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Reflecting the Past and Embracing the Future
Bochum, Germany, June 8-11
Workshops: June 1-7
Ruhr University Bochum (Online Event)

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Noticing, Understanding, and Encouraging Positive Engagement with Collaborative History Learning

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Abstract: This study analyzes the implementation of Net.Create, a collaborative network analysis tool (Craig & Danish, 2018), in the context of a digital humanities classroom. Undergraduate students used network analysis to investigate historical objects gathered from the local community in a History Harvest. This paper focuses on the collaborative engagement of groups as they co-constructed conceptual frameworks in Net.Create to explain the individual, social, and cultural histories attached to these objects. Findings suggest that positive social engagement and metacognitive behaviors can support students' sustained engagement with historical and network analysis ideas. Interwoven personal-oriented and class-oriented social engagement in the data suggest that these forms of engagement can productively sustain engagement with cognitively demanding activities. Having built a supportive environment for collaboration amongst themselves, students were able to smoothly and effectively build on each other's ideas to generate an understanding of historical and network analysis patterns.

Keywords: student engagement, history, network analysis, CSCL

Introduction

Promoting student engagement with history has been an important goal for history learning research (Brush & Saye, 2008; Sakr, Jewitt, & Price, 2016). However, studies of student engagement in history often focus on a single variable, such as excitement (e.g., Squire & Barab, 2004) or empathy (e.g., Endacott & Brooks, 2013; Savenije & de Bruijn, 2017). This contrasts with research in other disciplines, which often investigate the impact of multiple, interrelated dimensions of engagement on learning (Sinatra et al., 2015; Fredricks, 2011; Sinha et al., 2015). This paper explores a multidimensional framework of student engagement to understand mechanisms by which collaborative activity and network analysis can support deeper engagement with history learning. We analyze Net.Create, a collaborative network analysis tool (Craig & Danish, 2018; Craig et al., 2020), in the context of an undergraduate digital humanities classroom, where students were tasked with representing complex historical data for public consumption. Students used digital humanities tools (network analysis, mapping, and text analysis) to represent data gathered from a History Harvest. The History Harvest model brings students, academic researchers, and communities into partnership to preserve objects that tell personal and familial histories while keeping those objects with their owners. To accomplish this, history students photograph objects and conduct interviews about their importance for the community's history. Students then use digital tools to create interactive representations to display connections between personal, familial, cultural, and local histories.

This paper focuses on the collaborative engagement of groups that chose Net.Create to represent their objects. Net.Create engages students in detailed investigations of historical sources by providing a framework to support the contextualization of individual historical details in a complex web of people, places, concepts, and events. A persistent problem with history engagement is moving students beyond surface-level interest in a historical problem and towards the analysis and interpretation of historical sources (Brush & Saye, 2008). To understand how Net.Create supports this deeper engagement with historical analysis, we explore the following research question: *How did students engage behaviorally, cognitively, socially, and emotionally with and around Net.Create as they created networks of historical objects, and how did this influence their learning?*

Literature review

The History Harvest as a component of authentic historical thinking

Representing historical objects and their stories for the public offers unique opportunities for undergraduate engagement with history. Traditional large-lecture classes typically present history as a collection of facts to be memorized, thus obscuring how history is built up through multiple narratives and perspectives (Wineburg, 1991; Nokes, 2013; Wineburg, 2018). Engaging students in the authentic practices of historians—collecting artifacts, analyzing multiple narratives, and drawing connections—helps students refine historical thinking and argumentation skills that are key to the discipline (Shopkow, 2017; Martin & Monte-Sano, 2008; Lévesque, 2008).

