

Thinking Critically, Coding Creatively: *Elevating Social Studies Through Inquiry-Based Learning and Computer Science Integration*

**Michael J. Berson, Ilene R. Berson, Kristen L. Franklin,
Valerie N. Fawley, Perry S. Shank, Rebecca E. Dovi,
Santiago Gasca, Eric D. Hochberg, and Debra Bernstein**

The landscape of education is dynamically evolving with the infusion of technology into classrooms, but it is not just math or science disciplines that are getting a digital makeover. Social studies education has entered a transformative phase as well. Amidst the rush to modernize curricula, an innovative approach in Virginia is channeling the power of computer science into social studies classrooms. The *Computer Science for Social Studies* project, funded by the National Science Foundation, proposes a groundbreaking model tailored for rural middle schools. This initiative aims to weave computer science into the fabric of social studies, rather than teaching it as an isolated skill, making both subjects more relevant, engaging, and beneficial for 21st-century students.

Reframing Computer Science Integration: An Interdisciplinary Approach

Led by CodeVA, a nonprofit committed to inclusive computer science education in Virginia, the *Computer Science for Social Studies* project offers a transformative model for integrating technology into social studies curricula. Collaborating with educational research institutions, this initiative goes beyond simple coding instruction to weaving culturally relevant computer science concepts

into social studies, enriching the learning experience for a diverse student body, particularly in rural middle schools. This is achieved through ongoing educator professional development, enabling pairs of teachers to incorporate computational thinking and programming into their schools' social studies classrooms.

The integration into social studies classrooms serves multiple purposes. It is not just about solving the logistical challenges of introducing a new, standalone subject in already resource-constrained rural schools. It is about enriching the social studies curriculum by incorporating computer science in a way that brings history, civics, economics, and geography to life. Imagine students abstracting data from photographs or analyzing primary sources from multiple perspectives to tell often neglected narratives through programming. These computer science applications allow students to engage with social studies content in a more interactive manner.

The integration of computer science into social studies also presents a novel way to examine historical and societal themes. Primary sources gain new significance when coupled with computational analysis. This approach allows students to explore history more deeply, fostering critical thinking and empathy. By incorporating

computational thinking, students learn to approach historical analysis with a problem-solving mindset, similar to that used in the field of computer science. This translational application allows students to deconstruct complex historical events (decomposition), order them logically (sequencing), and identify and solve inaccuracies or inconsistencies (debugging).

Additionally, this initiative emphasizes the importance of asset-based design practices for social studies classrooms and content. By relating computer science to the local social, political, and historical contexts of diverse rural communities, we can make the subject matter resonant for students who might otherwise find it abstract or irrelevant. This method is backed by research showing increased engagement among populations traditionally underrepresented in computer science.¹

As one social studies educator said, “Incorporating this project into my curriculum has significantly enhanced my teaching methodology. Tools like Twine have introduced creative and dynamic elements to our classroom.”

Introducing Twine: A Platform for Interactive Learning

Twine, a user-friendly, open-source application, plays a crucial role in this initiative. In the project’s second year, Twine was incorporated as a pivotal learning tool, replacing the more complex and syntax-heavy programming language of Python. This transition was strategic, prioritizing the richness of social studies content over the complexity of technical skills involved in coding. The CodeVA curriculum team developed “The Twine Trail Guides,” comprehensive online resources that assist educators and students in harnessing Twine’s full potential. These resources, centered around project frames for historical events using primary sources, have enhanced engagement and learning in middle school social studies classes.

The Twine platform enables learners to create engaging web narratives based on diverse historical perspectives, with primary sources serving as the supporting material. The tool’s accessible interface, especially with the simplicity of its *Chapbook* story format, makes Twine ideal for introducing students to the world of coding in a context deeply rooted in historical content.

Twine’s capability to create interactive, web-based narratives that either follow a linear path or branch into multiple storylines offers students a unique way to capture a multi-faceted view of history. Users can link text, images, audio, and video, embedding primary sources and digital artifacts in a deeply engaging and relevant representation of history content. This platform also allows for the enhanced customization of narratives, moving from visual elements toward more complex programming structures like variables and conditional logic (if/else statements), enriching the storytelling experience and deepening students’ engagement.

