paid to maintaining transparency. This makes necessary the articulation of agendas, assumptions, beliefs, or procedures that might influence the study (Hesse-Biber & Leavy, 2011; MacLean & Mohr, 1999; Creswell, 2007; Merriam, 2002). I came to this study with a positive bias toward the modeling pedagogy. Part

of this is due to positive, anecdotal feedback from students and their parents, colleagues, and administrators. The fact that I co-created the humanities version of modeling also contributes to an inherent bias. My development and continued use of modeling as a teaching method is an outgrowth of my belief in the efficacy of constructivist pedagogy and a long-term emphasis on students learning through authentic and active engagement with historical data and through the expression of meaning and construction of theory.

### *Ethics*

It is important that research is trustworthy; but it is of equal importance that the study be executed in an ethical manner. MacLean and Mohr (1999) provide clear guidelines on the ethical practice of action research—though they would be well applied in other situations, too. The standards call on the teacher-researcher to be clear on the details of the study when speaking to any of the effected parties (e.g. students, parents, administrators, colleagues, and other stakeholders).

For the sake of privacy, anonymity and confidentiality were assured. This was achieved by, for example, by using Qualtrics—an internet research company—as an intermediary for data collection. The metacognitive assessment was created and posted on the Qualtrics site. Qualtrics generated a link that the researcher posted to the Private Suburban Day course management software (CMS) site: Haiku. Only students were given access to the metacognitive assessment posted by the teacher. The metacognitive assessment responses went directly to Qualtrics. No personal information was recorded or maintained that could identify respondents, or those who chose not to take the metacognitive assessment. The data was retrieved, by the investigator, from the Qualtrics site in the form of a spreadsheet-like table. Here, once again, there was no personal information displayed, further assuring anonymity for the participants.

Participation in the metacognitive assessment was voluntary. North Carolina State University's Internal Review Board (IRB) determined the research to be exempt from consent requirements. As part of good community practice, however, students and their parents were given information regarding the study and their potential participation. This information came in both written and oral forms. Additionally, all participants were given the opportunity to opt out of the study, at any time (Hesse-Biber & Leavy, 2011; Bilgili, 2005; Creswell, 2007; Merriam, 2002).

### ***Limitations***

Most of the limitations for this study arise from my dual role as teacher and researcher. As a participant-observer, it is incumbent upon me to take special care in the collection and analysis of data. Since I was, to my knowledge, the only one using modeling—to this extent and at the time of this research—in a high school history classroom, I had to rely heavily on action research. As stated and elaborated upon in the previous section, I am, undoubtedly, a biased source. While this does not invalidate my data, my predispositions were taken into account as I considered issues of reflexivity and bracketing—acknowledging and understanding my potential bias and seeking to minimize its effects.

A second problem arose from the lack of comparative cases: there is very little literature on the topic—the gap is more of a chasm. The lack of literature means my theoretical framework could arise *de novo*, from a virtual *tabula rasa*. There is some literature on modeling in physics, but nothing beyond this author's work on modeling in the humanities.

A third set of limitations comes from an all-too-common lack of money. I made use of a small sample—purposeful convenience sampling—made up of participants drawn from the suburban, private school at which I work. This was not a wide range of perspectives and

experiences on which to draw. While no data on economic diversity has been published by the school,<sup>20</sup> the website for Private Suburban Day reports that, as of the 2016-17 school year, 62% of the student body is white, as is 80% of the staff. Collecting data from different classes and groups of students, at different times, was designed to mitigate this and provide an expanded base for analysis. This limit on perspectives and experiences is not a severe a flaw for this type of study, though it is still problematic for transferability and generalizability.

Additional limitations of the study included time, distance, and school type. The research study was confined by trimester-long, 12-week courses. In their book, *Becoming Qualitative Researchers*, Glesne and Peshkin described how important spending time with participants at the research site and developing a relationship with them is in order to produce trustworthy data (1992). My tenure of 13 years, and the relatively small class sizes at the school, provide me with much stronger connections to students than are typical for this type of study, and thus provides greater assurance of trustworthy data. The perspectives and experiences of others might create more dynamic and robust findings.

The final limitation is the type of secondary school where the research was conducted, an independent high school in a suburban area. Teachers at this site have different requirements for licensure and expectations for results. The investigator, while an experienced teacher, does not have a teaching certificate. Also, as an independent school, teachers are free to develop their own classes—content and methods of instruction. There are no end-of-course exams, Common Core restrictions, or other state and local mandates that typically have great influence on curriculum development. To mitigate this limitation, studies should be conducted at other (dis)similar schools—e.g. public high schools. This would allow for more generalizable procedures and findings.

## Chapter 4: Findings

### Introduction: Conceptual Modeling in the Classroom

I began evaluating conceptual modeling as a classroom pedagogy in 2009; the same year I introduced the method into my courses. In the early years, these course evaluations took the form of informal discussions. I soon realized I could get a more fruitful evaluation through ungraded, anonymous metacognitive assessments given twice—early and late (i.e. within the first couple and last couple of weeks)—during each trimester course.

The direct rationale for having students complete these assessments—in the past and for this study—was to provide me with insights into how students were perceiving modeling and the impact of the pedagogy on their understanding of history<sup>21</sup>; information that would help me hone the conceptual modeling method. The results presented in this study are taken from a series of three rounds of these metacognitive assessments.<sup>22</sup>

### Research Questions

The following research questions guided my study

- To what extent did students feel that the integration of modeling as a pedagogy enabled them to attain concepts and skills central to historical understanding
- How did students perceive and describe the conceptual modeling process?
- How did students perceive and describe historical inquiry?
- Did students perceive any effects conceptual modeling has had on their view of historical inquiry, or on their more general thinking and learning?

This action research study was conducted within a qualitative, constructionist methodological framework. As such, my project was designed to draw meaning from the

participants' (students') viewpoint. In addition, the nature of action research helped me probe my own teaching and improve my practices—one of the goals of this study.

The data for this study were collected from a set of three different metacognitive assessments. The first two sets (see Appendix S) were given to students, freshmen and sophomores, that were enrolled in my trimester-long course: “Micro-histories,” offered in the of winter trimester of 2015-2016. The same metacognitive assessment was given at the beginning, December 15, 2015, and toward the end of the trimester, January 26, 2016. The third set were collected from a more extensive set of metacognitive prompts given to veterans, students that had taken one or more of my conceptual modeling-based courses in past years (see Appendix T). This latter assessment was given April 13, 2015.<sup>23</sup>

I used the constant comparative method, with multi-stage coding for my data analyses. At each stage, I read through the answers to the assessment prompts. I sought to conduct my initial readings without preconceived categories or schema. As I went through the three main stages of coding—open, axial, and focused—I worked to go from more general taxa to finer categories and sub-categories. My final themes were discovered during the inductive process that Hesse-Biber and Leavy (2011) termed, “The Dynamic Dance.” (c.f. Figure 3.1)

### **Modeling: Overall Themes**

The main aim of this study was to understand student perceptions of modeling. Based on my analysis of student responses, several major themes appeared in the ways students described conceptual modeling and their participation in modeling activities in the classroom. These themes are summarized in the coding frequency tables, distilled from the responses to the veteran and standard metacognitive assessments used for this research study. (Appendix AA)

A major theme that could be drawn from the assessments had to do with the abstraction of complex concepts that came as a result of being exposed to the modeling pedagogy. It also appeared that conceptual modeling led to big-picture thinking and a deeper mastery of historical concepts. The participants drew favorable comparisons between conceptual modeling and more traditional modes of instruction. Students remarked as to the power of collaboration in their learning and the ways they were able to use the method in other classes, including those outside the discipline of history. The participants in the study said that they found many ways of transferring the skills and concepts derived from conceptual modeling in other disciplines. The students also suggested that the conceptual modeling pedagogy, and the visual thinking fundamental to the process, helped them hold permanent the concepts they had derived. Finally, the participants provided constructive criticism of the pedagogy and ways of improving conceptual modeling.

### **Abstraction of Complex Concepts**

Students saw the (conceptual modeling) process as one of taking “larger themes and ideas from certain events and represent[ing] them in an abstract way” (V-20<sup>34</sup>). Abstraction was perceived to be the fundamental building block of conceptual modeling (M2-36). Students referred to the abstraction inherent to conceptual modeling as an important step toward the construction of theory. For example, one student reported:

Modeling is an abstract way of looking at material that goes beyond merely memorizing facts. It brings a very "macro-scale" view to things. Through modeling, we explore overarching themes and patterns, that deepen our understanding of the material. (M1-11)

This ability to abstract concepts at the “macro-scale” seemed to have enabled students to understand patterns and develop deeper understanding. It was suggested that conceptual

modeling provided a method “to convey a unified theme that stems from different elements” (M2-5). Similarly, by creating a visual metaphor through conceptual modeling, the process allowed for “creativity and a more personal understanding in the learning process” (M2-15).

### ***“Big Picture” thinking***

Abstraction was one of the elements students saw as central to conceptual modeling in making it a method for “big picture” thinking. One student reported, that conceptual modeling provided a mental workout“ that strength[end] my ability to grasp large topics and definitely increased my ability to see the ‘big picture’” (V-7) Students reported that big picture thinking was possible, due to the open nature of conceptual modeling—allowing the student “to go beyond specific data points or statistics” to grasp the larger concept (M2-3). Many other students, particularly the veterans made similar comments regarding conceptual modeling as providing a broadening of their perspective (V-3; V-14; V-24). Another student reported, “Modeling forced me to consider the bigger picture when I had spent my whole life in school focused on small facts. It made me realize the purpose to my education” (V-11).

It appeared that, as students described their understandings of conceptual modeling, they referred to the big picture or macro-level understanding that emerged through the process of modeling. They also reported that this process helped them develop depth and mastery of understanding.

### ***Visualization and visual thinking***

One of conceptual modeling’s signature features is the visual nature of the models (see Appendix F, G, H, and I). The product of modeling is a visual diagram or image that student construct in small groups in order to present and explain their conceptualization or theory. These theories are based on their examination of patterns found in the historical evidence.

Some of the students, who considered themselves “visual learners,” found this to be a natural mode in which to work (M2-23; V-1; V-15; V-18). For example, one student saw the tangibility of models as key to helping manage the onslaught of information and ideas by wrapping “all your thoughts together and put[ing] a helpful visual to them” (M2-31).

The abstract visual characteristic of modeling required students to be clear in their thoughts. The conceptual modeling process drove participants to simplify their message into a single visual: the model. Such visual abstraction came only through a deep understanding of the underlying concepts. One veteran saw modeling as a kind of test in that if it was, “‘impossible’ to sketch out or draw [a model], then most likely [the group] haven't thought it through enough” (V-14).

This same student continued in a more gestalt mode when addressing the depth of the critique and analysis that takes place at different points in and different levels of the conceptual modeling process. “Examining what every aspect of the model—even the negative space, the closed nature of the board, etc.—represents is a very profound lesson about our world, tangible and intangible” (V-14). The latter part of this evaluator’s statement speaks to the kinds of epistemological knowledge and metacognitive understanding that can come as a side benefit of model production, analysis, and presentation (V-14). For example, a group’s model of urban political development, meant to suggest connections between the level of economic resources available and the level of power concentration, may also reveal the difficulty of establishing and separating dependent and independent variables.

Students saw the process of visual abstraction, through pattern recognition as key to their mastery of historical ideas and concepts (V-2). Similarly, conceptual modeling was viewed as “a method with which students can formulate their own ideas on a topic and then express them in

symbolic terms which forces students to think deeper about their own idea and break it down further than they normally would” (V-11).

Students reported two approaches to abstract thinking through modeling. They noted the process by which conceptual modeling required them to absorb abstract concepts and to also create equally abstract theoretical models. For example, a student wrote:

I think Conceptual Modeling is taking something abstract like an idea and visually representing that idea. . . . In order to model a concept, you have to really understand all of the details and nuances of that concept. Modeling helps me to get a better understanding of what it is I'm trying to represent. (M2-35)

Students found modeling to require a depth of understanding in order to visually represent concepts that are otherwise abstract and nuanced. Students credited the visual nature of conceptual modeling for enabling a greater depth of understanding (M2-26) and creating a firm foundation for critical thinking.

### **Critical Thinking**

It appeared that students credited the visual nature of conceptual modeling, especially the need to represent complex patterns using symbols and other visual devices, as helping them develop critical thinking and depth and mastery of content. For example, a student reported, “conceptual modeling fosters fluency in critical thinking by having students symbolize information with abstract representations. Contrary to rote memorization, modeling promotes problem-solving and collaboration, important ideals for active members of our democracy” (V-16).

Another participant expressed a remarkably similar sentiment—extending the scope into depth achieved through focused research—saying:

I think that modeling enables students to move beyond the surface level facts into the realm of ideas and concepts. This is done through all phases of modeling from the initial research during which the student attains the basic factual information to the final sharing and discussion at which point they're able to solidify their understanding. (V-12)

This more expansive view of the depths plumbed through conceptual modeling's focus on a single topic connected to the important role students saw in conceptual modeling helping them to engage in critical thinking (M1-26; M2-29; V-23).

### **Modeling versus Traditional Instruction**

The students presented a stark contrast between conceptual modeling and what they considered the more traditional modes of instruction (e.g., M2-6). The more veteran students, in particular, suggested that they reached a level of analysis through conceptual modeling that went beyond that which might be attainable through lecture and memorization. One student stated that “modeling has given me a new perspective on how to retain information. Specifically, how to analyze rather than memorize” (V-23). While some students simply noted an improvement in their mode of thinking (V-1; V-17), others took a more nuanced approach—honoring conceptual modeling for opening the door to analysis, but suggesting that a hybrid, more balanced approach might make the most sense:

[Conceptual modeling] has definitely introduced me to the analysis form of studying history, as opposed to listening to lectures, memorizing dates, names, places, etc. I think the subject should be studied both ways; there are many benefits to lectures, but I think the only way to truly understand a subject is to make connections and analyze it, i.e., modeling. (V8)

Similarly nuanced understandings were offered to describe the way conceptual modeling moved them away from clear-cut dichotomous thinking and into a more thought provoking, less linear train of thought (e.g., V-13). For example, a student wrote:

[Conceptual modeling] has made me more of a deep thinker. Instead of being the old "right or wrong" person I was where everything has a clear-cut answer, now I am someone who will think deeper about issues and maybe dive into the gray area on certain issues. (V-4)

Students attributed these changes to “being forced to “break topics down to their fundamental characteristics” (V-6) and that “the benefit from being forced to break down the concept” was a better understanding of the historical forces in play (V-24). Similarly, a student wrote that conceptual modeling promotes “. . . deeper thinking to examine the way things work and the process that makes things happen” (V-17).

### ***The desire for more-traditional instruction***

Some students, mainly those who had not modeled before, hewed closely to traditional pedagogy—even when it seemed to contradict their stated learning preference, e.g. visual. These respondents looked to the methods they had already been exposed to in their earlier school experience. The methods these students highlighted were content-rich, authority-centered, and somewhat passive. They wanted the information presented to them by existing academic authorities, in order to better insure validity—i.e. that they were receiving the right information and giving the correct answers (M1-5; M1-19).

Most of these traditionalist students eschewed videos, projects, and presentations (M1-7). Four of those taking the M1 assessment and two from the M2 group stated their preference as taking notes on lectures (PowerPoints) and doing their reading in textbooks (M1-7; M1-25; M1-

38; M1-41; M2-28; M2-29). Four other students talked about having used what they perceived as tried and true methods, creating memory aids—e.g. flash cards and study guides (M1-3; M2-17; M2-20; M2-36). Two participants stated their preference for covering topics in chronological order, rather than thematically (M1-26; M1-42). Another pair of students related how they liked history better when it was presented as a complete narrative—a kind of documentary storytelling (M1-16; M2-6). Two other participants stated that they found rote learning the easiest path to take (M1-8; M2-6).

Evidence from this study suggested that preference did not necessarily equate to uncritical acceptance of traditional methods. Some students pointed to the drawbacks of these methods, including the narrowness of the narrative and the exclusion of whole groups from the story that is told. They also remarked about their inability to control the pace of instruction (lecture) or ask clarifying questions (videos) (M1-32). Their stated preference for these more traditional modes of instruction was likely the result of having been the only types of pedagogy to which some had been exposed and, despite a stated lack of fulfillment, found comforting (M1-24).

The more adventurous took a hybrid approach and sought to conduct their own research, but they still wanted to be guided by authorities and stay within the boundaries of prior work. Three of the M1 group and two of the students in M2 stated a preference for this balanced approach, but a desire to move toward more analysis and less memorization (M1-19; M1-35; M1-42; M2-3; M2-30). One respondent summarized this viewpoint, saying:

In my experience studying history, there has been emphasis on memorizing events and taking facts at face value, and only recently in the past few years has it developed into actual analysis of events. I think understanding why something happened, and not just

that it happened, helps me to not only remember it but also comprehend it better, and a combination of research and discussion is usually the best way for me to fully grasp a subject. (M1-9)

This desire to move beyond the bounds of traditional instruction was indicated in the metacognitive responses of students wanting to conduct research that connected to their own interests and that was relevant to today. As one participant put it:

[I]f you are going to study history in a positive way that is best for your learning, you need to take the general ideas and make them personalized in a way that interests you. In other words, you aren't going to like studying history if you are studying history that is boring to you. (M2-19)

While a few students stated a preference to be taught through lecture and textbook, others were skeptical about accepting theories and accounts of events from authorities, without pursuing their own questions and ideas. They worried that traditional methods transferred bias from teacher to student through the former's prejudicial selection and interpretation of facts (M1-27). The solution they saw was "to try to get the whole picture - when making conclusions about an event or comparing multiple events/places/etc. [Y]ou need to have all the facts to prevent yourself from developing biased viewpoints." To do so, one participant naively suggested limiting historical study to those events for which we have ample material to analyze (M2-21).