In this study, some artifacts collected by students were passed down through generations, while others were found, purchased, or received as a gift. For instance, one contributor shared a Japanese kimono that her grandfather brought back from Japan after serving in World War II. Situating class activities in community history increases the likelihood of deep cognitive engagement, because students must generate a workable solution to a real-world question of historical practice without a predetermined “correct” answer (Hmelo-Silver, 2004). Such ill-structured problems ground learning in disciplinary knowledge and practices (Bae et al., 2019). Authentic problems can also engage learners’ prior knowledge and experiences and motivate extended engagement (Hmelo-Silver, 2004; Blumenfeld et al., 1991). In this study, students were asked to represent historical objects in a way that reveals the social and cultural connections between them while also highlighting their unique features. This approach offers students authority over how they build historical arguments from a complex dataset and problematizes the notion of history as having one “true” perspective, both of which can influence learners’ engagement with history learning (Freedman, 2020). To support students in navigating this open-ended problem, the Net.Create tool (see Design section) was offered to students as one option to explore, analyze, and represent this complexity.

Using the structure of network analysis to frame an ill-structured problem

Digital historians balance between different methodological approaches to the study of change and continuity as they negotiate structured network analysis and individual close-reading of primary sources (Gould, 2003; Padgett and Ansell, 1993; Graham, Milligan, Weingart 2016). The open-ended nature of that negotiation provides an ill-structured, authentic historical-thinking problem that encourages deep collaborative discussion. Making history palatable for the public is also an ill-structured problem because historical complexity can be represented in many forms. Students were tasked with using digital tools to answer team-generated research questions, such as “How do the cultural differences of each object affect how they serve as a mode of individual self-expression?” After entering data about their objects to explore possible answers, students created public web pages to communicate their discoveries. Groups then used Net.Create and network analysis methods to investigate the multiple historical narratives attached to their objects and generate a representation to help the public interpret these histories.

For network analysts, decisions about transforming the open prose of historical primary sources into structured data shape which elements of the dataset are highlighted or obscured (Durland & Fredricks, 2005). Networks are composed of nodes (circles which represent people, places, objects, and concepts) and edges (lines connecting the circles which represent relationships between nodes). Students make decisions about types of nodes to add to the network as well as types of relationships between nodes that are worth highlighting. These decisions affect how viewers interpret the final network, because well-connected nodes will appear larger, signifying the importance of that object or concept for the overall network. The types and numbers of edges created will also influence which nodes have high measures of betweenness, or in other words which nodes link parts of the network that would be otherwise unrelated (Carrington, 2005).

Student engagement in building a collaborative network of history

Students are more likely to engage deeply with learning in a task that is authentic for both disciplinary practice and complexity (Calabrese Barton & Tan, 2010). To capture this engagement, it is useful to conceptualize engagement as containing multiple, overlapping dimensions (Fredricks, Blumenfeld, & Paris, 2004; Fredricks, 2011). Behavioral, cognitive, and emotional dimensions are commonly agreed upon as key aspects of engagement (Fredricks et al., 2004). Social engagement has also been recognized as a fourth significant dimension, given the importance of mutually respectful interactions for collaborative learning (Sinha et al., 2015; Isohätälä et al., 2018). This multidimensional conceptualization highlights that engagement is not a static attribute, but rather a dynamic state that unfolds over time and is transformed by context (Fredricks, 2011; Sakr et al., 2016). It is important to note that studying a single facet of engagement is not only theoretically problematic, but it does not reveal the complex mechanisms by which behavior, cognition, emotion, and social relationships interact to open or foreclose opportunities for learning more broadly (Sinatra et al., 2015). The present study takes a multifaceted approach to understand how emotional connections shape and are shaped by social engagement and in turn deepen students’ cognitive engagement with historical and network analysis concepts. Drawing on frameworks that have been applied in other disciplinary contexts (Fredricks et al., 2004; Sinha et al., 2015), we conceptualize engagement along behavioral, cognitive, social, and emotional dimensions to capture the complex ways that engagement unfolds over time as learners interact with each other and their environments (Sinatra et al., 2015).