In classrooms where Twine is employed, students become active explorers, navigating through a tapestry of historical perspectives and artifacts. This journey often leads them to discover nuanced and lesser-known aspects of history, fostering a learning environment that encourages critical thinking and empathy. By interacting with these stories and creating digital representations, students can develop a more profound understanding and appreciation of the complexities of historical events and figures.

Beyond deepening students’ historical comprehension, Twine also empowers students to connect local history with broader global narratives. This approach helps learners see history not as a series of isolated incidents but as an interconnected web spanning different cultures and geographies. It makes the study of history more relatable, broadening students’ perspectives and cultivating a global outlook.

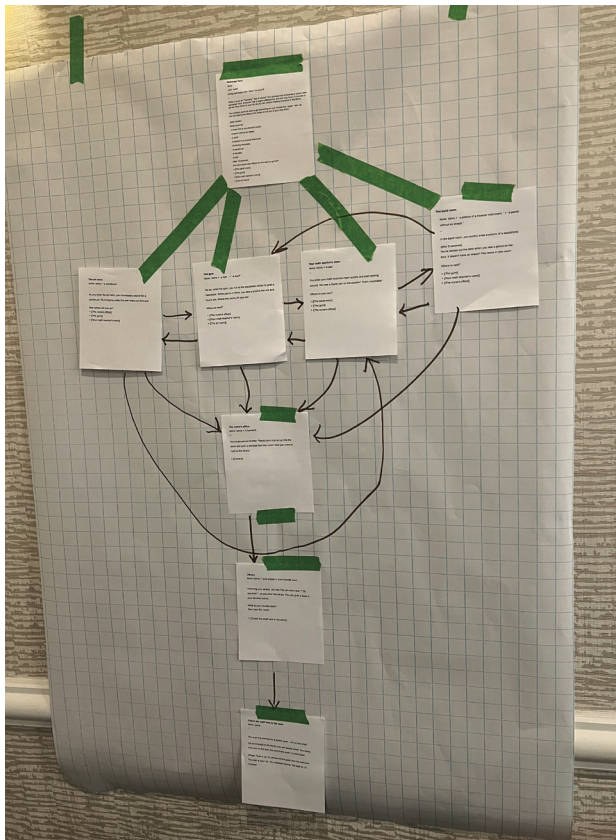
Twine, therefore, serves as more than just a tool; it is a conduit for a richer, more dynamic approach to social studies. It invites students to not only learn about history but to experience it. In an age where computational literacy is as crucial as historical knowledge, Twine offers a bridge between these two worlds.

Professional Development Case Study Reconstructing Rosa Parks’s Narrative

Prior to the implementation of Twine in their classrooms, educators received comprehensive professional development. Sessions were structured to demonstrate Twine’s practical application in a social studies context and to deepen technical

skills in coding. Facilitators merged these two learning objectives by guiding educators in creating interactive biographies of significant civil rights figures, such as Rosa Parks. Using Twine and various activities that did not require a digital device, educators learned how to construct narratives that branched into various pathways, providing ways to formalize different perspectives and insights into historic events.

Educators selected resources from the Library of Congress's Bus Boycott exhibit to build a comprehensive and factual base for Rosa Parks's story.² This approach allowed them to explore and present multiple facets of her life and the broader civil rights movement. In hands-on sessions, participants reassembled pre-made printed Twine stories (see image below), exploring the structure and logical flow of the event, which in turn enabled them to envision how they might implement similar lessons that do not require a digital device to use computational thinking in their classrooms.



Twine stories reassembled to study structure and logical flow.

This process helped educators recognize how computational thinking skills—decomposition, sequencing, and debugging—could be applied in the context of social studies. They practiced breaking down similar complex historical events into key components (decomposition), arranging these elements logically (sequencing), and refining the branching scenarios based on new insights to ensure factual accuracy (debugging). This process mirrors the iterative design approach of the software development process. The teachers rehearsed adding a small amount of new content to their narratives, testing the functionality and accuracy, and then making necessary revisions.

Disrupting and Reimagining Historical Narratives

A critical aspect of this approach involved using primary sources to challenge and expand traditional narratives surrounding the civil rights movement. The branching scenarios in Twine allowed educators to depict a nuanced view of Rosa Parks's civil disobedience on a bus, rather than presenting a simplified story. This method of storytelling provided a fuller understanding of historical events and figures, encouraging teachers to provide similar opportunities for students.