### **Doing History through Modeling**

Almost all the veteran modelers, and a few of the neophytes, saw a very different paradigm for learning history. These students sought a more active role; one in which they gathered primary materials and interpreted the evidence with a focus on the how and why, rather

than memorizing the who, what, where, and when. One student fitting this description stated that:

History works more in my head when it's understanding concepts like how a society's government functioned or how it's economic system remained stable. Memorizing facts is much harder and I feel that in the end I'm not able to memorize them for the long term. What's more useful is understanding the concepts and the ideas - not the names and the dates. (M2-18)

Modeling seemed to strike a chord for these students. Although they found conceptual modeling a challenging and lengthy process, they valued the big-picture focus and the ability to discover through their own analysis of the material, rather than merely repeating the thoughts of others (M1-33). As one participant put it, “[m]emorizing doesn't really help you to know what happened. You will only know the basics. Thinking about history analytically helps you to fully understand the “Who, What, Where, and Why” (M1-18). Another respondent explained how modeling helped “to link all the information together” and by doing so help them “understand the overall idea” (M2-32).

Even those who performed well on memory-based assessments, saw the limitations of more traditional methods. One student wrote that: “Memorizing facts is something I can easily do, but I never really remember the information for a long period of time” (M1-31). Another participant found that while traditional modes of learning were easier, they learned and understood more through the complexities and discourse that are part of conceptual modeling (M2-14). Another student was more agnostic in their approaching suggesting that “[h]istory is much like any other subject in that it can be learned in any number of ways” (M2-37).

Although, in the end this student sided with conceptual modeling saying that, “for me modeling

seems to cement ideas down” (M2-37). Another respondent went further into epistemology in comparing conceptual modeling to the more traditional methods, recalling that:

In the typical history course, I would gather knowledge and attempt to retain the knowledge, but in modeling I gather knowledge and create explanations. I think being able to create the explanations is more valuable than knowledge, especially with the easy availability of knowledge of modern times. (M2-42)

The dissatisfaction with the limited role students play in traditional instruction was on the mind of one student when s/he compared the relative benefits conceptual modeling offered by engaging students in authentic historical study (M2-35). In their metacognitive assessment response, this student said that:

As a student, we mostly study history by reading about and studying the things that these historians have already uncovered and analyzed. We usually do not make analyses of our own. For me personally, I like learning history in a way where I feel like I'm doing more than just memorizing facts. I enjoy having to formulate my own opinions and drawing connections between things, rather than just reading and recording. (M2-35)

Students saw that through the authentic mode of historical inquiry used in conceptual modeling they gained confidence and a sense of agency. And with that increased control came the opportunity to make choices and take risks.

### **Making Choices, Taking Risks**

Students saw increased confidence and a sense of greater agency as concomitant with the deeper, critical thinking afforded them by conceptual modeling. A number of participants, particularly among the veterans, remarked to their greater willingness to take intellectual risks

(V-10; V-12; V-15; V-16; V-18). One student clearly stated that they, “. . . gained a willingness to learn "off balance"— to take risks and accept challenges to understand concepts more fully”

(V-15). Another participant offered that:

Modeling has pushed me to explore learning styles with which I feel less comfort . . . [conceptual modeling] has made me more dynamic and versatile to various learning styles. It has also broadened the manner in which I think to allow me to see systems and processes on a larger scale. (V-12)

A third veteran echoed the last part of the previous student’s comment—in reference to seeing forces and systems in history—and posited that conceptual modeling had allowed them to “see history as a group of general trends instead of loosely connected events” (V-10).

By providing this broader view, according to one student, “modeling made history more interesting and exciting. Also modeling made learning more hands on and creative, causing topics to become more memorable” (V-18). Another veteran spoke to a more dramatic transformation, stating:

As a structured learner (and as someone with a generally Type A personality) the risk of fabricating and defending my own ideas about, for example, the Code of Hammurabi, was far out of my comfort zone, but I quickly grew to love explorative learning. . . . When I was given the opportunity to transform the material into my own intellectual property, I, with my peers, gained not only a deeper conceptual understanding of the material but a feeling of ownership manifested by our enthusiasm for and retention of the curriculum. (V-16)

One of the study participants turned the focus on the wider agency they felt had come from their experience with conceptual modeling:

I've . . . taken from the modeling experience great practices in agency and advocacy and a cultivated interest in creating and defending my own opinions and ideas about curriculum, even those I might have once found unimportant or irrelevant without taking a modeling class (V-15).

For some, this increased sense of agency had broader implications. For example, one of the veterans responded to a metacognitive assessment with the following:

Modeling has significantly changed how I view history because it allows me to shape the lens with which I perceive it. Rather than showing me another angle of history, I get to choose the angle. This power has really changed my perception of how history should be studied. I feel like too often history classes are focused on facts, figures, names, and dates.

Modeling has taught me that history is much more than that (V-14).

As a natural ancillary to this increased sense of agency, another commentator saw a commensurate gain in confidence enough “to ask more questions, specifically so I can understand why things happen and not just accept that they do” (V-16).

This enhanced sense of agency and willingness to take risks came from what students perceived as more authentic engagement with the material being studied. One of the students suggested conceptual modeling to be a valid method for:

. . . obtaining a higher mastery in a certain topic, . . . because the person using the method is not only getting information from say a lecture or from a reading, they are getting hands on experience. I also think that it differs from most classrooms in that it can a

better way for people to learn based on their independent learning styles. I also think that this way, information will stick better with the student, because they are using information as a concept which they can transfer to a unique scenario, as opposed to say memorizing information for a test. (M1-2)

Conceptual modeling thus provided, according to students, the opportunity for authentic engagement with historical material, through the use of disciplinary habits of mind, including the interpretation of primary texts and data, the creation of theory, and the ability to hone their ideas through oral/group presentation and individual/written expression.

### **Role of Student Collaboration in Conceptual Modeling**

Students suggested that conceptual modeling was different from traditional forms of instruction in terms of the critical role of collaboration. In conceptual modeling, students were assigned into groups of three. These modeling groups conducted research, discussed historical patterns seen in their findings, and cooperated in constructing and presenting a model representing their thesis. One student described modeling as:

[A] collaborative learning process [in which s]tudents work together in small groups (3-4 students) to create abstract visual representations of course information (for example, in history classes, students might model a historical trend related to rebellion or power structures). Afterwards, the groups present their respective models to the entire class, after which students ask questions about the presentation which often spark a full class discussion about potential changes/improvements to the model. Thus, students are given multiple opportunities to defend/edit their model, and it is a process-based rather than product-based mode of learning. Afterwards, each small group writes a short paragraph

describing the last draft of their model to give the teacher a more full understanding of the group's ideas. (V-16)

In this description of conceptual modeling the student focused on collaboration as a crucial component of the process.

Students found collaboration to be both challenging and beneficial. For example, a student reported:

[T]he collaborative aspect was initially challenging, but I think I have grown as a result because I have learned the value of the combination of everyone's thoughts and ideas. As a result of modeling, I have become a more perceptive and critical thinker. I enjoy exploring a topic in depth, so modeling has been an extension of this. (V-6)

This sharing of multiple perspectives, to which the student referred, occurred throughout the conceptual modeling process (V-16).

Collaboration was seen as the cross-fertilization of ideas that came through the sharing of multiple perspectives. Having input from peers helped students refine their ideas. Students “get to see how other people think and . . . get to combine . . . thoughts and ideas on a certain topic” (M2-27). According to another student, these fresh insights enriched the models (V-4). As another student put it:

Once the model has been created it spurs better discussions than anything else I've seen because there are a couple different ways the discussion can go. The discussion can support or disagree with the theory behind the model, it can debate whether the imagery is successful or could be more successful within the model, it can qualify the stance that

the model is taking, it can focus on one small aspect of the model or put the model in a grander theme. (V-14)

These peer interactions took place in three major ways: within groups, between groups, and during the all-class seminars. The students attributed the success of these components of conceptual modeling to the need to understand an idea well enough to explain it through an abstract or metaphorical model (e.g., M2-23) and to the ideas they receive from examining and discussing the models of other groups (e.g., M2-20).

### ***Whole-group deliberations***

While the students valued the conversations they had within their 3-4 person groups, as they developed better and more complete models (M2-20), the metacognitive assessments suggested they prized the whole class discussions even more. For example, one student stated that the whole-group presentations led to deeper thinking by allowing them to see how “parts of your model may have represented—to others in the class—different things than you had thought” (V-4). These wider discussions came in the form of the group presentations and whole-class seminars that took place at the end of each unit (each unit lasted approximately two-weeks).

These discussions were designed to be lively and contentious—while remaining civil—to help groups enhance their “unique visions” (M2-4), rather than come to an artificial or forced consensus. In the process, one student reported that, “Students gain[ed] a bigger picture view of the topic and how it applied to other topics. It also pushes[d] us to think deeper about how our models apply to real world topics” (V-7). Students saw the educational advantage in such discussions. For example, one student argued for “more group discussion time” since “the best (and most rewarding) part of modeling . . . is the class discussion that comes after” the models have been presented (V-3). The rewards seen by students, included the additional insights that

come of the questions and critiques provided by their classmates during presentations and seminars.

Students commented on the ways conceptual modeling brought insights through collaboration. They seemed to also understand that, while collaboration is a significant element in conceptual modeling, the learning process is ultimately the responsibility of the individual. For example, a student argued:

"Conceptual Modeling" means to me that you need to think and find out your own answer, bettering your understanding and thinking skills for subjects. It works for me, because not only am I learning about a topic, but I am also able to learn from myself and not just others. (M2-30)

This development of individual skills did not lessen the importance of collaboration. Rather, the student's remarks showed how group presentations and seminars could lead to the development of individual insights, conceptual understanding, and the honing of personal learning skills.

Perhaps even more significant for the individual student was the development of empathy, compassion, and a drive for equality—all central to the goals of social studies. As such, these values were of particular importance when students cited them as an outgrowth of collaborative modeling. One student noted that modeling made students:

[M]ore aware of other people's struggles with "traditional" pedagogy. I really struggled to understand modeling at the beginning, and I'm sure that's an experience that many people have with lectures and readings, and I'm sure many people never get over that struggle and continue to have difficulty all through school. This increased awareness definitely

made me more interested in and passionate about education and inequality, and I hope education will someday fully involve more students and allow them to pursue their own strengths and interests. (V-9)

In this manner, conceptual modeling provided students with a more outward-looking frame of mind—a way of thinking that can make them better scholars, in any field of endeavor, and better citizens.

### **Transferability of Concepts and Skills**

To be of the greatest benefit, the insights, conceptual frameworks, and thinking skills that students saw coming out of the modeling process, would need to be transferable to other disciplines. The pedagogy was itself an adaptation from another discipline. The team of teachers that I worked with to develop conceptual modeling adopted and adapted the style of modeling used in physics instruction for use in the humanities, specifically literature and history.

Fortunately, many students perceived just such an ability to use the skills and concepts learned in my conceptual modeling history classes in other history courses, and in other fields. A student made this claim manifest in writing, “through modeling in history, we were able to make very clear connections between each of the models and all of the information we were discovering, and I have been able to make these connections in other classes” (V-7).

Students took their skills in pattern recognition and theory/concept construction to their literature classes (see for example V-1; V-2; V-4; V-19). One student remarked that s/he used these analytical skills in literature “essays in which conceptual understanding of big topics has been key” (V-23). While another student drew the bi-directional link between conceptual modeling in history and literature even more directly, stating, “it is particularly helpful in literature because you can often draw parallels from the books you read to a model you have, or

are doing, in history” (V-3). In a similar vein a student remarked how this correspondence between history and literature helped them make connections among the “different stories we’ve read or subjects we’ve covered” (V-20).

These intra-humanities transfers of concepts and analytical skills were one of the desirable outcomes the conceptual modeling development team had sought when developing the pedagogy. At the time, the team hoped conceptual modeling could be, if not universal, at least transferable to other disciplines.

### ***Transferability in other social sciences and STEM***

Students found conceptual modeling techniques useful in developing analytical skills, concepts, and theories outside the humanities, as well. This transferability can be seen in my sophomore elective, “Measuring the Past;” the source of the non-veteran metacognitive assessments used in this study. In this course, students used statistical data and analytical techniques to understand historical patterns. A direct link can be drawn from this cliometrics course and the kinds of statistical modeling that has long been used in the social sciences to analyze, clarify, and predict many types of social phenomena.

The social science of economics has, particularly in recent years, touted quantitative modeling—in many ways similar to conceptual modeling—as a major component of the discipline’s analysis of, among other topics, market behavior and the impact of governmental policies on the larger economy. One student offered an example of the transferability of conceptual modeling skills and concepts to the work they were doing in their economics class. The student wrote how they, in one case, “applied modeling concepts to studying for tests. . . [by creating] a model for the banking system to help me understand the reserve requirement and the flow of money” (V-13).

Unsurprisingly, given its roots in science, student participants reported that elements of conceptual modeling proved to be an excellent tool in other quantitative classes they took. For instance, a student explained how modeling could be of aid in computer programming, stating:

In my AP java computer programming class, I use modeling as a way to simplify a complex program to make it easier to wrap my head around. Usually, the architecture of a program is drawn out using something called a UML [Unified Modeling Language] diagram, but I've found that even though a model doesn't go into the specifics, it makes the concept easier to think about. (V-22)

Thus, even if modeling was not part of the course's pedagogy, students were able to transfer the process and framework of conceptual modeling and use the method to improve their comprehension in multiple disciplines.

Some students saw conceptual modeling as a way of connecting all their classes and helping them to take on riskier and more creative modes of thinking. For example, a student felt:

[Conceptual modeling in history made it] easier to approach other classes with this view that everything had something to do with everything else. Calculus made more sense when we started using it in Physics, and it was easier to visualize things in these classes. This sounds kind of cliché, but modeling expanded my mind. I began to think in ways that I had not been able to previously. Thinking outside of the box came naturally. I began to solve problems my own way using logic before the teacher taught us the subject. (V-9)

While this student focused on the benefits accrued, through modeling, in their science and math classes, other participants, demonstrated how they were able to transfer the concepts and skills

gained through their exposure to conceptual modeling in my history classes to other disciplines in STEM and the humanities. In an emphatic testimonial to the interdisciplinary power of conceptual modeling, a student stated:

I believe modeling in general has enabled me to stop just looking closely at specific facts and instead be able to see the themes in any discipline and across disciplines. This has helped me with my education on a larger scale and has changed my way of thinking. (V-11)

As exemplified by this student, participants described being able to engage in high-level cognition and theory construction through the collaboration and the understanding of cross-disciplinary patterns and concepts inherent to conceptual modeling. The flexibility afforded by these modeling skills was enhanced by the permanence of the concepts learned.

### **Permanence of Skills and Concepts Learned**

The knowledge gained through education has to be permanent if the time and resources devoted to providing the content, skills, and concepts are to be considered well-spent. Based on my analysis of participant responses, students perceived conceptual modeling as having provided such permanence. For example, a student wrote in reference to the topics addressed during class, “To this day I recall almost everything which I modeled” (V-18). Another student echoed this idea, providing greater detail about how conceptual modeling led to more complete understanding, a greater hold on memory, and increased metacognitive awareness (V-9). The student attributed these benefits to the characteristics of multiple phases of the process, stating that, “because modeling has so many different steps, students are really able to engage fully with the material that they are learning” (V-9).

This same student provided a more in-depth summary of the benefits they accrued from conceptual modeling, especially in comparison to the more traditional methods they had used in the past, stating that:

[T]hough I'm naturally pretty good at rote memorization, I've found that subjects on which I've created a model are much easier for me to remember because I have more context and was forced to note more of the details as I created the model. additionally, the simple fact that creating a model is creating one's own creative intellectual property has a great effect on a student's confidence in his or her individual capabilities. knowing that I can create an organized and abstract study guide that represents something that I understand fully and can explain to other people definitely gives me a sense of awareness of my learning that I don't think I had before modeling. (V-9)

The metacognitive awareness, high level of comprehension, and knowledge permanence that students reported, came from their engagement in the multiple modes and phases of the conceptual modeling process. As one participant commented, “through research, write-ups, creating the actual models, presenting, and having class discussions, each person’s learning strength [was] able to flourish” (V-8). Another student continued in a similar vein, pointing out that modeling had pushed them to explore different learning methods and made them “more dynamic and versatile” learners. Others commented that modeling had made them more creative (V-18) and that they had become “fuller and deeper thinkers through modeling” (V-13).

### **Student Critiques and Suggestions**

A teaching method so complex and powerful is bound to have some weaknesses. One of the purposes of this study was to bring those flaws—as seen by students—into sharper relief so

that I, as a practitioner researcher could work on ways to improve the pedagogy. When they were first exposed to the modeling pedagogy, students found the transition from more traditional teaching methods challenging. They came to understand the greater responsibility inherent to this kind of authentic engagement—particularly the onus of generating concepts and theories. Eventually, even erstwhile neophytes benefited from the practice of abstraction and theory building essential to conceptual modeling.

This was evident in the comments made, during the first metacognitive assessment, by those new to modeling. Quite understandably, they were confused in their unfamiliarity.<sup>25</sup> Some of the respondents went so far as to state that not only had they never done conceptual modeling, they did not even know what the term referred (M1-16, M1-22, M-37, M1-40). Others, new to the pedagogy seemed to see a connection between conceptual modeling and the kinds of modeling they had done in their science classes (M1-16; M1-40). One beginner made a “guess” that conceptual modeling “is used to help people learn through visual representation” (M1-37).

### ***Optimal level of instruction***

The veteran modelers showed empathy for those new to conceptual modeling. For example, two students suggested that the conceptual modeling teacher provide a more complete explanation at the beginning of the term, in order to avoid confusion among the neophytes (V-2; V-18). Another student saw a benefit to the initial confusion students might experience when they begin modelling (V-8). S/he warned against providing too much aid during this formative period of learning conceptual modeling in saying:

[T]he most difficult part of the modeling process is definitely getting used to it at the beginning, but I don't know if that can really be improved. As I've tried to explain modeling to people myself, I've struggled to explain the process without informing the

models, which ruins the creative aspect that makes it so important. There isn't one definition of a "good" model, so I think the only way to get past that initial struggle is to keep modeling. (V-8)

This statement suggested the benefits of a light touch, with the educator facilitating inquiry, rather than directing process and therefore determining product. This student emphasized resilience being at the core of creative discovery (V-8).