An analysis of engagement in context requires the application of a sociocultural theoretical lens, which views engagement as a dialectic give-and-take process between learners and their social, cultural, and political environments (Sinatra et al., 2015). Engagement cannot be separated from the contexts in which it is produced—in other words, it cannot be captured in a single decontextualized snapshot but must instead be understood as “unfolding in place and time” (Sakr et al., 2016, p. 84). From this situated perspective, surveys of individual

engagement variables are not enough, and analyses should instead take up a frame of learners-in-context that highlights social positioning, available forms of participation, and the collective meaning assigned to these interactions (Nolen, Horn, & Ward, 2015). Behavioral, cognitive, social, and emotional dimensions are interwoven together in interactions between learners, so it is not always easy to operationalize where one dimension ends and another begins (Fredricks et al., 2004). To clarify dimensional boundaries, we consider behavioral engagement as the overarching visible “evidence” of learners’ engagement (e.g., entering network data into the computer), and cognitive, social, and emotional engagement as different goals that engaged behaviors may fulfill. Behavioral engagement encompasses ways in which students participate in the activity that surrounds them (e.g., asking questions, taking notes; Fredricks et al., 2004). The other three dimensions can then be defined through subsets of behaviors that make conceptual ideas, social relationships, and emotional reactions visible to other participants. Engaging along one dimension is good (e.g., taking notes), while engaging along multiple dimensions is better (e.g., taking notes while expressing excitement and soliciting contributions from peers).

Cognitive engagement is defined both as learners’ reflections on conceptual ideas, questions, and problems (Sinha et al., 2015) and as their use of metacognitive strategies to control and improve their learning (Greene, 2015). This dimension can be analyzed through the public negotiations and discussions that students engage in as they work to represent their historical data together. Collaborative activities are a powerful way to foster cognitive engagement because students must explain and justify their ideas to their peers (Gresalfi, 2009). In the context of Net.Create activities, students must determine what conceptual links to create between objects, such as geographic origins, cultural traditions, and personal experiences. They also negotiate network structures (e.g., what counts as a node or an edge) so that conceptual links are visible and interpretable to network viewers.

Collaboration can also socially engage students when groups thoughtfully consider and respect the contributions of all members (Sinha et al., 2015). Positive social engagement reflects “learners’ abilities and efforts to sustain cohesive, mutually respectful social interaction...including developing trust and fostering safety for collaboration and building a sense of community with a shared goal” (Isohätälä et al., 2018, p. 2). This might look like a balanced discussion in which each student can share and safely debate ideas without risking rejection. Negative social engagement would be seen through exclusion, ignoring the perspectives of group members, or social loafing (e.g., letting one person do all the data entry while others text on their phones) (Isohätälä et al., 2018). The instructor encouraged positive social engagement in this study by having each student take responsibility for a different set of historical objects, which they then had to add to their group’s network.

The network tasks supported by Net.Create offer students a way to engage emotionally as well, which can be defined as the positive and negative reactions that learners have to activities (Fredricks et al., 2004). Students’ emotional engagement with history can influence the extent to which they identify with people from the past, as well as their creation of links between past and present experiences (Sakr et al., 2016). Thus, supporting students in experiencing emotional reactions such as curiosity and empathy is central to the design of engaging history learning activities. When creating connections in Net.Create, students were encouraged to consider the perspectives of the people, families, and cultures who the objects belong to, which could help them identify and empathize with the emotional links that these people had to their donated objects (Endacott & Brooks, 2013).

Design

The Net.Create software (Craig & Danish, 2018) is designed to support collaborative, simultaneous data entry into a live network visualization, so that groups can enter and revise data to represent relationships between individual people, objects, and ideas in a complex dataset. To generate a visualization, students added nodes (objects, places, people, events, and concepts) into the network and then linked these nodes using edges (categories of relationships that describe how two nodes are connected) (Figure 1). Each node and edge entry had text boxes for students to explain historical significance and how the entry relates to the overall network. Nodes with many connections grew larger and pulled smaller nodes towards them to represent their growing importance.

