

PUBLISH ON DEMAND
Recasting the Textbook

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UPDATE

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Digital History Textbook

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Overview

Over the last year our team conducted a design-based research project, primarily in a diverse local charter school. Our goal was to better understand and support interconnections between schools, community organizations and learning resources involved in high school history class. Our research was guided by this question: How might schools, museums, libraries and media companies better foster the educational development of young people and educators through by using primary-source documents and technology?

High-school history class is a complex learning environment and our work introduced several new components into the learning ecology. These included but were not limited to digital resources, human resources, hardware and software. While the scope of the project was conceivable by the teachers involved, this exploratory research would not have been feasible for an individual teacher or history department. Our five-person team contributed many months of the intellectual ‘heavy lifting’ needed to develop and test a theoretically-grounded, ecologically-valid intervention to support history learning alongside technology. This consisted of vetting and assimilating current research on history pedagogical content knowledge, existing history teaching practices in the classroom under study, and the affordances and constraints of available technologies.

When unpacking the challenges that arose in conceptualizing the project, we consistently consulted existing research, current and former history teachers, project advisors, content experts and technology specialists afforded by our academic community. Through this process we have come to posit collaborative student construction of interactive digital textbooks that reconsider and recast traditional historical narratives as a potentially rich intersection between tenth-grade World History students, primary-source materials from various organizations and current technological tools. As we operationalized the components of this possible solution, we identified key challenges in the learning ecosystem and the shaping force of each in the digital textbook

project, designed and revised through iteration, based on continuous feedback. This solution has passed an initial feasibility test in a well-supported classroom.

A missing link exists between the abundant digital resources available through archives, museums and libraries and the dearth in high-school history class. We addressed this in three ways: (1) we served initially as liaison between the history teacher in our study and a local archive, resulting in a visit by the archivist to each of the four tenth-grade classes; (2) a university student with expertise in this area conducted a follow-up lesson covering important considerations for working with primary-source materials; and (3) the research team compiled a well-curated database of primary-source documents organized to meet the needs of the learning environment as identified in multiple interviews and correspondences with four tenth-grade history teachers. These resources were introduced as part of our curriculum.

The high-school history teachers wanted to integrate technology in their curriculum in meaningful ways but lacked the time, technical skills and technological pedagogical content knowledge (TPCK) needed to adjust their practice. Furthermore, while high-school students in 2013 are voracious digital-media consumers and prolific creators of digital content, they lacked the skills and resources necessary to produce meaningful digital content for learning by authentic audiences. Addressing these challenges took a multifaceted approach, including theoretical, technological, pedagogical and practical analytic lenses applied in combination or isolation as relevant to each phase of the project.

On the technical side, this included selecting, purchasing, organizing and deploying the hardware and software identified as having the greatest potential value for history learning with primary sources. In terms of pedagogy and practice, our research team conceptualized and implemented a two-week curriculum supplement integrating best practices in history instruction, resources from our curated database and instructional supports for technology use. More specifically, we worked alongside the teacher to support students' collaborative construction of multimodal, interactive, digital, history textbook chapters. We identified alignment between affordances of the software (such as callouts, galleries, interactive quizzes and 3D models) and use cases for sharing multiple perspectives. We supported the students and teacher in exploring and exploiting these tools specifically to author history with a thick narrative. One strategy for this included the design and deployment of template options to scaffold student groups in authoring a historical narrative that integrates multiple perspectives, each highlighted by a variety of primary-source documents. As a part of the curriculum, the research team developed and shared an exemplar created using one of the five template options. Each stage of the process was revised and refined based on student feedback gleaned during classroom activities and formative assessments throughout the pilot research study.

Thus our current work identified and tested potential arrangements for coordinating engagement with partner organizations in the community, including public schools, universities and archives,

and to a lesser degree museums and libraries. Furthermore we have posited collaborative authoring of multimodal digital textbooks as a feasible intersection between young people, educators, primary-source materials and technology. Resulting assets from our feasibility test include the artifacts created by students for future students, the curated database of standards aligned with primary-source materials, and the written curriculum that can be used in the future as a model for replication by the teacher involved in the study, a guideline for other history teachers in the school or charter organization and a baseline for the next phase of research by our team. While our curriculum documentation is tailored specifically to fill 14 class periods, our deployment was not rigid. In fact, school conditions demanded constant flexibility and adaptation during implementation. Thus the curriculum activities, pilot tested with more than a hundred tenth-grade students, are intended as gentle scaffolds, not rigid scripts, and as such can withstand modification to match the complexities of a wide range of classroom environments and learning objectives. We know that some of these resources have already been shared with other history teachers in the charter organization and there are plans for continued use of our curriculum materials in future years.

While our highly scaffolded project has added value in the ecosystem for our partners, this proof of concept cannot be conflated with its burden of proof. While we have accomplished the former, we have not adequately satisfied the latter. Specifically, considerable work lies ahead of us if we can determine the intersections between the variables of interest, unexpected variables of consequence and the development of historical understanding by high school students. As such, we pose a new question: Is student co-production of digital interactive textbooks an effective method for multiple-perspective tasking? If so, how? Additionally, what future technologies and business opportunities might surface from this question?