Students saw the need for more input from the teacher during the group presentations and seminars. Their comments reflected a concern that without the teacher pushing for peers to ask (and answer) probing questions, groups might not receive the critical feedback necessary to hone their theories (V-15). Since many of the models are both abstract and complex, this same student suggested that:

. . . the presenting students should be asked to breakdown their model until other students can understand it, because an essential part of modeling is learning information in new ways from peers (rather than a more traditional learning style where students just learn from the teacher). (V-15)

This veteran presented a nuanced view of how the teacher should choose their level of involvement at any given stage of the conceptual modeling process—probing, perhaps through Socratic questioning, for clarification and understanding, while making sure to leave the students in charge of transmitting and receiving the meaning of the models (V-15).

The optimal level of direction that should come from the teacher, particularly in the model-construction phase, was the focus of the one of the student responses. S/he remarked that:

Often students, especially students that have become accustomed to traditional learning, are stumped and cannot come up with an idea [for a conceptual model]. And once an idea is formed it is difficult to figure out a way to express it in image form. In my English class the teacher provided some images we could use as a starting point, but I think that was too much involvement by the teacher. I think a way to solve this would be to have a group discussion . . . before the modeling process began and come up with a very vague question that would serve as a starting point for all the models. Then model groups could tackle that question however they choose, but there would be something to start with. (V-10)

According to this student, teachers should strike a balance between pedagogical control and student-directed learning. In keeping with this, the student suggested that peers develop guiding questions, through a class discussion, prior to model construction (V-10).

Other comments were more closely in line with my own experiences as the teacher-facilitator. I used to begin each term with demonstrations of the process and prior, successful projects. I also held practice sessions in modeling. Unfortunately, this had the effect of tamping down creativity, as I got back only the types of models I had demonstrated. Since then, I decided it was better to let students face the challenge of confusion in the beginning of the term, so they would provide more creative, even idiosyncratic solutions moving forward.

While almost all of the students commented on the long-term value of modeling, a small minority of veterans suggested that the pedagogy had not significantly altered their way of thinking and that, therefore, modeling was only useful in a conceptual modeling class (V-12, V-14, V-18, V-23). Tempering this, half of these respondents still saw value in conceptual modeling having given them a greater awareness of their personal learning styles (V-14; V-23).

## **Conceptual Issues**

Some of the students in this study suggested that there were also some difficulties on a conceptual level. There were times when participants would have liked to have seen the class connect the models to a larger idea (M1-13; V-20). Others, in response to the same prompt said the opposite, that discussions stayed aloft, in the realm of theory, without grounding in detail (M1-9; V-7). Those who sought a more detailed approach suggested the topics be confined to shorter historical periods or smaller geographic scope. They also pushed for more emphasis on content, suggesting that “modeling would be better used after learning more facts, in order to see connections between events and concepts” (V-14).

### ***Concern about lack of information***

As to content, some of the student comments reflected a concern that a conceptual modeling course would not impart enough information. One student said that while conceptual modeling made it easier for them “to see the big picture,” they felt like they were “learning less overall content (which is maybe a good thing, I'm not sure)” (M2-25). One of the veteran students wrote in a similar vein, saying that while they saw the benefit of conceptual modeling as “a very good cognitive exercise—and should be incorporated into most history curricula,” it was their “understanding that many people feel that a class centered solely on modeling doesn’t teach enough history.” (V-3).

Others were more specific as to the courses for which they thought conceptual modeling would be an appropriate pedagogy. One participant suggested that while they saw conceptual modeling as appropriate for the upper school, that students in the middle school (and perhaps early upper school) should be given a more concrete and objective curriculum; once that had been accomplished (V-16). For example, according to this same veteran, students could begin

“branching out to conceptual learning about themes and trends using the vocabulary and knowledge they gained in more memorization-driven classes. Without something substantial to model about, I think the process would be rendered pretty useless and whimsical” (V-16).

Another veteran was even more specific, setting out the courses listed in the social science department’s catalog they felt were best suited to conceptual modeling:

As for topics like “Good and Evil” and “History of Science and Technology”<sup>27</sup> it works very well; however, I don't think it would work as well for courses such as U.S. History or ADV Euro (Advanced European History)<sup>28</sup>. I don't think it would work as well for these courses because they are really fact-intensive courses and are mostly about memorization. (V-7)

This parallels the criticism often leveled against student-centered curriculum, that such courses do not provide students with a body of content sufficient for them to interpret and analyze subsequent information. This fear of not knowing enough was compounded, for some, by the concern over not being told which information was valid and worthy of memorization. One student reflected this anxiety and lack of confidence in their reflection on their modeling experience in science—they had yet to do any conceptual modeling in their history class:

I have a hard time grasping my mind around what information I really need to know. Also, if I am able to figure out which information I must know, I have a hard time knowing whether it is correct or false (M1-21).

It was apparent that some students were more comfortable than others in taking on the level of self-direction they saw as fundamental to the conceptual modeling process. This spectrum of comfort was also seen in students’ perceptions and stated preferences regarding

aspects of collaboration, including working in and being evaluated as a part of a group rather than on their individual efforts and merits.

### **Logistical Issues**

In addition to raising intellectual concerns about conceptual modeling, students also pointed out logistical issues. These issues included group dynamics and the best approach to forming groups of students. Students also made suggestions for changing the process and adding more time for the final stages of conceptual modeling.

#### ***Call for more attention to group dynamics***

In their metacognitive assessments, students, particularly veterans focused on collaboration and presentation components. They saw the need for more attention to group dynamics in the formation of modeling teams to, among other things, avoid incompatibility and imbalance in workload (V-8). One student suggested the use of "Myers-Briggs or another type of personality/learning style/collaboration style test to create groups. . . . It would be interesting to structure the groups in a way to see how the collaboration changes based on the makeup of the group" (V-5).

The participants were in agreement that by working together in groups, multiple perspectives could be incorporated, making for a richer product. However, some saw the need for some individual reflection, particularly in the pre-model construction phases (V-1; V-4). This way, they felt, group members could bring more coherent ideas to the group that could then be massaged into theory. One veteran stated the need for "a greater balance between introspective modeling and collaborative modeling. While I think both are important, too often collaborative modeling is given the priority to the extent that no one has profound ideas to share with the group at first" (V-13).

### **Other Suggested Changes to the Conceptual Modeling Pedagogy**

The final phases of the conceptual modeling process, particularly the discussion and seminar, were seen as needing more time “for discussion between models, and maybe an attempt to combine them somehow” (V-16). In this way, students suggested, groups might have been able to see larger patterns and connections and to have formulated an overarching theory regarding the unit under study (V-19).

Students pointed to the final stage of the conceptual modeling process, the individual write-up, as a key element in there having been able to solidify their understanding of historical events and concepts (V-15). One veteran provided a more specific suggestion, stating that students should have been encouraged to “write their paragraph as if they were describing the model to someone who was looking at it without knowledge of the subject content . . . and they should include historical details from [their] . . . research in the write-up to defend their ideas” (V-18). S/He felt this would have pushed students to clarify their thinking and made the underlying concepts clearer to those viewing the model (V-18).

Some students, in responding to the metacognitive assessment, provided more extensive and creative proposals. The responses by one veteran were particularly rich in this regard; s/he called for exploring multi-sensory formats for modeling, making greater use of technology to enhance the process, and changing the way groups were assigned (V-11). This student went on to suggest that moving “beyond the visual format . . . would help with different learning styles” (V-11). Written and auditory models were offered as potential modes. This respondent also saw ways in which technology might have been leveraged “in the crafting of more intricate models” and providing “collaborative space for groups” (V-11). Finally, they suggested possible modifications to group size and to the way in which individuals are assigned to groups, putting

“people together based upon a Myers-Briggs or learning style (either complementary or contrasting)” (V-11).

The participants’ responses demonstrated critical understanding of the learning process and the ways in which conceptual modeling could be improved both for their benefit and the benefit of other students. Their articulation of the problems addressed, and solutions provided by students were a serendipitous benefit of the metacognitive assessments and a manifestation of authentic engagement with the discipline of history.

### **The Discipline of History**

As I had used conceptual modeling in my history courses, I felt the students (and I) would benefit from their reflections on history as a discipline. The students participating in this study had been enrolled in one or more classes that I taught under the aegis of the Upper School History Department, and the learning of historical content, skills, and concepts was the goal of these courses. Therefore, I wanted to discover the perceptions students had about the utility, scope, and process of historical inquiry and perhaps where they might have seen intersections with conceptual modeling.

I sought insight through the use of the same metacognitive assessments discussed in the section on conceptual modeling. Students<sup>29</sup> were given a prompt for the metacognitive assessments meant to elicit their perceptions of history as a discipline and to reflect on what if any impact conceptual modeling has had on these perceptions (see Appendix S).

### ***Utility of history***

Students offered a number of views on the purpose or goal for studying history. Chief among these was the often-heard cultural meme: “We learn history so as not to repeat the mistakes of the past.”<sup>30</sup> Historical study, according to one student is, “about comparing

yesterday's ideas to today's and avoiding some of the crucial mistakes we've made in the past (M1-1). It's about learning from our mistakes as a population.” Thus, one respondent claimed, historical study could “help to improve how people live their [present-day] lives” (M1-15). According to another student, history could even inoculate us from harm by warning “those in charge of the consequences of their actions, based off of historical precedent” (M2-8).

This utilitarian view can be seen in the roles or “jobs” participants assigned to historians. According to one participant, “it's the historian's job to tell us (in the present) about the way that the past people performed actions and find ways for the general public to apply those [past] actions and create new things from them” (M1-14). According to another student, the job of a socially responsible historian is to, “look for patterns and see what we can do to stop history from repeating” (M1-36). Another respondent suggested that:

Historians study past events and past ideas in order to help us better build our future.

Their process can vary, but their ultimate goal is to gain an understanding of what has happened before us, so they can know how to better help us in the future. (M2-25)

In an odd way, historians were converted into futurists by the students, discovering “the past, and making connections and finding patterns [among] past events, so that they may predict the future” (M1-14). For this same student, the whole purpose of historical study is to solve the future: “[B]ecause what is the point of learning the past if you can't apply it to the future” (M1-14). In this view, historians are the same as marketing, economic, and other data analysts—providing a mercenary edge in the competition for future success.

Students also claimed that the study of history gave us the opportunity to avoid the mistakes, not just of our past, but those committed by other civilizations. Practitioners did this, according to one respondent, by looking “at evidence left behind by cultures and civilizations to

find out their customs, economy, and political affiliation, for the benefit of learning from other civilization's mistakes" (M2-21). In this way, studying the problems of the past provided solutions in the present (M1-23). In a more extreme version of this presentism (perhaps ego- or chrono-centrism), one student averred that:

History should be studied by looking at all events through the scope of the modern day and should really only look at events or ideas that could relate to your current situation. For, the only thing that really matters is the current outlook, and by looking at history, you can see how it could affect your lives. (M2-8)

The usefulness of history, according to the student reflections, was not limited to avoiding mistakes. Understanding the past could tell us "how we got to the place we are in today" (M2-5) and brought greater clarity to the present (M1-4; M2-27) in that by connecting to the past we "enhance our understanding of the world we live in" (M1-44). According to one respondent:

Historians display the past in order for future generations to understand how the world has come to be and events that have shaped the present. [They do this by] finding artifacts and new information that convey events and people from the past and string them together to form a complete memory and understanding of the world before us. The product is new knowledge which we can further develop to use to our advantage in the present and future. (M2-15)

The students saw historians as the preservers, interpreters, and purveyors of our shared past. They also characterized the field as being dynamic and alive and as the key to understanding how we got here and where we might be going.

Another common use for history, alluded to here by the student participants, was to create a shared culture—a narrative that provided a group of people with a common story and a sense of unity. While not explicitly presented by any of the respondents. This suggests that this purpose—to create a patriotic citizenry—was, as far as the students participating in this study were concerned, part of a hidden curriculum—one in which they had no say, and only passing awareness.

### ***Scope and scale***

The most common observation regarding the scope and scale of historical inquiry, concisely articulated by one veteran, was that, “modeling allowed [an understanding of] the themes and forces of history rather than dates and straight facts” (V-13). This theme of conceptual modeling as a key to seeing the big picture—the webs and patterns of history at the macro scale—was carried forth in a number of similar responses.<sup>31</sup>

Two students focused on the way modeling caused them to “look at the processes and patterns” (V-17) or, “general trends instead of loosely connected events” (V-20). Another participant provided the same message in reflecting on how, “modeling has shown me that history is not about facts and events, but rather is a series of reoccurring patterns and trends that took place in different, yet similar environments across the globe” (V-2). This holistic approach of the conceptual modeling process provided students a way “to approach learning new material by looking at the universal aspects” (V-24) that tied events together.

Student responses suggested a kind of “universal and interconnected history;” one in which specifics (time, location, etc.) might have been in flux, but where there were patterns and themes that remained constant (V-21). One respondent used the trope about history repeating

itself to promote the same idea (V-15). Students saw this more holistic view as allowing them to, as one veteran stated:

. . . better conceptualize ideas within history and be better able to compare themes across places and eras. So often we get hyper-focused on one event or epoch that we miss the big conceptualization of that idea; yet modeling strings all of these seemingly disparate events together thematically into one cohesive narrative. Thus, it's enabled me to analyze historical events on more of a macro scale in lieu of a micro one. (V-12)

This attention to the larger patterns and trends could be seen as a demotion of content. In conceptual modeling, historical events are treated as case studies, providing the data from which larger concepts and theories may be induced. The focus on the macro and the generalizable can appear antithetical to what was usually seen as a chronologically linear field of study in which specific content served to illustrate established theory.

However, some students saw the macro/micro and concept/content balances differently. They viewed conceptual modeling as providing a broader, thematic view of history (V-6; V-9); one which was, “less linear and more complex than I had ever imagined. It’s not a timeline, more of an intricate and interwoven narrative” (V-1). Another veteran added detail to this vision of history as an interconnected web, when they speak to how they:

I used to think that history was a very linear thing that occurred through a very specific set of causes and effects. After two years of modeling, I learned this was not true at all. My history class with modeling caused me to look at history as an interconnected web of humanity. I learned more about how human nature and psychology affected history than I had in my entire life to that point. (V-10)

This transition from seeing the past as a simplified linear construct to viewing it as a more complex interconnected web was one of the ways students saw conceptual modeling as having changed their way of looking at history.

Another transformation could be seen in how a student's view of history as a simple narrative became more nuanced. One veteran recalled their transition as follows:

All of my history classes prior to Mr. Coven's class told history like a story. In Mr. Coven's class history was still a story but we weren't looking at the plot or the characters, we were looking at the theme and the genre the story belonged in and the tone of the story. Exactly how my more advanced English classes analyze texts, we were analyzing the story of history. That was endlessly fascinating for me. (V-11)

Thus, this student saw conceptual modeling as centering on a kind of literary analysis, rather than being limited to more uncritical storytelling (V-11). Along these same lines, students remarked to conceptual modeling's focus on finding "the meaning behind events" (V-8), symbols and artifacts— with modeling providing students the opportunity to authentically engage in historical work and present theory based on their own analyses (M1-42).

### ***Process versus product***

The authentic engagement provided by conceptual modeling led students to speak as "historians" and gave them the opportunity to reflect on the occupation (V-10).<sup>32</sup> Even so, their responses were characterized by some less sophisticated views—a holdover from traditional training centered on students being focused on providing the correct answer on a summative assessment. As a result, students still viewed history as a product, the result of rather than the process of thinking about the past (M2-17). In that light, they offered their views on how

historians go about “making history”; as though history were more about the container than the content.

In the course of comparing conceptual modeling to what they perceived as the more traditional modes of practice, students related the advantages and disadvantages of what they sometimes perceived as opposing and antagonistic methods—conceptual modeling versus more traditional methods. At other times, they saw continuity and compatibility. As an example of the latter, student participants viewed the research phase of conceptual modeling as a traditional component of historical study—a process-neutral endeavor that was perceived as being the same in any pedagogical approach.

There was wide agreement among students that one of the main tasks of a historian is to collect evidence from the past, often in the form of primary documents and artifacts (M1-3; M2-18). The simplest description of this essential disciplinary task came from one respondent, telling us that, “[h]istorians are people who study the past of a certain topic or study. They use primary sources to determine their own interpretations” (M1-48).<sup>33</sup> A much more complete response came from another student:

Historians are people who use information that already exists in order to find new information, which they can use to base theories off of, as well as use the information provided as a springboard to figure out new information. I would describe a historian’s work as ever-shifting, because there is a constant new flow of information, opinions, and ideas that have and will continue to make an impact on a historian’s work. I think the same goes for a historian’s end product, because I don't think that a historian's work is

ever done, or can ever be done, due to the fact that all information is in a constant flow.

(M1-2)

This same participant provided us with a standard view of the why and how of historical research, in stating that:

The main 'objective' for historians is to expand their comprehension on certain topics regarding the past events, figures, etc. of a certain time period before ours, ranging from the dawn of time to last week. These historical events can be discovered based on given evidence regarding the time period, for example a book, fossil, or even a person who has lived through this event. (M1-2)

Students made apt comparisons between historical study and the kinds of work done by journalists and forensic scientists. Similar to journalists, according to one respondent:

[The historians] job is to use information that can be found in written documents or physical evidence to explain the 5W's - Who, What, Where, When, Why (and How) about certain events or areas in history. This is done by reading already existing history books on said subjects, as well as using existing evidence to supply information about what they think happened. (M1-43)

Students saw the historian's job as presenting an objective accounting of past events in order to provide the information necessary to better understand how we got here and perhaps where we might be headed. The students saw this dissemination of historical facts as a social responsibility. One respondent, for example, suggested that "[h]istorians discover and compile history so that it is able to be shared with the world" (M1-46).

### *Historians as experts*

According to most of the participants, history teachers (and historians) gain their authority and credibility by focusing on a single topic (M1-7; M1-10; M1-39; M2-4; M2-14; M2-29) and “studying it for a long time” (M1-5), often to the extent of investigating minute details “. . . that many of us would completely ignore because of how seemingly irrelevant they were” (M1-31). One student suggested that historians need to have a more global understanding, remarking that they have the onerous task of “trying to memorize and get fluent in all things history” (M1-26). According to another participant, historians “should consider every possible causation and outcome” (M2-20). This desired omniscience was seen as being especially valuable for educators working in “Big History” which, as one student pointed out, extends “from the Jurassic Period which was millenniums ago, or even studying what happened 10 years ago” (M1-40). Another respondent provided a similar job description, saying that historians were expected to conduct their research in many venues and formats:

From examining the physical evidence left behind at archaeological sites to reading and analyzing written media from the time. Knowledge can also be gained through looking at art styles and specific artworks from a time period and location, as well as noting burial rites and customs and the bodies of the dead. (M2-16)

In this conflated view, a historian needs to be a paleontologist, archaeologist, and anthropologist (M1-17)—supporting the argument that history is the umbrella covering all the social sciences.