Analyzing relationships between central nodes and outlier nodes helped students identify connections between gathered objects and was one of three digital methods students could choose after they completed the history-harvest portion of the course (see “authentic historical thinking” above in lit review). To support students as they transitioned from the community-interaction unit to the analysis unit, several mid-semester class sessions were set aside for in-person data entry and analysis. The sessions are labeled Days 1-4 to denote their chronological sequence but were not consecutive—the research team gathered data from a sampling of class periods across the semester to capture group engagement as it shifted over time. On Day 1, students drafted research questions to guide their analysis of objects collected from the History Harvest. On Day 2, groups entered data about their objects into Net.Create and analyzed connections between their objects’ histories. On Day 3, they used evidence from their networks to draft paragraphs for web pages, to explain to the public their discovered patterns. Finally, on Day 4, they gave final class presentations summarizing their group’s historical research.

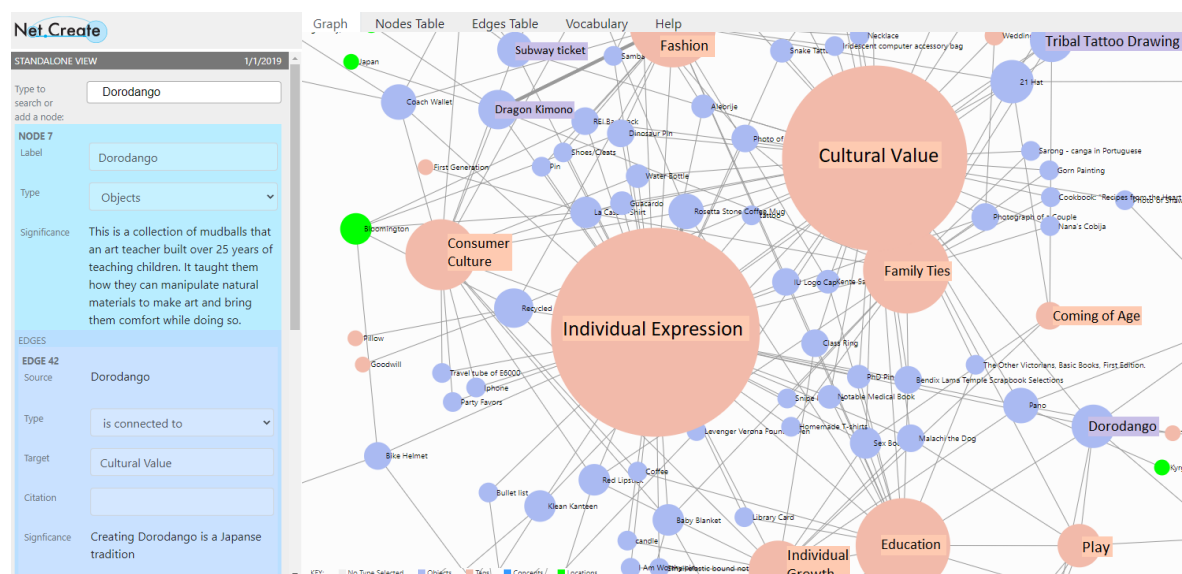


Figure 1. A node and edge entered by students (left) in their network of historical objects and concepts (right)

Methods

This paper focuses on the collaborative engagement of one focus group ($n = 3$ students) in a 25-student undergraduate digital history course at a large university in the Midwestern United States. A qualitative analysis of this group's interactions allowed us to explore how cognitive, social, emotional, and behavioral engagement intertwine to support students' learning during group work. The dataset, which consists of 4.5 hours of group audio data drawn from four different class sessions, was segmented into 30-second segments to give coders a standard unit of analysis for tracking engagement patterns (Isohäätä et al., 2018). We established seven general codes from the literature: 1) Metacognitive behaviors; 2) Positive emotional reactions; 3) Negative emotional reactions; 4) Positive social interaction; 5) Negative social interaction; two cognitive-conceptual codes capturing discussions of 6) Historical argumentation and 7) Network analysis concepts. The codes were used to tag engagement patterns and identify key episodes rather than evaluate discussion quality. Coders applied each code only once per 30-second segment and applied as many codes as were applicable for that segment. A second coder analyzed 1 hour of data to provide interrater reliability measures (1 / 4.5 hours of data, or 22% of the dataset).