Reflection, Adaptability, and Broader Implications

The professional development sessions also focused on the importance of empathy and adaptability. Educators reflected on their engagement with the material as new learners and considered how different delivery methods and curricular approaches might resonate with various student groups. They explored ways to lower potential barriers for students who might not connect with this teaching style.

Implications for Classroom Teaching

Educators who develop the computational skills to use Twine are able to offer their students a more dynamic and interactive way of learning history. They can create learning environments where students are actively involved in exploring a multi-dimensional understanding of historical events and figures.

Lessons Learned

In a seventh-grade U.S. History II class, as educators integrated computer science using Twine, they observed students immersing themselves in diverse historical perspectives, particularly during a comprehensive unit on the Civil War.

Using Twine and primary sources to explore the Civil War, students created interactive projects on topics including the roles of notable figures with an emphasis on women and African Americans, key events in major battles, and cultural developments in music and literature. This method allowed students to choose their focus, leading to more personalized and in-depth studies.

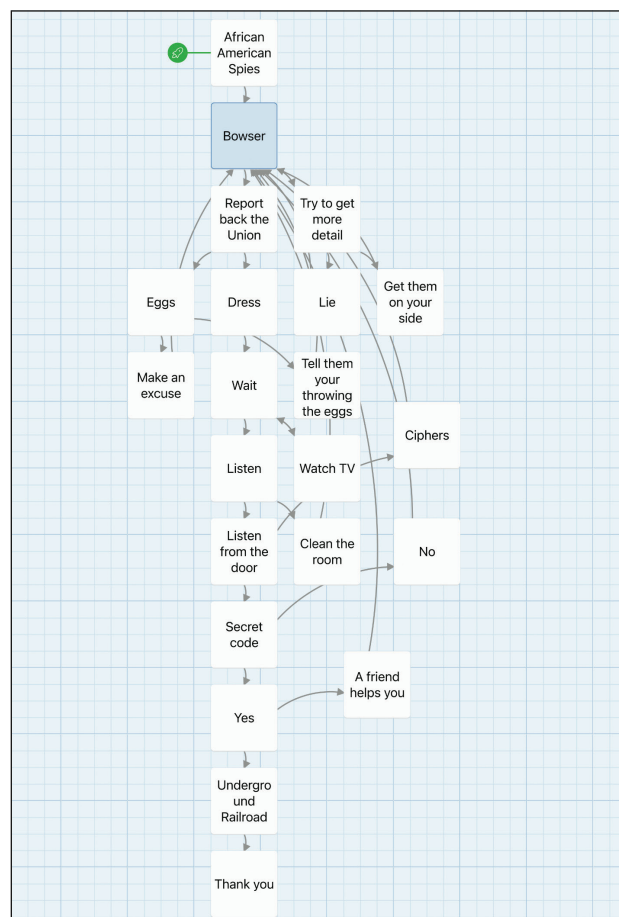
The teacher noted students' initial reservations:

Some students were skeptical of Twine and thought it was just a more complicated version of Google Slides. After learning how to create choices [in their stories], ... they saw that they could have different options.... They liked telling about history and learning things that way.

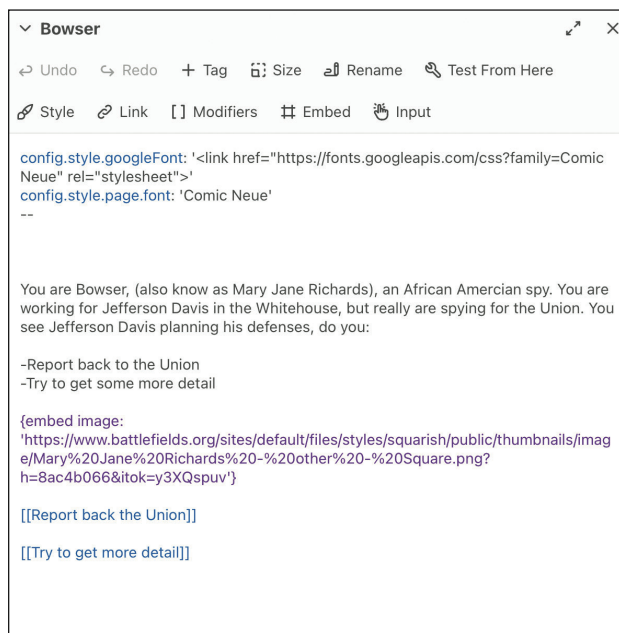
As students learned to create branching narratives, their engagement deepened. They grew to appreciate the platform's capacity for storytelling and its ability to bring historical events to life. The social studies teacher and their instructional technology resource peer were pleased with the results. The teacher said, "You could tell they had learned [about Hard and Difficult History] because it was woven into the longer, more researched stories."