Students saw the need for historians to have depth of expertise along with this breadth of knowledge. One participant saw historians as tireless forensic detectives whose work was:

. . . harder than it looks. they [historians] are researching usually just one topic say, US History, and they have to know everything about US History and if something is missing or doesn't fit, they have to research it and come up with an answer so it does fit and then they can say whether it happened or didn't happen depending on their research. (M1-6)

Another respondent saw historians in a similar way, as recorders and curators of history, using their expertise to “classify which information about these time periods or events are fake, and which ones are real” (M1-27).

Students saw the work of a historian as fitting together pieces of the past (M1-45)—from text and prior knowledge—in order to create a single narrative (M1-19; M2-10). One respondent provided the following job description: “Historians compile, translate or find sources on events or situations from the past. They take the data gathered from their sources and create a 'image' of the world around” (M2-9). While one participant described this work as “tedious” (M1-8), another put historians in a more positive light, calling them “meticulous” (M2-2).

Students saw historians, despite their diligence, as working with incomplete evidence and creating a tenuous product. They saw such ambiguity as a result of the speculation—what one student referred to as “estimation”—that results from historical evidence being interpreted by someone who has learned about the events second or even third-hand (M1-30).

### ***Becoming historians***

As students progress in their careers, they move from passively taking in information toward developing and disseminating ideas. Respondents noted the way in which history, by its nature as the study of the past, is passed down from generation to generation (M2-22). As one student put it:

Historians display the past in order for future generations to understand how the world has come to be and events that have shaped the present. The process is finding artifacts and new information that convey events and people from the past and stringing them together to form a complete memory and understanding of the world before us. The product is new knowledge which we can further develop to use to our advantage in the present and future. (M2-15)

Students, therefore saw the authentic engagement engendered by conceptual modeling as a way of becoming active participants in historical scholarship—taking on the mantle of good citizenship and disciplinary responsibility (M2-34).

### **Conclusion to Findings**

The metacognitive assessments, in which students were given the opportunity to express their understanding of the conceptual modeling pedagogy and the discipline of history, could be seen as an exercise in generational reciprocity. The feedback these students provided me, as their teacher, have proved useful in improving my teaching practice—of potential benefit to study participants and the students that follow them. In addition, their insights into how, as students, perceive historical inquiry helps me understand how they engage with the fundamental principles and concepts of my chosen field.

As to the conceptual modeling pedagogy, the students reported that the intellectual framework pushed them to think more deeply about historical forces and patterns—a depth they achieved through a level of abstraction unfamiliar to those new to the pedagogy. The participants made remarks suggesting that the visual abstraction that comes from model construction was one of the elements that made analytical skills and concepts easier to acquire

and the retention longer lasting. The more traditional teaching methods to which they had been exposed provided the frame of reference they students used to assess conceptual modeling.

Students remarked about the significant role collaboration played in their development of theory and of analytical skills. They saw greater understanding arising from their intra-group research, deliberations, and model construction as well as through the insights provided by presentations to their peers and seminar discussions.

Modeling, according to the respondents, provided them with a learning and analytical method that was transferable to other classes, particularly those in the social sciences, math, literature, and natural sciences. In addition, they remarked to their ability to apply analytical skills and concepts from other fields to their work in history—making conceptual modeling a vector for the interdisciplinary transfer of knowledge.

The students provided insightful and constructive critiques that will allow for improvements in the modeling method. While they felt they had greatly benefited from the conceptual modeling method, they found it hard to set aside the familiar methods of their past instruction. The breadth of content was one of the areas expected to garner criticism.

The participants were also critical of the ways groups were established. They seemed to feel that greater attention to the makeup of the groups would temper some of the vices to which teams are prone—unequal distribution of labor and the need to compromise were cited as the most egregious examples of poor group dynamics.

The second main theme of the study was focused on student perceptions of the field of history. They saw the discipline as having utility, but this was often limited to preventing the people of today from making the mistakes of the past—the Santayana dictum. The participants suggested that the discipline of history is broad in its scope and powerful at multiple scales.

History, according to the students, is the umbrella for other disciplines, helping to unite, for example, archaeology, economics, sociology, political science, etc. in a common pursuit: understanding the human condition.

The students also proffered some of history's inherent flaws. They pointed out elements of subjectivity and confirmation bias that were apparent in historical analysis and made worse by the narrowness of the records available and chosen, i.e. the silence of the lower orders.

Ultimately, the students seemed pleased with the analytical skills and concepts they had learned through the modeling pedagogy. And I, as a practitioner researcher, found great value in the collection and analysis of my students' metacognitive assessments—providing me insights with which to improve my professional practice.

## Chapter 5: Conclusion

History and the other social sciences prepare young people to serve and improve society. This is the transformative mandate espoused by those who see education as an engine of democratic progress (Barth & Shermis, 1970; Parker, 2008; Eisner, 2009). Students can become agents of positive change by learning to think critically about problems and solutions. As a teacher, I consider it my responsibility to improve my practice in order to better prepare my students to be productive citizens.

As part of my professional development, I wanted to find ways of improving my teaching practices, in order to better meet these pedagogical goals. I worked with three other like-minded teachers at my school to develop conceptual modeling as a strategy for improving instruction. This teaching method, based on a similar method that had been used in physics instruction (Hestenes, 2000), was designed to allow students to move from passive consumer to active producer of historical knowledge. By providing the opportunity for them to be authentically engaged in historical inquiry—to induce theory and derive meaning from historical evidence—I hoped they would learn the habits of mind and disciplinary practices that would give them a set of skills that were permanent, broad, and transferable (Timmins, Vernon, Kinealy, 2005; Lévesque, 2008).

Having helped to develop and implement this new pedagogy, I felt the next step would be to begin a program of recursive research, using student feedback to make iterative improvements in the conceptual modeling method. It is part of my school's common practice to give students the opportunity to complete course evaluations and provide other types of feedback. These are meant to provide the administration with student input regarding the quality of instruction they are receiving.

I decided to build on this school-wide practice in my own research by giving students metacognitive assessments, twice per course (once at the beginning and once in the penultimate week of instruction), to elicit their insights. In doing so, I hoped to gain a better understanding of how my students perceived both the conceptual modeling pedagogy and the discipline of history. I undertook this action research study to strengthen my teaching and the conceptual modeling pedagogy, through a deeper and more focused collection and analysis of student insights.

### **Intellectual Autobiography**

Before turning to the interpretation of the findings for this study, it is important to reflect on the development of my intellectual framework. My commitment to a strongly interdisciplinary form of teaching can be traced to my training and experiences. As an undergraduate, I found it difficult to confine myself to a single discipline. I had interests across the humanities and social sciences. Ultimately, I created an individualized major, made up of a broad spectrum of courses in international relations, economics, history, political science, and sociology. Late in my junior year—after an internship working as an analyst in the international finance division of a bank—I took a life-changing course on the evolution of the American landscape.

At that point, in addition to completing courses for my individualized major, I began to take classes in architecture. With my B.A. in international economics in hand, I started a graduate program in architecture—a field with interdisciplinary elements drawn from the humanities and the natural and social sciences. My studies focused on the semiotics of architectural design. Upon completion of my M. Arch., I worked for a number of small and large firms. The discussions of architectural theory, design, and engineering, that had dominated

my graduate school experience, gave way to the mundane nature of technical drafting and construction specifications.

I reached another transition point. I wanted to return to the world of abstract theory, but I also wanted to take an even broader and more interdisciplinary view. I found a match in studying cultural history. I was intrigued in how all aspects of life could be viewed through the all-encompassing lens of history. Through my subsequent graduate studies, I developed a particular interest in the systems and forces that seemed to organize and propel historical events. These ways of seeing became the seeds for the heuristic tools (appendices K and M) on the cycles and forces of history and the taxonomy of the discipline broken down into the interrelated and interconnected categories of economic, political, intellectual, cultural, and social history (EPICS—Appendix L).

As a result of my training and background, I tend to look for larger, underlying forces and find meaning in the patterns of complex systems. My affinity for conceptual modeling is a reflection of my habits of mind and my worldview. I understand the world by creating analogies and metaphors drawn from all my diverse interests. Yet, it was not until I began to watch my students develop their own conceptual understanding and theories that I fully realized that I was teaching as I thought: through abstractions and models.

### **Interpretation of Findings**

I conducted this action-research study to explore student perceptions of the discipline of history and the conceptual modeling pedagogy I co-developed. In analyzing my findings, I see some major themes. Regarding the pedagogical affordances of conceptual modeling pedagogy. Student responses revealed ways in which modeling's abstract and visual nature promoted critical thinking; how students viewed the pedagogy as supplementing or supplanting more

traditional methods; the transformative impacts students claimed resulted from engagement with authentic inquiry through conceptual modeling; and the ways in which collaborative historical inquiry created deep, permanent, and transferable knowledge. Students also pointed to some of the flaws in the pedagogy and provide suggestions for improvement. The participants' comments on history as a discipline are equally worthy of analysis and raise larger questions about the goals of historical inquiry and the intellectual and civic duties of the historian

### ***Abstraction, visualization, and critical thinking***

Student comments suggested that the power of conceptual modeling, to enhance historical understanding, comes from the focus on the simplification of complex patterns and ideas into visual, often metaphorical abstractions. As Ayers (1999) points out, we are hardwired to see patterns and connections and we can use this visual acuity to create mental images. These metaphorical and abstract images, presented in models, and retained in memory, provide students a way of developing and demonstrating explanatory analogies that help elucidate clear and compelling ideas and theories (Voss & Wiley, 1997; Wormeli, 2009).

The abstract models seemed to support critical thinking. The findings suggested that students found modeling helpful to their analysis and understanding of historical patterns, particularly those on the larger—“big picture”—scale. The evidence suggested that the pedagogy under investigation provided students an opportunity to construct their own conceptual frameworks and to ask important questions (Brunheide, 2007; Damrosch, 2007).

Students, through their self-derived models, can interpret complex evidence. In this way, simplification through abstraction leads to a more sophisticated and nuanced understanding of historical forces and systems (Dulberg, 2005). By doing so, students are engaging in higher-

order, critical thinking, marked by their ability to construct and deploy conceptual models (Parker, 2008).

### ***Modeling in comparison to traditional instruction***

It is evident from the student responses that they perceived benefits of traditional instruction—mainly the use of comprehensive textbooks and lectures by teacher—as well as conceptual modeling. However, their comments suggested that the newer, conceptual modeling pedagogy provided them with a firmer foundation for analytical thinking and intellectual skill development than the rote memorization of disconnected content which they seemed to associate with more traditional methods. This aligns with Barth & Shermis, 1970’s three-part taxonomy of social studies instruction, especially comparing the modes of social studies for transmission or for reflective inquiry. Bain (2000) echoes this sentiment—when discussing the “transmission model of learning” (p. 334)—suggesting that history is too complex to be reduced to the kind of trivializing minutia that can crowd out the understanding of deeper and more significant historical forces at play.

There is a long history to this portrayal of the inadequacies of hidebound instructional methods (Mann, 1840). While this is an extreme, and perhaps unfair characterization, nonetheless, students seemed to feel that the more traditional methods of instruction were less engaging and allowed for less creativity on their part. The findings support the notion that conceptual modeling empowered students to overcome the view of history as a fixed and immutable doctrine, revealed through the words of established authorities: the textbook and the teacher (VanSledright, 2011).

*Authentic inquiry: Making choices, taking risks*

My analysis of student comments suggested that conceptual modeling provided them with greater choices and intellectual risks. These are but two of the elements of the pedagogy that place the teaching method firmly in the constructionist, experiential family and under the banner of “authentic instruction.” The standards for authentic instruction are laid out in, among other places, in the work of Newmann and Wehlage (1993). King, Newmann, and Carmichael (2009) expand on the earlier work and focus on “meaningful intellectual work . . . [involving] the original application of knowledge and skills” (p. 44) as the fundamental component of authentic instruction.

The analysis of student responses suggested that they perceived modeling as authentic intellectual work, providing them the opportunity to “construct knowledge, . . . to express themselves . . . and to study topics that have some significance beyond the classroom” (King, Newmann, & Carmichael, 2009, p. 49). By engaging in authentic historical inquiry—doing history (Barton & Levstik, 2003; Downey & Levstik, 1998; Foster & Padgett, 1999)—students reportedly developed a historian’s habits of mind and disciplinary skills (Sexias, 1998; VanSledright, 2002; Wineburg, 2001). Milson (2002) posits “that students learn history most effectively when they are engaged in asking historical questions, collecting and analyzing historical sources, and determining historical significance” (p. 348)—all critical elements of the conceptual modeling pedagogy and of the benefits students reported in this study.

The articulate and comprehensive nature of the student responses to the prompts on the metacognitive assessments, further supported the notion that greater, intrinsic motivation came as a result of a feeling of competence in a valued task (Schunk, et al., 2008). According to the students, while conceptual modeling might at first appear daunting and confusing, ultimately the

process provided the right level of challenge to be engaging and interesting (James, 1922). Succeeding with such a valued task, students reported having a stronger self-concept which, in turn, motivated greater engagement and further success, leading to a positive feedback loop (Hirsch, 1996).

### ***Role of student collaboration in conceptual modeling***

Conceptual modeling is a collaborative endeavor. Modeling groups of three to four students conduct research and analyze the results and then construct a group model that summarizes the historical patterns and the theory they believe explains the forces at play. Afterward, each group presents their model to the class and that is followed by a seminar, led by and involving all the students.

According to the findings, students felt such collaboration was very beneficial. The opportunity to present an external representation of historical phenomena—in the form of a visual metaphor or abstraction (van Drie, van Boxtel, Jaspers, and Kanselaar, 2005)—provided for a cross-pollination of ideas. Students reported that collaboration aided them in seeing problems from multiple points of view and that diverse perspectives led to greater empathy. This peer interaction, in which good questions prompt better responses, helped all involved develop better arguments and greater clarity—skills necessary for civic engagement (Dewey, 1915; Hess, 2002).

### ***Depth, permanence, and transferability of concepts and skills***

Student responses suggested that these civic and disciplinary skills were cultivated, thoroughly embedded, and transferable to other settings and context. Deep understanding and long-term retention, according to King, Newmann, and Carmichael (2009), happens as a result of students applying disciplinary skills, e.g. the analysis of evidence, and the parlaying of prior

knowledge, in the pursuit of authentic inquiry. These elements of disciplinary mastery, according to the students, were being accomplished in the process of developing their conceptual models. By knitting together disparate pieces of evidence, rather than just memorizing fragments, students are able to better understand and retain historical concepts and practice the construction of theory (Mann, 1840).

Students reported that they often developed their conceptual models through analogy and metaphor. They attested to the interdisciplinary nature of modeling in remarking how they used concepts from other disciplines to explain history and, reciprocally, use the conceptual models developed in history to better understand ideas in other fields.

Findings revealed that disciplinary transfer took place between history and the STEM fields, particularly the physical and natural sciences. This was likely due to modeling's origins in physics instruction (Hestenes, 2000). Students noted that while the modeling they do in science is similar to conceptual modeling, they are not the same. Physics has well established laws from which models may be deduced (McDermott, 1993). The construction of theory that takes place in conceptual modeling, on the other hand, is inductive and not bound by the constraints of natural laws. Students find that this difference makes conceptual modeling more challenging, but also more fruitful.

### ***Student critiques and suggestions***

Although the findings show an overall appreciation for the conceptual modeling pedagogy, the students did provide both critiques and suggestions for enhancements. This is of great benefit as this action research was done, in large part, to find ways of improving the teaching method.

The student findings reflect concerns that are raised in the literature by Hirsch (1996). The first of these is an offshoot of the “two cultures” argument. According to Hirsch (1996), the epistemological differences between the sciences and humanities preclude the transfer of what he claims are domain-specific concepts and skills. Although some of the findings echo this claim, the position is weakened by the fact conceptual modeling, itself, has been adopted from the sciences and adapted to use in the social sciences and humanities. As previously suggested, there remain differences in approaches between the types of modeling owing to the fact science deals more with deduction from set laws, while conceptual modeling in the humanities and social sciences deals with greater ambiguity and the inductive construction of theory.

The results from the metacognitive assessments show some agreement that conceptual modeling is not the best way to convey content. Hirsch (1996) suggests that inquiry-based pedagogies are not as content rich as more traditional teachings. This mistakes content offered for content learned. It is true that the student-directed data collection presents less data than lectures and textbooks commonly provide.

The findings argue that the lower priority conceptual modeling places on the transmission of content is, on the whole, advantageous. Students, with guidance from their teacher, are able to find more than adequate data to analyze. The Internet and multimedia technologies have provided students with access to an abundance of material—so much so that it is now incumbent on educators to help students learn how to filter and choose between the wheat and the chaff (Seefeldt & Thomas, 2009). More to the point, students are motivated to find the data, as a good model depends on having substantial evidentiary support—sufficient material to allow the construction of tenable models. In addition, the search for data is a critical skill, one that is

difficult to develop if the students are given the source material. And, as the results point out, students retain better that which they searched for and analyzed.

Hirsch's (1996) content argument remains powerful, however, in a culture resistant to theory development. Instead, as reflected in the findings, our society places much greater value on the pragmatic and materially applicable, rather than what is often portrayed as the nebulous and gauzy world of ideas (Barth & Shermis, 1970).

### ***The discipline of history***

The emphasis on utility can be seen in the findings of this study. The very purpose of the discipline has been a matter of contention. Purpose guides curriculum—agendas are reflected and transmitted by the goals to be served (Eisner, 2009). As educators, it is our responsibility to create curricula that best serve our students and our society (Tyler, 2009).

As can be found in the literature, the history of social science education has been marked by rise and fall of three goals that are summarized by Barth and Shermis (1970) as: 1) creating good citizens, with a focus on obedience to authority; 2) developing the field of history into an objective science; and 3) helping students develop “reflective thinking” (p. 749) skills, so that they might rationally and critically discern and solve social problems.