Because behavioral engagement takes a variety of forms (e.g., active listening, independent work) and provides evidence of the other three dimensions, we did not code for behavioral engagement but instead analyzed it qualitatively in selected episodes. We identified episodes in which multiple coded dimensions of engagement overlapped to explore the complex interactions between dimensions, which are not yet well understood (Sinatra et al., 2015). For example, episodes of extended social engagement mixed with metacognitive and conceptual engagement were pulled to explore how these dimensions might be building on one another to support learning. These episodes of complex engagement were then qualitatively analyzed using interaction analysis (Jordan & Henderson, 1995), which involved multiple rounds of listening to audio clips, transcription of key episodes, and analysis of screen capture and video data when available to contextualize student conversations.

Findings

Coding of group interactions revealed that positive social engagement and metacognitive behaviors were most common. For example, Figure 2 shows group engagement across Day 1, with minutes 0-24 of class on the first line, 25-49 on the second line, and 50-72 on line three. Each column represents one 30-second segment of activity. Group members were periodically monitoring their collective progress, voicing confusion, asking for help, and clarifying goals and plans (i.e., cognitive engagement via metacognitive behaviors). They also consistently solicited ideas, responded to contributions, affirmed the value of peers' ideas, and engaged in friendly teasing and humor (i.e., social engagement via positive group interactions). The other five general codes also appeared across the dataset, though less consistently. Negative emotional and negative social engagement were relatively rare (e.g., negative social engagement did not appear on Day 1), while positive emotional engagement was moderately common but not as consistently present as positive social engagement. Most positive-emotion moments appeared as laughter around teasing or humor. Finally, historical argumentation and network analysis discussions were also moderately present, often towards the end of class during group review of network entries and webpage writings.

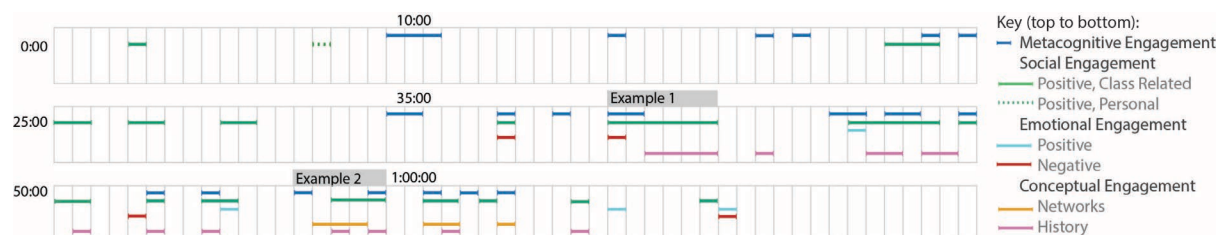


Figure 2. A timeline of the focus group's engagement along the seven coded dimensions during Day 1