This engagement was particularly evident in projects like the hidden story of Mary Jane Richards, an African American spy, where a dyad of students linked text and images to craft a compelling narrative. The image that follows shows the passage titles. Students embedded text and image content into each passage. The arrows show how each passage links to others.

Another notable student project explored the decisions of Robert E. Lee at the Battle of Appomattox Courthouse and included a series of branching choices for the reader to make about how to conduct the battle (for example, retreat or push ahead). The collaborative nature of this project fostered a greater depth of understanding and creativity. Students not only brought in more



Student passage titles with arrows showing linkages.



Here is a peek inside the "Browser" passage, showing how the student pair added the story's syntax and content.

You are Bowser, (also know as Mary Jane Richards), an African Amercian spy. You are working for Jefferson Davis in the Whitehouse, but really are spying for the Union. You see Jefferson Davis planning his defenses, do you:

-Report back to the Union -Try to get some more detail



[Report back the Union](#)

[Try to get more detail](#)

This image shows the readers' view of the students' "Bowser" interactive passage.

detailed historical information but also engaged more deeply with the content, showing a preference for this interactive and collaborative learning style.

The educators also noted a stark contrast between students' engagement in this project and their previous experience with a Civil War reflections journal. Last year's approach yielded limited success, with students struggling to empathize and connect with historical figures. However, with the Twine project, students were more willing to engage with the content creatively, enjoying the process of giving readers choices and exploring different historical paths.

Reflecting on the value of these integrated lessons, the educators noted the minimal cost and significant benefits. The rich historical detail brought in by students, their enthusiasm for finding primary sources, and the increased engagement were all testament to the project's success.

Resources

The following tools can support educators and students in seamlessly integrating computer science into the social studies curricula. These key

resources each serve as a stepping stone toward mastering the use of Twine in educational settings:

- Twine Trail Guides (<https://curriculum.codevirginia.org/twine-trail-guide>): These guides include guided tours of various stories that can be created using Twine, complete with video and text tutorials, particularly focusing on the Chapbook format.
- CodeVA's Twine Editor (<https://curriculum.codevirginia.org/twine-trail-guide/editor>): While Twinery.org provides a rich, open-source programming environment, it includes community-generated content that might not be suitable for all audiences. To address this, CodeVA hosts a custom link to the Twine editor, free from user-generated content, providing a safe and focused platform for educational purposes.
- Twine Resources by CodeVA (<https://curriculum.codevirginia.org/library/browse/twine-resources>): This page includes a wide array of lesson plans and materials specifically designed for the Computer Science for Social Studies project.
- Centralized Access: All of the previously mentioned resources (and more) are conveniently available at <https://curriculum.codevirginia.org>.

Looking Forward

The intentional integration of computer science tools like Twine into social studies education marks a transformative step in our approach to teaching and learning. This interdisciplinary venture not only enriches the curriculum but also equips students with a blend of technological literacy and historical knowledge, essential for navigating today's digitally driven world. By merging the analytical prowess of computer science with the depth of social studies, we are preparing our students to be critical thinkers and adept problem solvers. The success of the Twine project exemplifies the potential of such integration to create engaging, relevant, and dynamic educational experiences, setting a precedent for future curriculum development across various subjects.