Approach to investigating the problem

For our project, the term ‘multimodality’ encompasses modes of communicating, most notably gesture, gaze, artifacts and language in face-to-face interaction, as well as images, layout, sounds, color and language in digital media. In our pilot study we captured over three terabytes of data, including video, audio, screen capture, keystroke data, field notes, research memos, formative student work, summative transfer task and the final artifacts. To interrogate this data, we face a learning-analytics challenge.

We now face the research problem of integrating a number of existing tools or designing, programming, testing and implementing our own computational video analysis tool that will let us quantify our screen capture, local audio (capturing student dialogue while at the computer) and keystroke data collected in-situ. This tool or suite of tools is necessary both for data cleaning and analysis. In the process of cleaning, we hope to computationally link data from multiple sources to the same timeline. By analysis, we intend to implement a combination of qualitative coding and machine-learning algorithms. One potential application of this analytic scheme is to identify differences in patterns of student behavior and the relationship between these, the quality of their

final product (assessed by a rubric developed in phase 1), self assessment scores, peer assessment scores and demonstrated ability on a skills-transfer task.

Moments of potential interest for analysis include primary-source selection, source comparison and content synthesis as they are likely to contribute to abilities of the research team in assessing the interactive textbook project in terms of the objectives and essential questions stated in the curriculum documents.

Example Objectives (excerpted from longer list in curriculum documentation):

- Students will work to develop the requisite skills and expertise to be effective iBook publishers.
- Students will work to utilize historical thinking as they deepen their understanding of historical narratives through comparison of multiple perspectives and sources.
- By authoring and publishing individualized historical textbooks, students may gain a new perspective on how history is written and not just ‘consumed.’

Essential Questions (excerpted from longer list in curriculum documentation):

- What are the most effective ways to use iBooks author to create digital textbooks?
- What multimodal meaning-making may (or may not) be happening for students participating in this research?

Potential noteworthy multimodal foci for either the qualitative or quantitative analysis include but are not limited to the following:

- Instances of digital media reshaping historical knowledge, literacy, learning and teaching
- Critical reflection on assumptions about knowledge and learning, as well as historical thinking, that undergird the use of digital technologies in education
- The cultural, social and relational nature of multimodal communication and learning
- Multimodal dialogue, or ‘talk’ and argumentation
- The semiotics of multimodal environments and cultural practices
- The interdependence of multimodal and intercultural communicative competence and the emergence of online learning cultures in collaboration (The Open University, 2013)

Future technologies and business opportunities

Increasingly, technology — and publishing on-demand, in particular — is letting schools consider a move from a ‘one-size-fits all’ education to a more personalized approach. While the notions of adaptive computer programs, ‘flipped’ classrooms (in which typical lecture and homework elements of a course are reversed) and continuous performance assessments have existed for some time, they have not been considered alongside the learning affordances offered by truly interactive, on-demand textbooks. The following highlights briefly illustrate five potential technology and implementation opportunities that the research group may consider going forward:

Wineburg, S., Bullock, M., Franz, P., Jimenez, J.D., Moorhead, L., Alexander, M.
Recasting the Textbook

- **Education content management system with teacher, student, and administrator dashboards:** While commercial and open-source content management systems (CMSes) have emerged and improved during the past decade, the education market has been — and remains — largely overlooked. Yet, with many states mandating a move to digital textbooks (most notably California and Florida) and publishers moving toward publishing-on-demand efforts, there is an opportunity and a need to create a system that addresses the concerns of content providers, as well as the needs of a school's primary stakeholders, from students (and their families) to teachers and administrators. The current batch of content-management systems, including web-based WordPress, Joomla and Drupal, to costlier, licensed platforms such as ExpressionEngine, Vivvo, and eZ Publish, have been fine-tuned for professional publishing and business or marketing efforts. Thus, a variety of currently unmet CMS requirements exist within the education market, from built-in 'teaching moments' about copyright, accuracy and sources to a broader mix of legal and educational concerns and use issues. Additionally, a user interface that caters to both educators and learners is required, as well as the need to work across various computers and devices, as teachers and students move through their day from school to perhaps a library or internet cafe and then home.
- **Analysis tool for digital textbooks:** A need exists to design a computational video-analysis tool that will let researchers quantify their raw data in the form of screen capture, local audio and keystroke data collected in-situ. This tool or suite of tools is necessary both for data cleaning and analysis and would combine coding and machine-learning algorithms. As previously discussed, one potential application of this analytic scheme is the identification of differences in patterns of student behavior and the relationship between these, the quality of their final product, self-assessment and peer-assessment scores, and demonstrated ability on a skills transfer task. Moments of potential interest for analysis include primary-source selection, source comparison and content synthesis as they are likely to contribute to abilities of educators in assessing the interactive-textbook project in terms of the objectives and essential questions stated in the curriculum documents. While researchers, publishers and entrepreneurs highlight the features and value of 'big data' — a significant part of digital textbooks — more resources for analysis and management of the data are required before such information can be used adequately as an education resource. A tool such as this might offer help with this effort.
- **Data-mining and adaptive-learning software combined to make the textbook an adaptive-software platform:** A great deal of development is happening in data-mining software for massive open-online courses (MOOCs). However, such work has not been extended to interactive digital textbooks, where data-mining software could help identify students struggling with the subject matter and needing special attention or individualized learning. Additionally, data-mining software can be combined with adaptive-learning software embedded in a digital textbook. With such software, new'

learning' dashboards and' widgets' (applications or components of software that let people perform functions or access services) could emerge, letting teachers and perhaps parents intervene before students fall behind and/or help those students learn to spot areas of potential weakness or confusion early in their learning process.