Given the consistent presence of positive social engagement and metacognitive behaviors, we focused our qualitative analysis on the possible functions of these forms of engagement in supporting students' conceptual understanding. We present two episodes below demonstrating how these dimensions overlapped in discussions. In the first example (Table 1; Example 1 in Figure 2), our focus group (Patrick, Aubrey, and Jordan) have joined with another group (Students 1-3) to brainstorm research questions. The segment begins with several metacognitive behaviors: Patrick agrees to take notes, and Aubrey reminds him that the goal is to record their brainstorming. Aubrey and Jordan then organize the discussion by proposing that everyone share what object they have been studying. When Student 3 says his object too quietly, the group responds with positive social engagement in the form of polite questioning, re-voicing, and a bit of humor that carries on for ten lines of talk (one student misheard and thought Student 3's object, a subway ticket, was a Subway cookie from the sandwich shop). The discussion preceding the transcribed segment intertwines cognitive and social engagement as students use metacognitive behaviors to steer the conversation towards a collective goal. Students are consistently socially engaged, using laughter and humor to keep the conversation moving when a student is briefly misheard. This social engagement then transitions seamlessly into a discussion of potential concepts to organize their analysis:

Table 1: Positive social engagement in the form of respectful disagreement

Line	Speaker	
1	Aubrey	I feel like individual expression is probably
2	Patrick	Individual expression is definitely—like I think everyone can hit on that
3	Aubrey	Mhmm
4	Jordan	That's uh
5	Patrick	Cause they're all individual items
6	Jordan	Individual expression um...like it could get even deeper into cultural expression too
7	Patrick	I was gonna say even sediment—sen-i-ment—like, how sentimental it is
8	Aubrey	Mine's not very sentimental
9	Patrick	Oh, no?
10	Student 2	Same here
11	Patrick	Oh really?
12	Aubrey	Mine are just—
13	Student 2	Just tattoos
14	Jordan	Mine's pretty sentimental
15	Student 2	It's not sentimental, it's just more of a—like the self-expression angle
16	Jordan	See mine's more of like a sentimental tattoo
17	Student 2	What?
18	Jordan	It's like a more of like a tribal tattoo from like a ((inaudible))
19	Aubrey	Mine is—mine is used in education. To play as development...so
20		((inaudible side conversation))
21	Aubrey	I don't know if that technically- if that would fit with sentimentality. I feel like that's more of like- Like, how I- how I'm relating it to individual expression is through individual growth rather than sentimentality

In this discussion, students shift fluidly between multiple forms of engagement as they share ideas and negotiate what aspects of their historical objects should shape group analysis. Positive social engagement transitions seamlessly into a historical analysis of potential categories to address similarities between the group's objects (lines 1-7). When Aubrey and Student 2 respectfully disagree with a suggested category, Patrick pauses to question and listen to their reasoning for not wanting to use sentimentality as a conceptual frame (lines 8-11). These respectful interactions influence how the group's final network (Figure 1) unfolds—the group leaves out

sentimentality and instead uses family ties, cultural value, coming of age, individual expression, and individual growth to better represent the similarities and differences between their objects' histories. This positive group functioning, with its blend of supportive, light-hearted discussion and guiding metacognitive behaviors, appears frequently in our focus group's interactions. While some might assume social engagement would distract from disciplinary engagement, it appeared in many cases to advance engagement with conceptual ideas. In a later episode (Table 2; Example 2 in Figure 2), our group again engages in metacognitive behaviors by reflecting on their research questions and assessing how their collaborative network sheds light on their data.

Table 2: Positive social engagement in the form of building on one another's conceptual ideas

Line	Speaker	
1	Aubrey	I feel like our question actually—I feel like our question actually like works well
2	Patrick	Mhmm
3	Aubrey	With (.) um network analysis, because like the middle of the structure is like, individual self-expression then, our branches are like—you know how I was saying earlier like individual growth as ((inaudible)) education, individual growth as a mode for self-expression. So then my like, thing related to it is like, individual growth. And then through that I would have like all the things relating to mine. And then you guys would have the same
4	Both J&P	Yeah
5	Aubrey	And there are probably crossovers between
6	Jordan	Yeah, and like with individual growth on yours, mine's about coming of age
7	Aubrey	Yeah
8		[...] ((group briefly clarifies which research question they're talking about))
9	Patrick	Cause each of us has a different object, and like not saying that tattoos are similar, but they're not—they have totally different meanings
10	Aubrey	Right. Right right. Right.
11	Patrick	So yeah you're totally right, as long as we have a center-
12	Aubrey	Like and I think the center-
13	Patrick	-we each branch out and we'll find like smaller parts that each go together
14	Aubrey	And like I feel like our center can literally just be individual self-expression, like as simple as that
15	Patrick	Yeah, that's what I was thinking
16	Aubrey	And then I feel like our network analysis, you know how she ((instructor)) was saying like, there's something that always ends up, like in the- it gets like super centralized
17	Patrick	Yeah. They'll be different parts that come together, and we'll find that out soon as they come out