As the findings attest, the civic goals of history (Dewey, 1915; Hess, 2002) are much more in the minds of educators than in those of the students. This may be a reflection of the priorities of students at the study site. It is quite possible that students and teachers perceive different goals and priorities in historical study. In the college preparatory environment in which I work, concerns about grades can overwhelm other, longer-term objectives.

This view of high school as a mere stepping stone to college and career, can also change the ways in which students perceive the conceptual modeling pedagogy. For example, students

may (initially) put greater value on more traditional content focused, rigidly regulated, and concrete coursework rather than on what may seem to be the more ephemeral and abstract realms like those of modeling. In producing models, students may also get stuck on simplistic caricatures and metaphors, while losing sight of the teacher's goal of having students creating theory and understanding important historical concepts.

However, the results of this research point to conceptual modeling as providing students a more expansive view of the purpose of studying history in high school. Students, in their metacognitive reflections, say that conceptual modeling gives them a more complex and multifaceted understanding of historical phenomena (Dulberg, 2005) and pushes them to delve deeply into historiographic issues that lie at the core of the discipline, as well (VanSledright, 2011).

Conceptual modeling, students state, provides them the opportunity, through authentic inquiry, to develop important skills. Through experiential practice, they learn to make meaning from the analysis of historical data, assess the validity and bias of sources—and take responsibility for their own subjectivity, realize the importance of the voices not heard, and to take temporal and cultural context—both historical and current—into account (Parker, 2008). Students learn, they say, to see patterns of cause and effect, underlying forces, and operative systems.

Ultimately, through conceptual modeling, according to the findings, students learned to “do history.” Students came to accept the subjective and flexible nature of any analysis related to (ir)rational human behavior, especially when compared with the, apparently, concrete and objective world of STEM. The participants in the study noted some of the advantages to working in ambiguity—in a field where there may be no, or more than one right answer.

McClymer (2009) the attempt to bring order out of historical chaos compels students to ask better questions and not be satisfied by the answers offered by others.

Conceptual modeling, according to the respondents, provides them agency and a sense of control over their education. This can help students overcome what Bain (2000) describes as the “static, formulaic vision of history. . . [in which] the past is filled with facts” (p. 337); facts that are retrieved by expert historians and passed on to students to memorize and repeat.

The student construction of meaning and theory—fundamental aspects of conceptual modeling— can be transformative. The pedagogy provides students with the skills and habits of mind that will aid them in all contexts and pursuits and allow them to create a world of their own making (Noddings, 2009; Eisner, 2009; Kliebard, 2004).

### **Reflections**

This action-research study gave me the opportunity to examine my teaching goals and the methods by which I attempt to meet them. I remain firmly committed to providing students with greater control, and responsibility for their education. The findings indicated that conceptual modeling was an appropriate method of providing students an authentic experience in historical inquiry and of helping them grow as critical thinkers and scholars. I was also happy to see that the high level of engagement in the classroom, and in the metacognitive assessments.

My reliance on student feedback provided a number of benefits. First, the metacognitive assessments reaffirmed my belief that students are very good at articulating their own educational goals and learning process—information that is invaluable in the design of curricula and instructional methods. Second, I was able to get a different perspective on conceptual modeling and on the discipline of history. These fresh insights were particularly useful in helping me set aside the mental restrictions that come from being so intensely involved, for so

long, with the discipline of history and the development of conceptual modeling. Third, the student responses provided me with insights into how well the messages I was attempting to transmit were being received.

The research study, along with the more informal student evaluations I have solicited and received on conceptual modeling, provided an excellent platform for engendering important and meaningful discussions with my students. These discussions on educational practice and policy were fundamental to the development of a student club known as “Shifting the Educational Paradigm” (STEP). This student-led organization, dedicated to providing students a voice in the education they and their peers are receiving, is one of the largest student clubs on campus. Members of the STEP group have joined me in making presentations at national conferences. STEP has also organized and sponsored conferences of their own—attended by students and faculty from regional schools—on subjects like designing the ideal school and developing a student evaluation system that provides multiple views of student performance and better serves students, parents, teachers, administrators, and college admission officers.

Having worked with students in STEP, I was not surprised by the depth and clarity of their metacognitive assessments, particularly when responding to prompts regarding the conceptual modeling pedagogy. I found it interesting that they were not as articulate in their comments on the discipline of history. I suspect their immersion in more traditional methods of teaching history has not given them the direct experience and language necessary to analyzing historical inquiry. Instead, they seemed to quite often fall back on common canards like learning history to avoid the mistakes of the past, or the view of practitioners as little more than antiquarians cataloging archives of esoterica.

I went into this project with the underlying assumption that through understanding student perceptions of the how and what they were being taught was key to improving curriculum and pedagogy. This study was a productive step in finding ways to improve practice as I seek to help students become thoughtful and productive citizens. This research study has provided me with a foundation for my future investigations into conceptual modeling and ways of helping students partake in authentic historical inquiry.

### **Recommendations for Further Study and Action**

This action research study has laid the groundwork for further investigations of the best ways to help students become independent scholars, capable of using interdisciplinary skills and concepts to analyze historical material and generate theory. More specifically, further study and action needs to be done on the conceptual modeling pedagogy.

Improvements to conceptual modeling, that take into consideration the suggestions students made regarding the teaching method, should be developed, implemented, and evaluated. As with any action research program, student feedback should continue to be sought, so as to maintain a productive student-teacher dialog. This study has outlined some areas of potential improvement. The metacognitive assessments have provided suggestions, from students, to realize these pedagogical enhancements. A number of these improvements can be implemented in short order.

Per student suggestion, I plan to try different methods for creating the trimester-long modeling groups, and provide students more opportunities for individual reflection during the initial phases of a unit, but still allowing for the benefits of collaboration. I will continue to look for the right balance between challenge and assistance, to provide students greater clarity and confidence, without sacrificing creativity.

The findings of this study support my continued development and use of the conceptual modeling pedagogy. However, in order to make significant improvements to this method of teaching and to provide the greatest benefit to the greatest number, the pedagogy will need to be tested in other environments. The adoption and adaptation of conceptual modeling in other settings is crucial for success. It would be interesting to see what the best implementation might be in, among other settings, large public schools, and in fields of instruction like world languages, the arts, and mathematics.

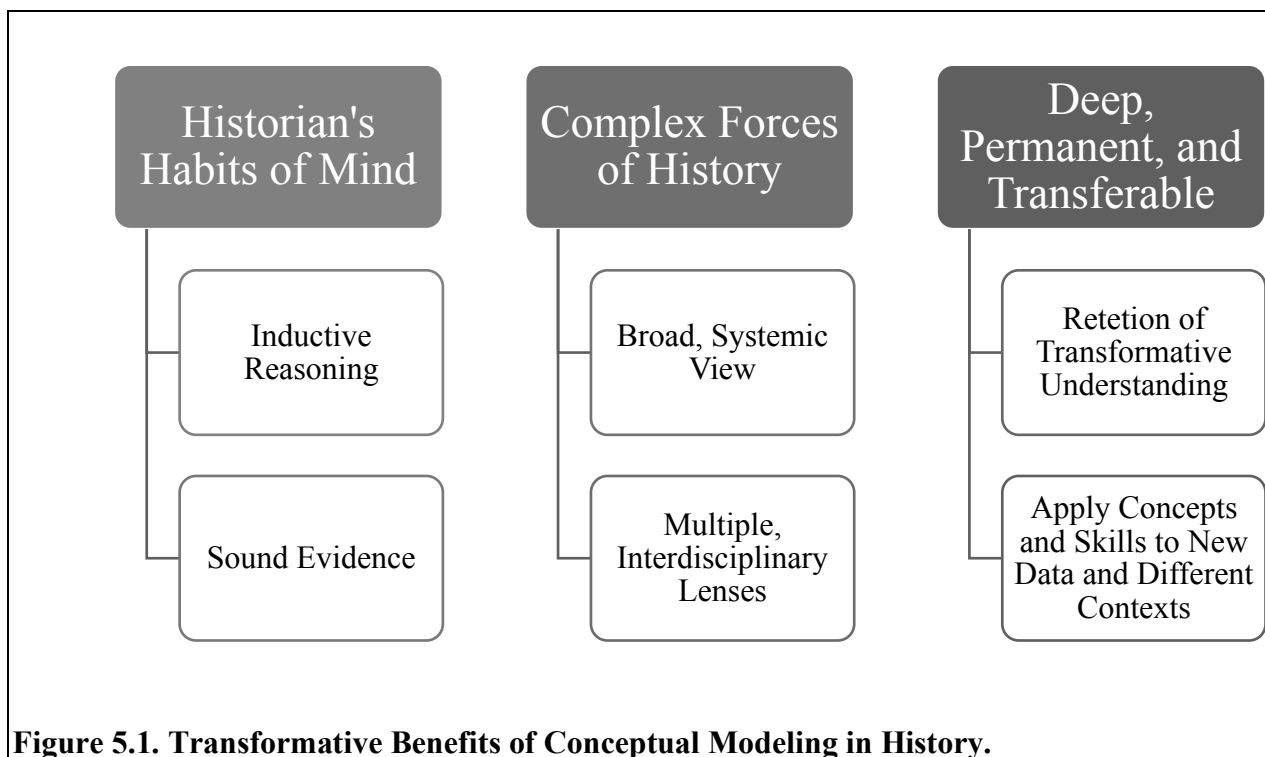
As I discovered from my involvement with the multi-disciplinary team that developed conceptual modeling, the broader the perspectives and more diverse the voices of those involved, the richer the product will be. A larger pool of students would also open the pedagogy to more types of analysis. In the initial stages, qualitative and mixed methods studies—perhaps including more action research—might prove most fruitful. These studies could provide the framework and parameters for more generalizable quantitative analyses. This variety of studies would help fill the gaps in the literature, extend the practitioner conversations, and lead to significant improvements in the pedagogy.

Though the skills and concepts of historical study have a much better developed literature than conceptual modeling, further research is still needed to better define the components and goals of historical inquiry. While I would like to see student input, beyond that of being the subjects of study, be instrumental in the design and implementation of research projects, my experience with this study demonstrated the limitations of this more inclusive approach. Therefore, I would suggest that academics and practitioners develop a research program—guided by theory and informed by practice—to establish the critical skill and threshold concepts that are necessary to conduct authentic historical inquiry. This research would build on the many similar

endeavors—like those leading to Common Core, the National Curriculum Standards for Social Studies, and the more recent, C3 Framework.

### Conclusion

The modeling pedagogy has three major goals, that students: 1. develop a historian’s habits of mind—coherent, inductive reasoning based on evidence that has been vetted for accuracy, bias, and completeness—which leads them to a deeper understanding of history; 2. are able to see the complex interplay of forces in action in history and honor that complexity by viewing events through a broad set of lenses; and, 3. can apply their knowledge and skills to new data and in different disciplinary contexts.



Conceptual modeling is an expression of constructionism (see Manfra & Coven, 2011; Coven & Hamilton, 2009 for a more detailed discussion). Modeling, as a pedagogy, and the

focus on creating conceptual understanding, fit well with constructionism's (demi)-autodidactic, progressive approach. Modeling departs from the didactic approach in which students are provided with "objective truths" to memorize and feed back. Instead, the pedagogy provides a way of getting students to construct their own meaning. Working in groups—using data of many types, e.g. artifacts and texts—students discern the patterns that appear in historical events. They look for, and diagram, the forces of history and the ways in which events reflect the complex causes and effects that can be seen in economics, politics, intellectual life, culture, and social organization (Manfra & Coven, 2011; Bain, 2000).

Modeling relies on students to develop their own theories through induction and deduction, construction and deconstruction (James, 1922). In searching for the patterns revealed in historical events—in discovering the forces of history—students are engaged in authentic disciplinary work. As the process (model development) and product (theory) are generated by them, they are owned by the students. Students are thus engaged in the creative construction of historical knowledge. The meanings they discern are, of course, inflected by their own experiences. This subjectivity helps them to understand that while history, itself, does not change, its interpretation is always in flux and is a social construction. Students become informed interpreters and contributors to the socially-constructed worldview. Through modeling, students learn to form their own frameworks—i.e. they engage in historical theory making (VanSledright, 2011).

Modeling instruction holds tremendous promise for humanities classes, just as it does for physics and other science courses. It offers a way for teachers to become more efficient at getting students to retain and truly understand material and to be adept and confident in applying it to new scenarios. By shifting the focus away from piling on more and more information to

understanding and deploying core concepts, modelers become historians—thus mastering the discipline.

### **Limitations**

There were limitations on this study, most were the result of my choice of action research and my dual role as teacher and observer. As I, to my knowledge, am the only one using conceptual modeling—to this extent and at the time of this research—in a high school history classroom, I had to rely heavily on action research. The action research I conducted, qualitative in nature and with a relatively small sample taken from my own classes, presented a natural limit to the scope of my conclusions. Given my role as both subject and researcher, subjective bias was assumed and taken into consideration in my analyses of data.

The single setting of a private suburban high school and a lack of comparatives, placed additional limits on this study. The lack of prior studies in the literature, a problem inherent to a new and innovative pedagogy, provided me with little grounding for my research design.

There were a number of aspects of this study that added to its trustworthiness. My small class sizes and the multiple roles I have played in my tenure of 13 years, with much stronger connections to students than are typical for this type of study, and thus provides greater assurance of trustworthy data. The anonymous nature of the responses helped assure the participants words reflect their meaning. By drawing the data from different times, classes, and sections, the research provided better opportunities for constant comparison and analytic induction. Additional dependability was provided through, among other measures, recursive analysis and coding (Creswell, 2007). The flexibility of this analytical process allowed for the emergence of new patterns and themes, and the correction of erroneous assumptions, over the course of the research and analysis.

While there are limits to the generalizability of action research findings, the method provides the practitioner with a level of insider knowledge difficult to obtain through other kinds of research. The practitioner researcher has a uniquely binocular view, i. e. the ability to see educational practice from two perspectives at the same time. The researcher practitioner can apply the lessons learned through their self-study to enhance their teaching. More importantly, others can benefit from the complex, nuanced theoretical frameworks and practical applications developed by those engaged in action research.

### **Discussion of the Findings**

The important themes that arose out of the results of the study can be tied back to the research questions. Students suggested that the abstract visual presentation of theory—a fundamental aspect of conceptual modeling—allowed for a deeper understanding of historical concepts and the ability to see larger scale systems, forces, and processes. They found that the need to present complex concepts and theory in a simplified, though comprehensive manner improved their critical thinking skills and mastery of the material.

The participants made favorable comparisons between modeling and more traditional methods of instruction. The students commented on the greater depth of analysis and nuanced understanding they were able to achieve. The respondents also appreciated the level of intellectual ownership and authentic engagement provided by conceptual modeling.

Participants made favorable comments on collaboration, an important aspect of the pedagogy. They saw the modeling groups and class presentations as providing an opportunity for the cross-fertilization of ideas, drawn from multiple perspectives. Collaboration, according to the students, helped them develop greater empathy, as well.

The participants in the study said that they found many ways of transferring the skills and concepts derived from conceptual modeling into other disciplines—fields within the humanities, social sciences, and STEM. The students also suggested that the conceptual modeling pedagogy, and the abstract thinking fundamental to the process, helped them hold permanent the concepts they had derived and use them in and out of the classroom setting.

The participants also provided constructive criticism of the pedagogy and ways of improving conceptual modeling. They provided insight into the proper level of teacher instruction and intervention that should be used. The students saw content-related shortcomings that might be addressed through the supplementing of more-traditional methods of instruction. The participants suggested other forms of hybridization, as well. This was particularly the case with collaboration. The students provided suggestions for improving group work and pointed to a need for more individual processing of data and ideas, prior to group work and presentations.

Finally, students examined and commented on the discipline of history, itself. For this theme, they focused on the utility and scope of history and the process of inquiry used in the field. Students suggested that an understanding of history could be used to prevent the repeat of past mistakes. The participants related a preference for historical inquiry that provided a grand overview of “universal and interconnected” (V-21) patterns and trends. This more holistic view, participants felt, would be the result of a more abstract and conceptual form of historical inquiry. The students suggested that conceptual modeling provided for this kind of historical thinking.