- **Digital textbooks designed around primary source materials:** To date, digital textbooks are primarily print textbooks recast into a digital format. For the most part they have not taken advantage of the vast amount of high-quality, publicly-available, primary-source material made available through archives and other institutions. Such material has not been adequately inventoried, cataloged and vetted on a variety of fronts, from historical relevance and authenticity to topic weight, copyright clearance and age appropriateness. Further still, publishing enterprises have allotted few resources to investigate best practices for embedding primary-source documents into learning materials. With the mandate for digital textbooks and the Common Core Standards Initiative (the latter designed to align state curricula through standards-based education reform), the realm of designing digital textbooks around primary-source material remains overlooked despite the area's potential for growth in both the private and public sectors and across subject matter.
- **Open access curriculum and primary source resource center:** As noted throughout our mediaX research project, schools — even the high-achieving, well-organized charter-school team that we worked with — struggled to create an ongoing, easily-accessible resource center, something they valued and wanted. Educators, from newly trained teachers to master-level instructors, expressed a desire to continually build and curate teaching and learning resources, largely through primary sources, relating to history, as well as a database of student work. For the most part, they create an ad hoc collection of easily-attained content that soon becomes buried and, for the most part, useless. This growing resource center could address the needs of both teachers and students. For instance, at the beginning of a teacher's career pre-prepared lessons and teaching resources help teachers know what to do and where to locate primary sources. As teachers become more experienced, the resource center and those involved with it could encourage these teachers to share their knowledge and provide guidance to each other. The aggregation of the lesson plans in one central resource allows teachers and their schools to distribute quality teaching resources, including primary-source documents in the realm of the humanities and the sciences to every teacher and offer ways for teachers and administrators to learn what is working well and what isn't. Additionally, a clear, navigable online platform for training could help bring onboard and train large groups of teachers in multiple classrooms or campuses smoothly and effectively. The power of the resource center is the ability to foster teacher dialogue, elicit feedback and encourage the creation and collection of materials. In doing this, the center captures the 'tribal knowledge' of the organization and maps it to the school calendar, grade, historical or

other subject, and specific lesson plan. The ultimate goal is to help teachers meet and surpass the benchmark for quality without 'losing' or burying what has already been learned or collected.

Research Timeline: Next Steps

With information from consultations and literature, the research team will need to decide to pursue the development of a new learning-analytics tool or to cobble together a set of existing tools to meet our needs. This decision should be made in early fall and followed immediately by the articulation of technical features and timeline with milestones for development.

Ideally, additional funding would then be applied to cover the costs of hiring a programmer working throughout the fall quarter who will help execute the plan. Concurrently in the fall quarter, the research team will seek computational support from several members of the Stanford Lytics Lab. This collaboration is necessary to determine a classification (k-means clustering analysis) for the moments in the media production process relevant to our research question. Once tool development and clustering are in progress, the team will begin necessary qualitative analysis in the fall, to be completed by late January.

Additionally, the research team plans to continue collaborating with the current charter school, possibly expanding efforts across additional classrooms and the charter system's collection of schools. In the fall the research team will work with the history teacher to possibly roll out an on-demand digital history textbook effort that runs throughout the school year (as opposed to several weeks at the end of the school year) and builds on our past work and findings. Possible options might include working with teachers and students to create an ongoing digital textbook that acts as a foil to their formal, school-mandated history textbook. How might students recast history in light of what they discover through primary-source materials? Additionally, the effort would address several still-to-be answered questions around digital textbooks and on-demand publishing, again, building on findings from the previous year: How might young people come to value and access the vast, largely untapped and publicly available reservoir of knowledge, ultimately combining and curating it with their own historical knowledge and experiences of both the far and near past? How might technologies such as near-field communication (NFC) tags, quick response (QR) codes and other methods of collection and curation for smartphones and various mobile devices let students literally tap into a historical narrative at their local libraries, archives and museums? (Previously, we did some pilot studies of these technologies in the classroom and are now ready to expand our efforts.) How might these technologies encourage the discussion and 'rating' of documents that allow for a historical event to have multiple 'truths' or narratives, which include a variety of media? Can these technologies further push the boundaries of on-demand publishing?

The research team is proposing several papers to various conferences, most notably AERA (American Educational Research Association). However, as our raw data has yet to be turned into

a usable format and findings discerned, we must allot further time and energy to this task in the fall, when the entire research team reconvenes.

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Additional Reading:

Statement of the Publish On Demand Research Theme

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