This episode demonstrates a solid collaborative foundation that supports conceptual richness. Students negotiate their collective understanding and affirm the value of peers' ideas. Throughout the segment, all three group members offer small verbal acknowledgements (e.g., “mhmm”, “yeah”, “totally”) to encourage one another's continued sharing of ideas. Aubrey makes important observations about how branching nodes and centralized nodes highlight relevant conceptual tags, and Jordan responds to Aubrey's mention of “crossovers” by noting a commonality between his object and Aubrey's (line 6). Patrick also builds on Aubrey's ideas with multiple explicit affirmations (“you're totally right”, line 11) while adding his own idea that building the network will reveal emergent patterns (line 17). The group's final network (Figure 1) reveals how these early negotiations supported later engagement with the Net.Create tool. Jordan and Aubrey's objects do indeed end up in “branches”, with Aubrey's dorodango linked to education, play, and individual growth, and Jordan's tribal drawing tattoo linked to coming of age and cultural value. Patrick's comment about ideas coming together (line 17) also played out in the group's network. The group predicted individual expression would be an important concept (line 14), but cultural value also became a central node. This engagement with network analysis structures helped this group engage with the history as well. Linking their objects to distinct conceptual tags helped make visible Patrick's understanding that a tattoo isn't just a tattoo (line 9)—each object has its own history and sources of meaning.

After the transcribed segment, the discussion wraps up with another blend of social support and humor. Patrick's “Good job, Aubrey” was met with thanks and Aubrey's joke that “there's a brain in here sometimes.” These small moments of positive social engagement, which may seem insignificant in isolation, appear to build up across the activities, providing a consistent supportive context in which to negotiate evolving ideas. Based on

the glimpse this focus group provides into the benefits of social engagement and metacognitive behaviors, positive social engagement has the potential to form a foundation for future engagement, with teasing and humor not only creating a positive context for discussion but also sustaining engagement through moments of confusion or frustration. For example, in other focus episodes students joked about having no idea what's going on as a light-hearted bid to solicit support from group members without directly asking for help. Productive behavioral and conceptual engagement (e.g., entering data into the network) also often coincided with personal-oriented positive social engagement (e.g., discussing plans for the weekend), which typically lasted for only a minute or two before the group returned to discussing the task. This suggests that class-oriented and personal-oriented engagement could sustain one another productively and provide temporary breaks during a cognitively demanding activity. It is likely that such complex relationships between forms of engagement could perform a variety of functions depending on context, and so future research should investigate additional patterns in how these dimensions interact with one another.