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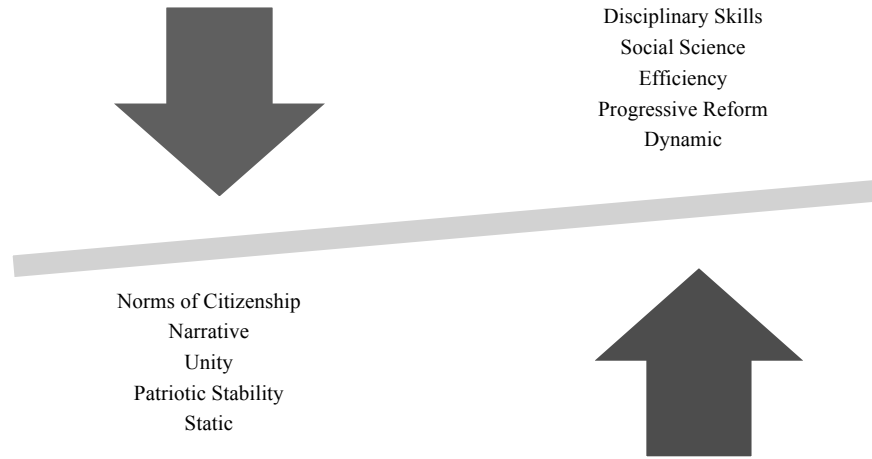
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**APPENDICES**

## Appendix A. Transmission or transformation



## **Appendix B. Becoming historians**

### **Students conducting authentic historical inquiry**

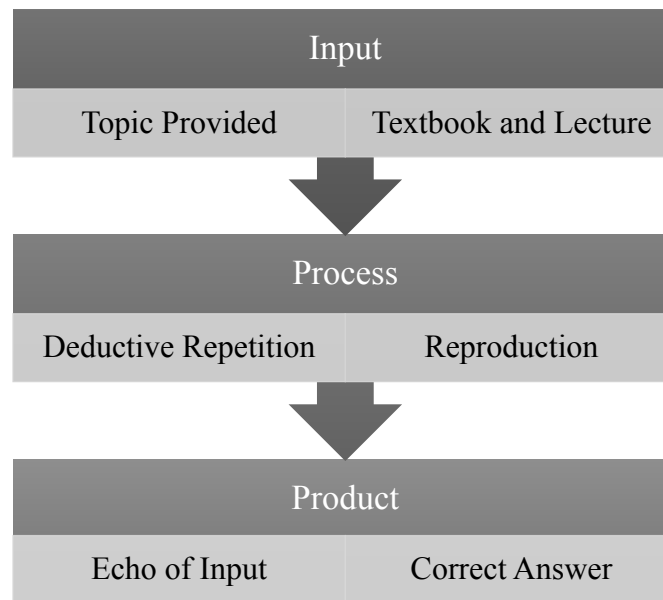
- Collecting evidence
- Conducting analysis
- Constructing meaning
- Creating theory

### **Understanding how history works**

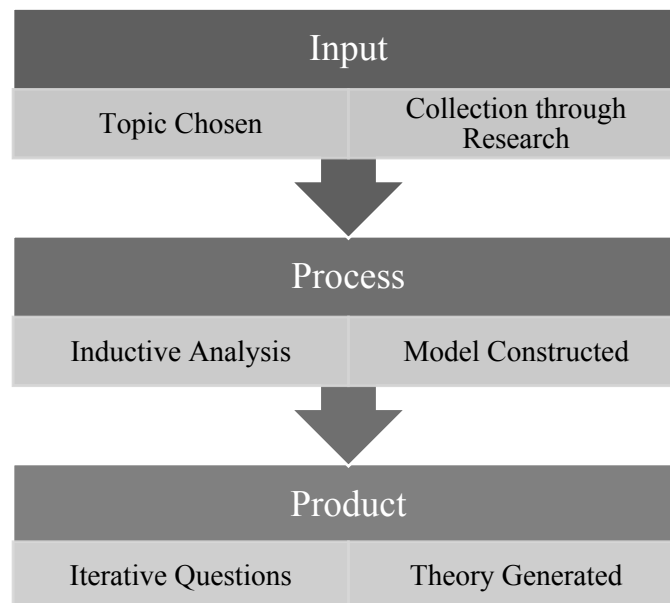
- Patterns
- Systems and connections
- Forces

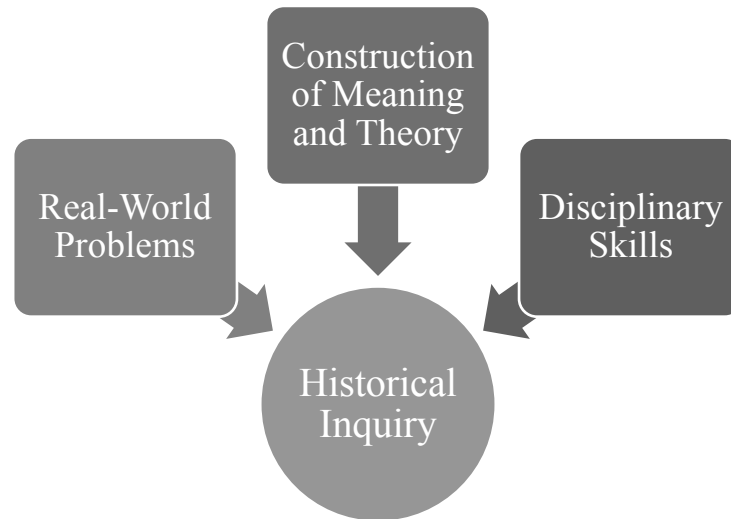
### **Developing knowledge that is deep, permanent, and transferable**

### Appendix C. Traditional instruction versus conceptual modeling



### Conceptual Modeling



**Appendix D. Authentic Instruction**

**Appendix E. Passive / Active—Student as consumer and as producer**

Student as Consumer	Student as Producer
Deductive (Theory Provided)	Inductive (Theory Created)
Content and Product Prioritized	Skills and Process Prioritized
Authority-Controlled—Teacher-Directed—Hierarchical	Collaborative—Student-Directed—Shared Power
Echoing and Reacting	Creating and Acting
Topic Given	Topic Chosen
Lecture / Textbook	Data Collection
Memorize Content	Case-Study Analysis
Conclusions Provided	Pattern Recognition—Model (Meaning) Constructed
Answer Predetermined Questions	Generate Questions and Engage in Seminar Discussion
Provide Correct Answers to Endpoint Assessment	Develop Concepts and Theory—Recursive Spiral

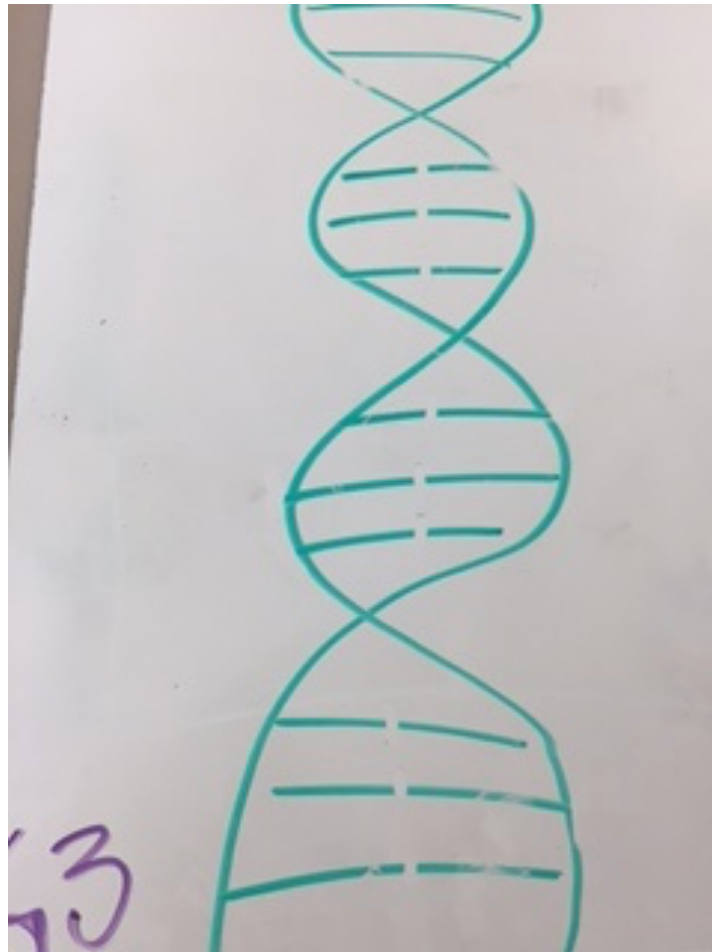
**Appendix F. Lava lamp model: Intellectual unit**

A city's middle and upper political classes are constantly moving and shifting, due to the constant pressures generated by revolts, turbulence, and tension generated by the lower classes

**Appendix G. Independence model—Intellectual unit**

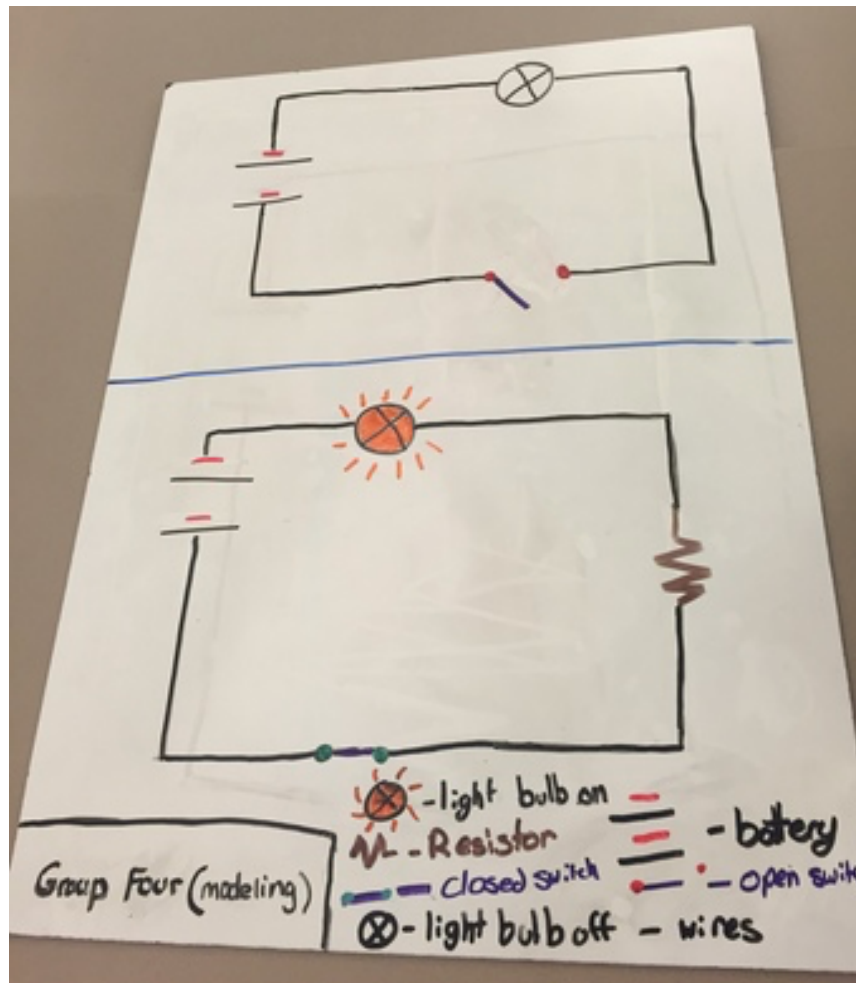
A city can reach the destination of Independence through three different methods which are having their independence given to them by a more powerful country, rebelling against higher powers to gain independence from them, or creating the city as independent from the start by forming it without any dependence on others.

## Appendix H. DNA model: Intellectual unit



- The two strands in DNA represent different factors that are working together, and they influence the nature and behavior of a city through time.
- Religion pairs together with political power like adenine and thymine in DNA.
- At their essences, politics is the allocation of power and religion is belief, and through believing giving power to the idea.

## Appendix I. Circuit model: Intellectual unit



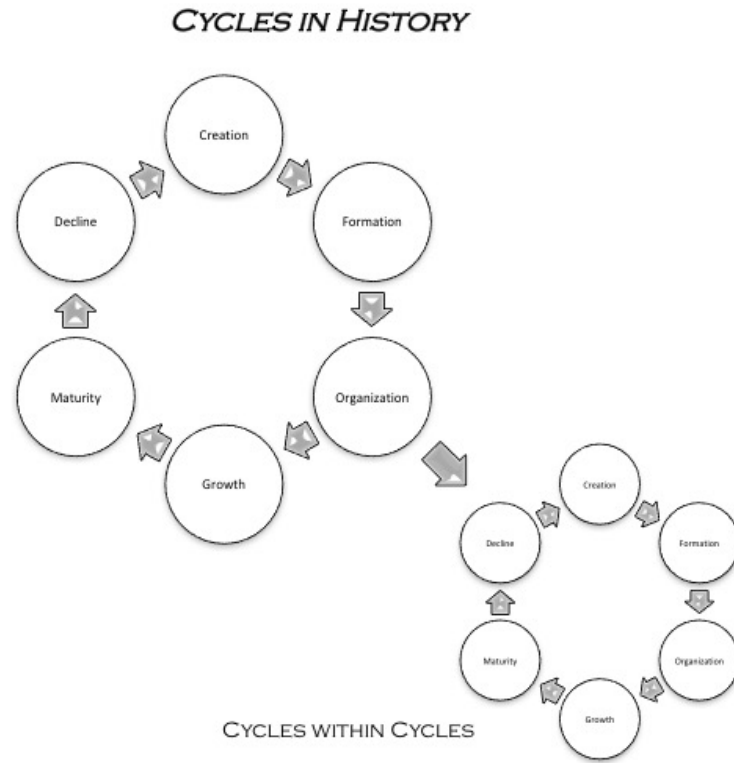
- The light bulb represents inventions and innovations in science and technology.
- The battery represents ideas or resources that fuels the cycle of innovation.
- The position of the switch represents if the city focuses on or applies themselves to inventing or promoting these innovations.
- The resistors represents any trouble a city might come across while trying to invent something.

**Appendix J. Assignments of cities to groups, i.e. “Rise of the City” modeling topics**

<b>Region</b>	<b>City 1</b>	<b>City 2</b>	<b>(City 3)</b>
<i>Africa</i>	Memphis	Thebes	
<i>Africa</i>	Alexandria	Cairo	
<i>Africa</i>	Lagos	Monrovia	
<i>Africa</i>	Leopoldville	Kinshasa	
<i>C&amp;S America</i>	Port au Prince	Havana	
<i>C&amp;S America</i>	Teotihuacan	Tenochtitlan	Mexico City
<i>C&amp;S America</i>	Cuzco	Machu Picchu	Quito
<i>C&amp;S America</i>	Caracas	Buenos Aires	
<i>N America</i>	Mesa Verde	Chaco	Canyon de Chelly
<i>N America</i>	Boston	Santa Fe	
<i>N America</i>	New York	Philadelphia	
<i>N America</i>	San Francisco	Los Angeles	
<i>N America</i>	Detroit	Atlanta	
<i>N America</i>	Chicago	St. Louis	
<i>N America</i>	Las Vegas	Phoenix	
<i>N America</i>	Montreal	New Orleans	
<i>N America</i>	Charleston	Savannah	
<i>N America</i>	Minneapolis	St. Paul	Winnipeg
<i>Asia</i>	Uruk	Babylon	Baghdad
<i>Asia</i>	Pasargadae	Persepolis	Tehran
<i>Asia</i>	Samarkand	Xianyang	
<i>Asia</i>	Kyoto	Tokyo	
<i>Asia</i>	Shanghai	Hangzhou	
<i>Asia</i>	Karakorum	Ulan Bator	
<i>Asia</i>	Guangzhou	Canton	Hong Kong
<i>Asia</i>	Byzantium	Constantinople	Istanbul
<i>Asia</i>	Bombay	Mumbai	Delhi
<i>Europe</i>	Sparta	Athens	Troy
<i>Europe</i>	Tarquinius	Rome	
<i>Europe</i>	Copenhagen	Oslo	
<i>Europe</i>	Amsterdam	London	
<i>Europe</i>	Paris	Berlin	
<i>Europe</i>	Florence	Venice	
<i>Europe</i>	Moscow	St. Petersburg	
<i>Europe</i>	Budapest	Vienna	
<i>Europe</i>	Toledo	Madrid	

<b>Summary of Choices</b>			
	<i># in pool</i>	<i># to choose</i>	
<i>Africa</i>	7	2	
<i>C&amp;S America</i>	6	2	
<i>N America</i>	12	5	
<i>Asia</i>	14	6	
<i>Europe</i>	12	5	

Appendix K. Cycles in History



## Appendix L. EPICS

### EPICS

- **Economic**
  - Environment/Geography/Land/Nature
  - Labor
  - Capital and Money
  - Infrastructure
  - Agriculture
  - Industry
  - Banking/Markets/Mercantile
- **Political**
  - State (Government and Institutions)
  - Law and Justice
  - Rights, Restriction, and Duties
  - Relations with Others (Diplomatic/Military)
- **Intellectual**
  - Philosophy
  - Ideology
  - Theology
  - Science
  - Technology
- **Cultural**
  - Mores
  - Rituals
  - Art—High/Popular—Crafts
  - Literature
  - Architecture
  - Sports/Entertainment
  - Food
- **Social**
  - Demography
  - Migration
  - Community
  - Family
  - Individual
  - Class
  - Race/Ethnicity/Religion
  - Gender
  - Health

**Appendix M. Forces in History**

*Forces in History*

<p><b>Stasis vs. Change (Order vs. Chaos)</b></p> <ul style="list-style-type: none"> <li>• Economic</li> <li>• Political</li> <li>• Intellectual</li> <li>• Cultural</li> <li>• Social</li> </ul>		<p><b>Control vs. Resistance (Power)</b></p> <p>Economic Political Intellectual Cultural Social</p> <p>Control by authority / majority</p> <p>Resistance to authority / minority</p>	
<p><b>Settlement vs. Migration (Motion)</b></p> <p>Colonization</p> <p>Expansion</p> <p>Urbanization</p> <p>Emigration/Immigration</p> <p>Forced migration / settlement (slavery)</p>	<p><b>Nature vs. Technology</b></p> <p>Environment</p> <p>Resources</p> <p>Challenges</p> <p>Ideology</p> <p>Cultural &amp; Intellectual view</p> <p>Bounding &amp; Controlling</p>	<p><b>Inclusion vs. Exclusion</b> (Us vs. Them; Defining Identity)</p> <p>National</p> <p>Group</p> <p>Individual</p>	<p><b>Cooperation vs. Competition</b></p>
<p><b>Hierarchy vs. Equality (a later addition)</b></p>			

**Appendix N. Excerpt from summative essay for economic unit—1.**

At the beginning of our research, our group came up with the thesis: Rice cultivation in the Song Dynasty led to major growth of the population and urbanization of the region, proving that a solid agricultural foundation can quickly lead to economic growth and prosperity. We chose to conduct research on this topic because Asia is so old and so incredibly developed that we would be able to easily (or so we thought) see trends, patterns and other visual statistics of the development of the land. Since rice is a major staple in the Asian culture we thought it would be interesting if we could trace it back to its origin and then follow its spread around the region and analyze the effects caused by the spread. During our research, we were able to find enough statistical information of population size before and after the Song Dynasty, and the amount of arable land before and after. With more research, we were able to prove that the population densities around the region were directly correlated to the spread and growth of rice. Although, not everything turned out to be in our favor. It was incredibly difficult to find information on the rice yields during that time period. Our group reached out to several professors and a handful of schools and were only able to reach two. One of which replied back after our presentation with a very rare source and the other redirected us to a wrong email.