As we look to the future, the onus is on us, as educators and innovators, to continue exploring the synergies between technology and traditional academic disciplines. The journey with Twine in social studies is a promising example of

expanding educational boundaries and redefining learning paradigms. It's an invitation to continually seek novel ways to enhance both teaching and learning, ensuring our students are not only adept at using technology but also at understanding and shaping it. Embracing these opportunities with enthusiasm and open-mindedness, we can pave the way for more inclusive, engaging, and effective educational experiences that resonate with twenty-first-century learners. 🌟

Note

1. See Ismail Güven and Yasemin Gulbahar, "Integrating Computational Thinking into Social Studies," *The Social Studies* 111, no. 5 (2020): 234–248; Meghan McGlinn Manfra, Thomas C. Hammond, and Robert M. Coven, "Assessing Computational Thinking in the Social Studies," *Theory & Research in Social Education* 50, no. 2 (2022): 255–296; Sarah Jane Van Wart, "Computer Science Meets Social Studies: Embedding CS in the Study of Locally Grounded Civic Issues," in *Proceedings of the Eleventh Annual International Conference on International Computing Education Research*, pp. 281–282. 2015; Christiane Gresse von Wangenheim, Nathalia Cruz Alves, Pedro Eurico Rodrigues, and Jean Carlo Hauck, "Teaching Computing

- in a Multidisciplinary Way in Social Studies Classes in School—A Case Study," *International Journal of Computer Science Education in Schools* 1, no. 2 (2017): n2; Aman Yadav, Marie Heath, and Anne Drew Hu, "Toward Justice in Computer Science through Community, Criticality, and Citizenship," *Communications of the ACM* 65, no. 5 (2022): 42–44.
2. The Library of Congress exhibit *Rosa Parks: In Her Own Words* is accessible at www.loc.gov/exhibitions/rosa-parks-in-her-own-words/about-this-exhibition/#explore-the-exhibit.

Acknowledgments

The project team would like to acknowledge teachers Patrick Hausamann and Ross Keefer for their contributions to the *Computer Science for Social Studies* project. Additionally, we want to acknowledge Jon Stapleton, curriculum lead at CodeVA, for their dedication to publishing a CodeVA instance of Twine, developing the Twine Trail Guides, and creating the Twine resource video library for use with teachers and students (available at <https://curriculum.codevirginia.org>).



This material is based upon work supported by the National Science Foundation under Grant No. 2010256.
Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.



Michael J. Berson is a Professor of social science education in the Department of Teaching and Learning at the University of South Florida and a Senior Fellow in The Florida Joint Center for Citizenship. His research focuses on technology in social studies education. He can be contacted at berson@usf.edu.



Ilene R. Berson is a Professor of early childhood education in the Department of Teaching and Learning at the University of South Florida. Her research explores early childhood social studies with a focus on the engagement of young children with digital technologies. She can be contacted at iberson@usf.edu.



Kristen L. Franklin serves as the Curriculum Faculty Administrator at CodeVA, working with a diverse team of curriculum leads, writers, and facilitators to provide equitable computer science learning opportunities and curriculum. Her research and work explore integrating computer science into all content areas K-12 through partnerships and federal and state grant initiatives. She can be contacted at kristenfranklin@codevirginia.org.



Valerie N. Fawley is a Curriculum Lead at CodeVA. Her work and research focus on integrating computer science into other content areas and empowering teachers to weave computer science into their daily curriculum. She can be reached at valeriefawley@codevirginia.org.



Perry S. Shank serves as the Director of Curriculum at CodeVA, spearheading curriculum development for Virginia's educators and learners in computer science integration and technical skill building. His research and work explore advancing K-12 computer science education for all students on a statewide level through partnerships and federal and state grant initiatives. He can be contacted at perryshank@codevirginia.org.



Rebecca E. Dovi is the Co-Founder and Chief Computer Science Advocate for CodeVA, a nonprofit centered on bringing computer science education to all students in Virginia. Her work centers on innovating to build connections between people and communities. She can be reached at rebeccadovi@codevirginia.org.



Santiago Gasca is an Evaluator and Researcher at TERC. He is especially interested in character development and resilience, particularly pertaining to youth STEM educational engagement in informal settings. He can be reached at santiago_gasca@terc.edu.



Eric D. Hochberg is a Senior Researcher at TERC. His research and evaluation work focuses on development and refinement of professional learning experiences and resources to support rigorous, meaningful, relevant, and accessible STEM learning. He can be reached at eric_hochberg@terc.edu.



Debra Bernstein is a Senior Researcher at TERC. Her research and evaluation work examines curriculum design, implementation, and learning opportunities arising from the integration of technology design activities into K-12 and informal learning settings. She can be reached at debra_bernstein@terc.edu.