We believed that our model was very appropriate for our thesis. In our model, we had 4 steps. The first was of a small tree seedling, representing rice before it was spread and popular. Then, we had a fully-grown tree, representing the initial discovery and cultivation of rice in a specific location. Thirdly, we had an acorn falling off and flying in the wind which represented the rapid spread of rice and spread of people to grow the rice. Finally, we drew a large field of full-grown trees which is meant to represent how it was after rice as spread around the region and helped populate different areas of the region. During the presentations and discussions, it

was obvious that all of the four models had a similar theme: cause and effect. The opium group's model had a flask before it underwent a reaction and then the flask as it is reacting, representing a boom and a spread of opium. This is just like ours. I found this very interesting because we could have picked anything to talk about but somehow, we all had the same concept.

**Appendix O. Excerpt from summative essay for economic unit—2.**

Although the free market aspect of capitalism allows for consumer freedom with competition created by supply and demand, it creates a higher risk for economic instability as opposed to a command market of a communist system. A free market is used to describe when all exchanges that take place in a certain economic environment are undertaken as voluntary agreements without further interference. This type of system allows for supply and demand between private businesses in which if a given supply of a good's value is increased, the demand for the product will increase as well. This is seen in reverse as well where if the value of a good is seen to decrease, as will the demand. On the contrary of this market style lies the idea of a command economy which has been adopted as key features of communist societies today. As opposed to features such as supply and demand, a command economy has the government determine the supply of each product and the price of what everything is.

. . . [W]ith command economies, there are very consistent upwards trends. The government has more of an ability to predict and control these trends when altering the supply of goods and price to alter demand. With free market economies, there are very big fluctuations in economic growth. . . . This is due to the inability of the government to control not only the supply of products annually being exchanged and sold but the demand as well. This type of system can lead to events as shown by drop in the United States GDP in which the Great Recession occurred. This is created by consecutive negative periods of growth when there's aggregate demand shocked by several factors such as a financial crisis, rise in interest, or a fall in asset prices. This then creates situations of economic stability which although hasn't been fatal enough yet to not recover, could potentially be in future years.

**Appendix P. Excerpt from summative essay for economic unit—3.**

In his book on market design, *Who Gets What—and Why*, Nobel Prize-winning economist Alvin E. Roth succinctly relates his view of the field as being “about the efficient allocation of scarce resources, and about making resources less scarce.” While this is certainly true in the ideal sense, lapses in judgement and execution throughout much of history have done almost the opposite. It is altogether fitting, then, that several models explored the discrepancies between expectation and reality while simultaneously attempting to explain their roots. Time and again, the cause of economic failure was the irrationality of humans and their unwillingness to sacrifice their own personal agendas for the sake of the greater good.

Relatively recent is the addition of behavioral economics in seeking greater understanding of these quirks and inconsistencies. The study of this innate ignorance almost creates a sense of reason throughout the illogical and seemingly unclear. This paradox is, perhaps, responsible for the incongruities discussed. For example, the opposition to equal funding for public schools was primarily based on sympathy for the rich who would have to pay more personally. However, the benefit to the whole system clearly outweighs the costs to individuals. The true utility is higher than any private drawbacks. In another example, the allusion to a governmental suppression of certain national data would only be reasonable if specific leaders felt threatened and opted to jeopardize civilian accessibility to knowledge out of this fear. All in all, it would undoubtedly be detrimental, but these people would theoretically prioritize their own desires, an inadvisable choice, at least for the whole community. The fact that humans systematically err is and would be what led to these breakdowns.

Another external factor that was vital in people’s decision-making processes was the social pressure of the status quo. This was another economically unproductive tendency as it is

only through change that there is progress. It is human nature to be risk adverse at times, and uncertainty is often perceived as peril. Whether it was farm owners discriminating against black sharecroppers because it felt so achingly similar to slavery or tourists allotting Japan a never-ending stream of second chances, the familiarity of the past won out over potential growth solely because of its comfortability. This siren call seems so benign but is potentially deadly. As with other instances where the average conception of truth differs from the literal economic one, the danger lies in the distinction between what seems right and what actually is.

## Appendix Q. Quantitative Survey for Pilot Study (Not Used in This Study)

	Mean	SD	Y Variable (independent?)	Chi 1: Mod Useful Skills	Chi 2-- Learn Deliv Model	Chi 3-- Gender	Chi 4: Excel Hist Student	Chi 5: Enjoy Deliv Model	Predicted
Mean(Excel Student)	3.37	0.55		0.1582	0.3344	0.7832	0.1185	0.9789	0
Mean(Excel Hist Student)	3.19	0.59	Chi 4	0.0187	0.3961	0.1059	Y Var.	0.5732	1
Mean(History favorite)	2.32	0.59		0.0133	0.0908	0.0198	0.0001	0.4122	5
Mean(Hist essential educ)	3.25	0.62		0.0106	0.0044	0.2553	0.1823	0.0497	5
Mean(History import career)	2.81	0.69		0.0673	0.9673	0.6183	0.3541	0.7336	0
Mean(Modeling useful skills)	3.40	0.68	Chi 1	Y Var.	0.0003	0.2337	0.0187	0.0001	7
Mean(Modeling Control Learn)	3.27	0.70		.0001	0.0001	0.1128	0.0969	0.0001	9
Mean(Enjoy Hist more post mode)	3.24	0.80		.0001	0.0001	0.725	0.272	0.0001	9
Mean(Mod skills other classes)	2.89	0.65		.0005	0.0161	0.4625	0.6597	0.0307	5
Mean(Mod match learn pref)	3.13	0.75		.0001	0.0001	0.7331	0.0203	0.0001	10
Mean(Enjoy mod collaborat)	3.24	0.78		.0015	0.0001	0.0258	0.0025	0.0001	11
Mean(Learn deliv model)	3.48	0.69	Chi 2	0.0003	Y Var.	0.7887	0.3961	0.0001	6
Mean(Learn deliv lecture)	2.87	0.91		0.2289	0.3329	0.4082	0.3371	0.4651	0
Mean(Learn deliv textbook)	2.13	0.94		0.9776	0.4830	0.7130	0.2183	0.7867	0
Mean(Learn deliv on-line db)	2.29	0.89		0.5332	0.8726	0.4476	0.4234	0.5262	0
Mean(Learn deliv Sem Disc)	3.29	0.89		0.0136	0.1646	0.844	0.5580	0.0658	3
Mean(Learn deliv essay)	2.44	0.91		0.2203	0.7036	0.2839	0.2724	0.6113	0
Mean(Learn deliv A/V Film)	3.41	0.73		0.8809	0.2412	0.46	0.5301	0.2378	0
Mean(Enjoy del modeling)	3.38	0.75	Chi 5	0.0001	0.0001	0.1074	0.5732	Y Var.	6
Mean(Enjoy del lecture)	2.65	0.99		0.2569	0.4985	0.2102	0.4203	0.1958	0
Mean(Enjoy del textbook)	1.71	0.81		0.2707	0.3992	0.9194	0.0787	0.3829	0
Mean(Enjoy del on-line db)	2.03	0.84		0.7152	0.6230	0.9303	0.0867	0.6973	0
Mean(Enjoy del Sem Disc)	3.16	1.02		0.1567	0.1282	0.1651	0.7652	0.4817	0
Mean(Enjoy del essay)	2.08	0.90		0.8041	0.4661	0.6045	0.3148	0.5694	0
Mean(Enjoy del A/V Film)	3.56	0.62		0.6069	0.1386	0.0337	0.3627	0.074	1
Mean(Effect Ass Essay)	2.68	1.01		0.9686	0.7140	0.0393	0.3804	0.3478	1
Mean(Effect Ass M/C)	2.95	0.94		0.3461	0.2184	0.1735	0.0110	0.1118	1
Mean(Effect Ass Project)	3.40	0.77		0.6314	0.4701	0.8333	0.9775	0.678	0
Mean(Effect Ass Oral)	2.94	0.97		0.1416	0.3854	0.5346	0.0975	0.1479	0
Mean(Effect Ass Group)	3.11	0.90		0.0127	0.1003	0.3761	0.2083	0.1227	1
Mean(Engaged Background)	0.44	0.59		0.7583	0.3907	0.1539	0.0004	0.6541	3
Mean(Engaged Research)	0.33	0.60		0.1187	0.0972	0.4247	0.5746	0.1037	0
Mean(Engaged Develop)	0.83	0.49		0.1554	0.4441	0.3844	0.0081	0.2871	3
Mean(Engaged Grp Pres)	0.76	0.47		0.3699	0.6069	0.4751	0.0399	0.1204	1
Mean(Engaged Class Disc)	0.59	0.59		0.0533	0.6226	0.6565	0.0004	0.896	3
Mean(Engaged Write-up)	0.37	0.63		0.2141	0.3979	0.2831	0.3724	0.4216	0
Mean(Enjoy Background)	0.27	0.65		0.048	0.0909	0.1671	0.2636	0.0234	2

## **Appendix R. Unused Survey on Student Perceptions—Co-developed with STEP**

This survey is intended to provide me critical information for my current research into the way students, like you, perceive the kind of modeling we do in my classes. Please know that I take your input very seriously and appreciate your willingness to provide thoughtful answers. Also, be assured that your responses will be anonymous. Your name will be encrypted, so that I will not know the source. In other words, the first two sections of this survey will be kept separate from the replies you give to the last section (the invitations to be interviewed and/or participate in the focus group). Thank you for your help in this project. I look forward to your input.

### **Section I—Short Answer Questions:**

1. How would you describe the modeling experience?
2. How and what do you learn through modeling?
3. How does modeling compare with other teaching styles you have experienced?

### **Section II—Rating Questions:**

1. Are you developing useful academic skills through modeling? (Strongly Agree, Agree, Neither Agree nor Disagree, Disagree, Strongly Disagree)
2. Are you developing a greater understanding of history? (Strongly Agree, Agree, Neither Agree nor Disagree, Disagree, Strongly Disagree)
3. Is modeling a worthwhile process? (Strongly Agree, Agree, Neither Agree nor Disagree, Disagree, Strongly Disagree)

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**Section III—Interview and Focus Group Invitations:**

1. Would you be willing to be interviewed about your modeling experience? (Yes, No)
2. Would you be willing to participate in a focus group to discuss and model the modeling experience? (Yes, No)
3. If you answered yes to either or both of the preceding invitations, please provide your name and email address. (Short answer)

## Appendix S. Final draft of metacognitive assessment used for study

Your answers to the following questions are critical to my dissertation research on modeling. I want to know what you think—there are no right or wrong answers. Your responses will remain anonymous.

### Background:

How much experience would you say you have in modeling in each of the following disciplines (If you've never done modeling in a class, check "none."):

{NOTE: Do **Not** include the class in which you are taking this metacognitive assessment in considering your answer.}

	None	Some	Quite a Lot
History	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Science	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Math	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Art	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
World Literature	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
World Languages	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Modeling:**

I would also like to know what Conceptual Modeling, as a teaching method, means to you. In order to assess that, I am asking you to write about a paragraph in which you cover the following (If you have never had a course in which modeling is used, then just focus on the first question):

What is meant by the term: "Conceptual Modeling"? What is your definition? Does it work for you? Present your own theory as to why it does (or does not) work.

**History:**

I would like to know what History, as a discipline, means to you. In order to assess that, I'm asking you to write 1-2 paragraphs in which you cover the following:

What do historians do? How would you describe their work—both process and product? How do/should you study history? Which method(s) work best for you in your learning history?

**Any Comments?**

The space below is for additional remarks:

**Appendix T. Veteran assessment on student perceptions of modeling**

This assessment is intended to provide me critical information for my current research into the way students, like you, perceive the kind of modeling we do in my classes. Please know that I take your input very seriously and appreciate your willingness to provide thoughtful answers. Also, be assured that your responses will be kept anonymous. Thank you for your help in this project. I look forward to your input.

1. How would you describe modeling to someone new to the method?
2. What are some of the benefits students gain from the steps involved in modeling?
3. What improvements would you like to see in the modeling method?
4. Please describe the extent to which modeling has changed your view of history and the way that subject should be studied.
5. How have you applied the concepts you learned in history modeling to classes that do not use modeling as a major learning tool?
6. How has your overall learning style and thinking changed as a result of modeling?

**Appendix U. Course and Intellectual unit descriptions for “Rise of the City”****Course Description— “Rise of the City”**

By the middle of the last century, most of the population of Western Civilization was living in or near cities. In this course, we will use the cities as a way of understanding the economic, political, intellectual, cultural, and social (EPICS) aspects of urban areas. We will examine the ways in which the manmade environment can tell us about our past. We will be looking at ways of “reading” and interpreting such features as gardens, parks, city plans, neighborhoods, roads, infrastructure, shopping malls, etc.

**Prompt for Intellectual Unit— “Rise of the City”**

For this unit, you are asked to examine your assigned cities and see if there are detectable patterns visible in one or more of the sub-topic areas. For example, are there particular ways religions change and develop in cities—do religions change cities, do cities change how religions operate? Is there a connection (a pattern) that you see between cities and education, etc. As a group, you might choose to focus on the same sub-topic(s), or attempt to develop a more generalizable model.

## **Appendix V. Upper School History Department PATH Curriculum**

### **WORLD HISTORY (PATH PROGRAM)**

#### **OVERVIEW.**

9th and 10th grade students at Private Suburban Day complete a series of six trimester courses in World History in which they develop an understanding of how historians and social scientists work and also practice those skills themselves. Students are presented with a substantive base of historical information from which they gain insight into how civilizations develop and change over time. Focusing on the powerful influence that worldviews and religious beliefs have had on the world's cultures, the curriculum explores Western and non-Western civilizations from the Ancient world to the present.

#### **PROGRAM STRUCTURE.**

All students complete the foundational course *World History: Themes and Approaches* during the first trimester of their 9th grade year. From there, students complete five additional World History trimester electives of their choice, to include at least one course with emphasis in the era before the year 1500 CE and one in the era after 1500 CE; at least one course that is thematic (as opposed to focused on the history of a particular place and time); and at least one course with a primary focus other than Europe or the Western world.

#### **LEARNING OBJECTIVES.**

We want our World History students to acquire the skills and habits of mind of historians and social scientists while exploring topics, themes and periods of their choice. Throughout their six trimesters of World History study, students will learn to:

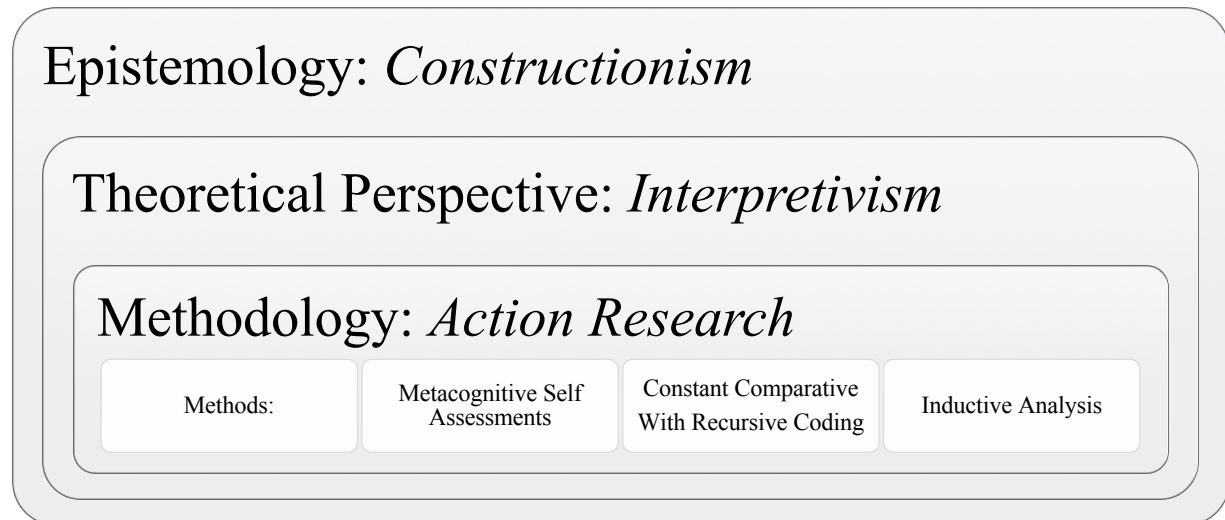
- Access and evaluate numerous types and sources of information with emphasis on research (including library resources like catalog searches, eBooks, and databases) and primary document analysis.
- Develop complex questions and frame worthwhile problems.
- Analyze and evaluate arguments.
- Effectively present the results of their research in both oral and written forms. This will include essay writing (with emphasis upon the creation of compelling introductions, strong thesis statements, effective topic sentences, and meaningful conclusions), oral communication, and research paper writing.
- Recursively evaluate all of these processes (through, for instance, self-critique, peer review, evaluations by a teacher, ongoing conversation, etc.).

**TRIMESTER ELECTIVES WITHIN THE WORLD HISTORY (PATH)  
CURRICULUM.**

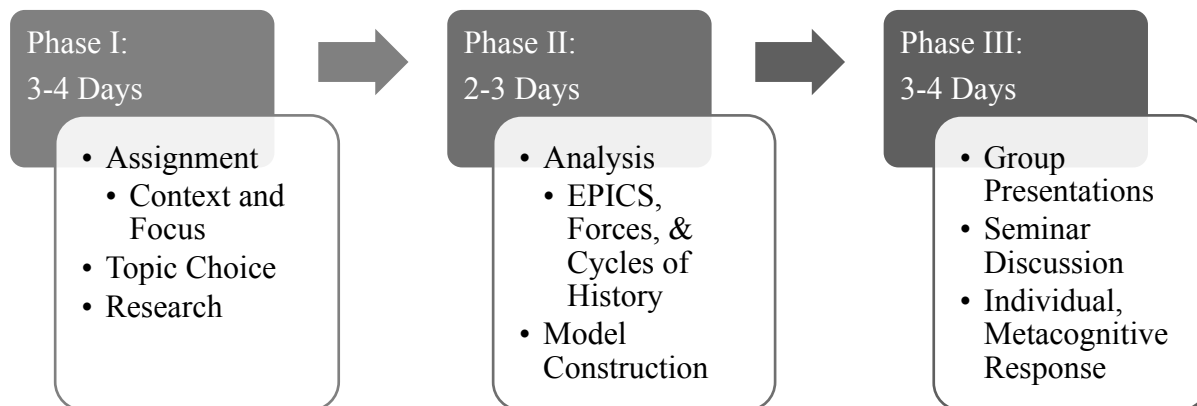
Course offerings will vary from year to year, with the following being a representative sampling of the options available in a given year. Please see the Upper School Course Catalog for a complete list of course offerings.

- History of Science and Technology
- Government, Law and Justice
- South Asia
- River Valley Civilizations
- Latin America
- Slave Trade and Human Trafficking

- History of North Africa
- Greece and Rome
- World War II
- Women in History

**Appendix W. The four elements of the research approach**

Based on Crotty, 1998.

**Appendix X. Conceptual modeling process: Two-week sub-disciplinary unit**

**Appendix Y. Study aid for modeling unit— “Rise of the City”**

The following information is to help you produce a better final product:

- Make use of the “Heuristic Tools”—that are online and in the packets—i.e.:
  - Cycles of History
  - Forces of History
  - EPICS
- Be sure to keep in mind the “Mastery of Learning” criteria that were posted online (and are in the packets).
- Make use of an inductive approach to derive your theory and construct your model.
  - Go from the trees to the forest—micro to macro—details to pattern.
  - Is your thesis universal or conditional?
  - What system/structure does your model describe?
  - Your model should be the result of critical analysis and not merely a description or overly-simplistic (reductionist) caricature.
- Address the main concepts of history:
  - change over time
    - conditions at the beginning and at the end
  - cause and effect
  - means and ends
  - Use historical evidence (case studies) to support the thesis expressed in your model.

- Ask yourself:
  - Why did it happen?
  - Why should we care? What's the significance?
  - What problem was being addressed?
  - What were the motives and intentions?
  - What were the (un)intended consequences?
  - What are the implications (theoretical and practical)?
  - How are clarity/ambiguity seen? Is the account "true"?
  - With evidence, ask:
    - who created it?
    - why was it created?
    - for whom was it meant?
    - what bias or subjectivity is contained in the evidence and portrayal?
    - what is the explicit/implicit (hidden) meaning and how does the meaning change with context and perspective?

## Appendix Z. Consolidated taxonomic schema and code listing, as of October 29, 2017

### Modeling

How do students describe the modeling process and their understanding of how the pedagogy elicits historical thinking?

- 1) Themes M's: C 1, 2; VA 2
  - a) Concept-based
    - i) Taxonomy—Breaking down topics M's: VA 7
    - ii) Concepts (Abstract) M's: A 5, 6, (7); C 6, 7; V A 1
  - b) Big-picture / The forest—Summary M's: VB 1, 2; VF 7 (all connected), 10
    - i) Theory M's: C 11; VA 8; VB 7
  - c) Patterns / Relationships /Analogies /Metaphors M's: VA 5; VB 2, 3, 4; VF 4  
(meaning)
    - i) Abstract Relationships M's: A 1, 2; C 8, 9; VD 1 (webs), 2 (patterns); VF 7 (all connected)
    - ii) Analogies (Concrete) M's: A 4, 5; C 4, 5, 6
    - iii) Concrete Examples M's: VA 3
      - (1) Scientific M's: VA 4
- 2) Mastery / Depth M's: A 3, 2; C 2, 3, 4; VB 6, 8; VD 4, 8; VE 2; VF 6
  - a) Critical Thinking M's: VB 9; VD 5 (Analysis); VF 2 (has changed),
- 3) Transferable
  - a) Collaboration M's: VA 6
  - b) Relationships to other models

- i) Other Groups M's: VB 5
  - ii) Multiple perspectives M's: VF 5 (empathy)
  - c) Past models
  - d) Other Disciplines
- 4) Permanent
- a) Experiential—Impact on creativity M's: VD 6 (shape own views), 7 (creativity); VE 3 (thinking outside the box); VF 3 (creativity), 9 (out of comfort zone)
  - b) Visual
  - c) Individual learning styles M's: VF 2 (has changed)
- 5) Negative Aspects M's: A 8; C 10; VC 1 (none)
- a) Confusion and unfamiliarity w/ process and/or goal M's: A 10; VC 6
  - b) Concepts (abstract) Taxonomy / Flaws M's: A 7; VC 2, 9; VD 3 (did not change perception); VE 1 (have not applied modeling to history); VF 1 (has not changed learning style)
  - c) Relationships (abstract) Flaws M's: C 9
  - d) Loss of nuance—No trees, Just Forest
  - e) Lack of content M's: VC 7, 8
  - f) Problems with process—Lack of collaboration M's: VC 3 (format), 10 (lack of time)
    - i) Perception M's: A 9
    - ii) Collaboration M's: VC 4
    - iii) Discussion and Critique M's: VC 5

## History

As they engage in modeling activities, to what extent are students understanding the skills and habits of historians?

### 1) Scope

- a) Breadth of topic(s)
  - i) Big picture
  - ii) Small (detailed) evidence M's: B 5; D 1, 2
- b) Type of topic
- c) Who, What, Where, When
  - i) How
  - ii) Why
- d) Theory M's: B 6, 7

### 2) Process

- a) Research M's: B 3, 4
  - i) Sources M's :B 3, 4
    - (1) Primary / Secondary
    - (2) Non-textual (artifact)
    - (3) Bias (See also Analysis and Interpretation)
  - ii) Analysis and Interpretation M's: B 3, 4, 5; D 2, 3, 4
    - (1) Bias
- b) Presentation and Dissemination
  - i) Audience

- ii) Concepts / Details
  - iii) Publication
  - iv) Teaching M's: D 8
  - v) Mode and Style
    - (1) Discovery M's: B 10; C 7
    - (2) Mystery
    - (3) Models
    - (4) Storytelling M's: B 1, 2; D 6
  - c) Other Methods M's: B 9
- 3) Use (usefulness / utility)
- a) Past, Present, Future
    - i) Avoiding mistakes of the past M's: B 2, 3; D 9
    - ii) Understanding the present M's: B 7, 8; D 4, 5
    - iii) Promoting past success
  - b) Providing unity and identity

## Appendix AA. Code frequency tables

### Conceptual Modeling Prompt

Topic (Level 1)	Topic (Level 2)	M New	M Exp	Vet	Total
Gen. Themes	Concept-Based	10	10	5	25
	Big Picture	0	1	8	9
	Pattern & Abstraction	26	15	33	74
Mastery & Depth	Critical Thinking	3	2	14	19
Transferable	Collaboration	0	0	15	15
	Perspectives	1	1	0	2
	Interdisciplinary	0	0	13	13
Permanent	Experiential	1	0	13	14
	Visual	1	1	1	3
Negative	Process	0	0	9	9
	Confusion	5	0	2	7
	Content / Concept	5	1	4	10

### Historical Inquiry Prompt

Topic (Level 1)	Topic (Level 2)	M New	M Exp	Vet	Total
Scope	Breadth	4	0	2	6
	Theory	0	0	13	13
Process	Research	16	7	0	13
	Analysis	16	8	0	14
	Dissemination	1	3	0	4
	Mode / Style	4	2	0	6
Use	Past, Present, Future	11	7	0	18
	Unity and Identity	0	0	0	0

## Endnotes

<sup>1</sup> Thus, Wineburg's choice of title: *Historical thinking and other unnatural acts*.

<sup>2</sup> The coining of the term, "social studies," came out of a circle of turn-of-the-20th-century scholars—including Thomas Jesse Jones (Jones, later the chairman of the Committee on Social Studies at Hampton Institute—a historically-Black college—was particularly interested in addressing the needs of African Americans and Amerindians) and Hebert Newton—who looked to use the data and theories coming from the newly developing social sciences as a way of improving the lives of the American people (Beal, Bolick, & Martorella, 2009; Saxe, 1991). In an 1897 paper, delivered to the National Herbart Society, Edmund James, then president of the American Academy of Political and Social Sciences, called for the introduction of the social sciences into the nation's schools. Drawing on an analogy to the umbrella term, "nature studies"—used to describe the combination of life and earth sciences—James suggested the use of "social study" to "to describe the use of the social sciences in the schools for the development and nurturing of young citizens" (Saxe, 1991, p. 20).

One question, which still remains, is the relationship between history and the social studies. Nelson (2001) asks whether there is more than one field in the social studies. If the discipline is singular, then it is a coherent and independent field of study. If plural, then it becomes a collection of quasi versions of political science, sociology, anthropology, economics, etc. If the former, it can stand beside history as an equal; if the latter, it is likely to be subsumed by its ancestor (Nelson, 2001).

<sup>3</sup> Barth, in 1996, further refined these definitions—narrowing the field to three categories: “improving social welfare, meeting student needs for problem solving, and developing democratic citizens” (p. 21). Tyler (2009) speaks of four similar camps: 1) the progressive, seeking to match the developmental level and interest of the child; 2) the traditionalist (“essentialist”), wanting to convey the best of human culture; 3) the meliorist, looking to improve society through the schools; and, 4) the educational Taylorist, desiring that teachers focus on what students need to know in order to prosper in their adult lives.

Nelson (2001) recounts the five sub-categories laid out by Martorella in 1996. The first three parallel those of Barth and Shermis (1970), i.e. “citizenship transmission, social sciences, and reflective inquiry,” to which Martorella adds two more: “informed social criticism and personal development” (p. 20).

<sup>4</sup> The group giving primacy to critical thinking, inquiry, and discussion had early antecedents. Mary Nelson Barnes, working at the turn of the 20<sup>th</sup>-century, was an early adopter of concept and skills, over content. Barnes developed a tiered curriculum that took into account the intellectual development of adolescents. Her curriculum asked students, by the time students were of high school age, to focus their historical studies on particular topics and build their knowledge through the close examination of primary documents and artifacts—using methods drawn from a variety of disciplines (Monteverde, 1999). In this way, Barnes gave students the opportunity to act as historians and scholars, not just consumers of information.

<sup>5</sup> By taking “a ‘historical approach’ to primary sources,” Wineburg (2001, p. 1) wants students to interrogate the texts, to examine them for the validity of the source, corroborating

evidence, and context—the heuristics of scholars he put forth in 1991. The reader might question, however, the order of the steps: sourcing, corroboration, and contextualization. Students should have some background knowledge before they attempt to contextualize the text; otherwise, they leave themselves susceptible to the very misconceptions and “presentism” Wineburg decries in earlier work (1999). Only once they have some understanding of context, will questions of sourcing make any sense. After dealing with context and sourcing, students would then profit from a search for corroborating (or contradictory) evidence.

<sup>6</sup> Successful social studies teaching should combine the in-depth study of a limited number of topics and training in the analytical skills 21st-century students will need to "construct and operate on knowledge." (353) Engle (1960) and Newmann and Wehlage (1993) decry the still-prevalent tendency to try to cover too much content. As a result, history classes are like taking a local bus on a cross country trip, stopping in every hamlet, but only for a moment—the stops become a meaningless blur. In confusing information with knowledge (Engle, 8), we don't allow are students to reflect. Instead, we should, as all three authors assert, provide a curriculum that allows for higher-order thinking, depth of knowledge, and the democratic participation of students in the discourse of history.

Peter Seixas, in his 1998 article, calls upon student teachers—and by extension all teachers—to pore over the texts they use. Acknowledging “we never have access to the historical context in direct or unmediated form (p. 314),” Seixas asks us to focus on the interaction between text and context. By doing so, we can build more accurate interpretations

based on the more direct, documentary reading of the text (or artifact) while keeping in mind the context in which the artifact was created—its “work-like” aspect (Seixas, 1998).

<sup>7</sup> Many authors see these strategies as enhancements of more traditional methods, e.g. essay assignments.

<sup>8</sup> For a broader, epistemological view, of why this kind of student work is so well suited for training in historical inquiry, the explorations of the intersection between history and the new media are instructive. Seefeldt and Thomas (2009) look forward to a digital future in which the Internet will shift from product to process—from a repository of static information to a tool for research and analysis. Like McClymer (2009), the authors look to the new media as a way of helping students to do history.

<sup>9</sup> For example, in what Coven calls, “the Core,” students are provided heuristic scaffolding as an aid to understanding the “grammar” and structure of history. Through EPICS, Cycles, and Forces in History, (see appendices K, L, and M) students learn to analyze historical data—to cull, organize, interpret, and synthesize. As such, modeling allows students to act as historians, applying the methods of the discipline to discern cause and effect, patterns, and connections, to understand and convey the deeper meaning of historical events (Hicks & Doolittle, 2009).

<sup>10</sup> Whiteboards are erasable 2’x3’ sheets cut from large sheets of laminated Masonite that can be purchased at a building supply store (often the store personnel will cut the large board into six smaller boards). This is a convenient size for small-group work. Having a full set of boards (one for each group in each class) allows for overnight storage when groups do not finish

their diagrams. Also needed are one or more erasers for each group and an ample supply of dry erase markers, with plenty of color options.

At the moment, computers are not a viable option. While it is relatively easy to make changes on a computer diagram, the medium is too small which tends to discourage collaborative work and revision. This is because the computer image looks polished while the whiteboard image invites collaboration and revision because it looks ephemeral and several students can draw and erase at the same time.

<sup>11</sup> In physics, this entails drawing graphs and lines representing the forces they observed in their experiments and patterns they find in data collected and tabulated.

<sup>12</sup> The related concept of Expectancy-Value Theory came out of the work pioneered by John Atkinson, with later developments by Allan Wigfield and Jacquelynn Eccles.

<sup>13</sup> Carole Hamilton (English), Ned Hamilton (Computer Arts and Sciences), and Matt Greenwolfe (Physics). The latter had introduced the modeling pedagogy to the group and helped us adapt the technique to humanities instruction.

<sup>14</sup> Social constructionism developed out of the work of George Herbert Mead and Herbert Blumer at the University of Chicago. Their work drew on the tenets developed by the American pragmatists, e.g. John Dewey, Charles Peirce, and William James. The symbolic interactionists, in turn, provided the foundation for the Chicago School, led by Robert Park and Ernest Burgess—leading lights of the social sciences (Hesse-Biber & Leavy, 2011; Crotty, 1998).

<sup>15</sup> Action Research studies are often designed in cyclical form, what Hesse-Biber and Leavy (2011) called the “Dynamic Dance.” (Fig. 3.1.) In this inductive process, researchers

formulate tentative hypotheses, generate theory, gather observations, look for patterns in the data, and use the results of their analyses to reconsider and reformulate tentative hypotheses, beginning the cycle anew (Creswell, 2007).

<sup>16</sup> The resulting survey, created was much more detailed than the one ultimately developed for my dissertation research. For this, four-section, 25-question, more quantitative survey—created fall 2014—students were asked to evaluate their past modeling experience, i.e. how the student saw themselves as students, how important they felt history was in their overall education and for their likely career, the benefits of modeling (in comparison to other teaching methods), whether modeling suited their learning style— this line of inquiry was related to a conference presentation on matching pedagogy to learning style the STEP students were working on at the time—their level of engagement when modeling, and the utility of the different stages of modeling.

<sup>17</sup> Owing to typical time constraints, the Social unit is rarely covered on its own. Instead, this unit is often combined with the Cultural unit. The topics covered in the sub-discipline of social history are usually addressed in the E, P, and I units, as well.

<sup>18</sup> The number of participants is double the number of students—152—that were in the three classes.

<sup>19</sup> Anecdotal evidence, drawn from prior experience, suggests that these figures are within the norm.

<sup>20</sup> Anecdotal evidence suggests that the vast majority of the student body is in the upper socio-economic quintile. Based on prior administrative statements, approximately 20% of the

student body receives some level of tuition support. The annual tuition is approximately \$25,000.

<sup>21</sup> I have endeavored to leave student phrasing as near to original as possible. Therefore, I have quoted much of what I would normally paraphrase, and I have used a very light touch in editing their comments. I only corrected grammar and word choice when I felt the original would be confusing.

<sup>22</sup> As a side benefit, these metacognitive assessments gave students an opportunity for epistemological reflection and for engagement in authentic historiographic discussion. Some of these discussions took place out of class and therefore are not part of the formal results of this study. Though not part of this research, these assessments spurred a rich discussion of teaching methods, with a group of interested students, that ultimately led to the formation of an afterschool club dedicated to student-led examinations of educational methods and policies. This club has gone on to presenting at and holding conferences—seeking ways to bring student-generated solutions to the most critical issues facing education.

<sup>23</sup> A small group of veterans (V6, V9, V12, V17, V21, V22) provided no suggestion of changes to be made to the modeling process in their response to the question: “What improvements would you like to see in the modeling process?” (Appendix T) V9 spoke for this group of six veterans in writing: “I’m pretty happy with what I’ve learned in general and I’m not really sure what I would like to learn more of.” While this suggests modeling worked for them, it provides no constructive criticism, the purpose behind the metacognitive assessment. This lack of criticism by the group of six veterans in response to one question does not reflect a severe

problem with the metacognitive assessments. On the whole, the response in the metacognitive assessments were more expansive.

<sup>24</sup> I have used a set of abbreviations as a naming system for my sources. The letters refer to the type of survey, i.e. “V” refers to the veteran metacognitive assessment and “M” is the designation for the metacognitive assessment completed by students in my then current course, “Rise of the City.” This course was designed to introduce students to the sub-discipline of urban history. The class was offered during the winter trimester: December 2015-February 2016. The assessments were given on December 7, 2015 (M1) and January 25, 2016 (M2). The number after the hyphen, e.g. the 22 in M2-22 is the designation for the particular, anonymous student being quoted.

<sup>25</sup> Most concise about their confusion, one student simply responded to the prompt about conceptual modeling with: “????” (M1-48)

<sup>26</sup> I’m interpreting “history” to mean historical content.

<sup>27</sup> Both courses in which I use the conceptual modeling pedagogy.

<sup>28</sup> Courses that are currently taught in a more traditional way.

<sup>29</sup> That all but one comment for this section on history as a discipline comes from the metacognitive assessment-veteran is to be expected. Both the nature of the question and the level of experience would promote these students providing more complex statements on this subject.

<sup>30</sup> This sentiment is attributed to George Santayana.

<sup>31</sup> Compare with “Big Picture,” earlier in this chapter.

<sup>32</sup> As the prior section was dominated by the views of veterans, this one, the description of the historian's job, comes almost exclusively from Mas written by students who had yet to model.

<sup>33</sup> Not being familiar with usual practice of placing records in off-site archives, the students seemed to assume that a portion of historical research must be done at the appropriate historical site (M1-25; M1-33; M1-41).