Discussion and conclusions

The complex potential interactions between social engagement, metacognitive behaviors, and other aspects of engagement suggest that engaging students deeply with history learning requires a consideration of how activities are structured to support positive group interactions. The extent to which collaborative group members support one another's ideas and encourage sustained participation in the face of obstacles may have a significant influence on their synthesis of historical ideas. Additionally, a classroom environment that encourages voicing confusion and seeking help can support students in monitoring their own understanding and the collective understanding of peers. Much of the conceptual work that students were engaging with was not visible in discussions with their group members; instead, it was more apparent in their writing. Net.Create offered students an alternate pathway for making their cognitive engagement with history visible to each other through prompts to write about the significance of each object. Students could move from entering individual historical details into the network to making higher-level summaries of patterns in their group discussions, constructing both individual understandings of their objects and collective understandings of how these objects are conceptually related. The combination of positive social and cognitive engagement appeared to help groups sustain their engagement across long periods of independent group work, with group members periodically checking in with one another and bolstering group cohesion with light-hearted jokes. While such aspects of positive social engagement may appear tangential to learning at first glance, qualitative analysis of this focus group suggests that small moments of humor, supportiveness, and mutual respect can set the stage for later moments of deep conceptual engagement. This highlights that cohesive group functioning, which plays a central role in collaborative science learning contexts (Sinha et al., 2015; Isohätälä et al., 2018), may be of central importance for history learning, as well. Having built a supportive environment for collaboration, these students effectively constructed a collective understanding of historical and network analysis patterns and made those patterns visible for their community.

References

- Bae, H., Craig, K., Danish, J., Hmelo-Silver, C. E., Uttamchandani, S., & Szostalo, M. (2019). Mediating collaboration in history with network analysis. In Lund, K., Niccolai, G. P., Lavoué, E., Gweon, C. H., & Baker, M. (Eds.), *A Wide Lens: Combining Embodied, Enactive, Extended, and Embedded Learning in Collaborative Settings, 13th International Conference on Computer Supported Collaborative Learning (CSCL) 2019, Volume 2*, International Society of the Learning Sciences, 949-950.
- Blumenfeld, P. C., Soloway, E., Marx, R. W., Krajcik, J. S., Guzdial, M., & Palincsar, A. (1991). Motivating project-based learning: Sustaining the doing, supporting the learning. *Educational Psychologist*, 26(3-4), 369-398.
- Brush, T. & Saye, J. (2008). The effects of multimedia-supported problem-based inquiry on student engagement, empathy, and assumptions about history. *Interdisciplinary Journal of Problem-based Learning*, 2(1).
- Calabrese Barton, A. & Tan, E. (2010). We Be Burnin'! Agency, Identity, and Science Learning. *Journal of the Learning Sciences*, 19(2), 187-229.
- Carrington, P. J., Scott, J., and Wasserman, S. (Eds.). (2005). *Models and Methods in Social Network Analysis*. Cambridge University Press.
- Craig, K. and Danish, J. (2018). Net.Create [Computer software]. Available from Netcreate.org [2018].
- Craig, K., Humberg, M., Danish, J., Szostalo, M., Hmelo-Silver, C., & McCranie, A. (2020). Increasing Students' Social Engagement During COVID-19 with Net.Create: Collaborative Social Network Analysis to Map Historical Pandemics During a Pandemic. *Information and Learning Sciences*, 121(7/8), 533-547.

- Durland, M. M., and Fredericks, K. A. (2005). An introduction to social network analysis. *New Directions for Evaluation*, 105, 5-13.
- Endacott, J. & Brooks, S. (2013). An updated theoretical and practical model for promoting historical empathy. *Social Studies Research and Practice*, 8, 41-58.
- Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School Engagement: Potential of the Concept, State of the Evidence. *Review of Educational Research*, 74(1), 59-109.
- Fredricks, J. A. (2011). Engagement in school and out-of-school contexts: A multidimensional view of engagement. *Theory Into Practice*, 50, 327-335.
- Freedman, E. B. (2020). When discussions sputter or take flight: Comparing productive disciplinary engagement in two history classes. *Journal of the Learning Sciences*, 29(3), 385-429.
- Gould, R. V. (2003). Use of network tools in comparative historical research. In Amenta, E., Mahoney, J., & Rueschemeyer, D. (Eds.) *Comparative Historical Analysis in the Social Sciences*. Cambridge University Press.
- Graham, S., Milligan, I., Weingart, S. (2016). *The Historian's Macroscopic: Big Digital History*. Imperial College Press.
- Greene, B. A. (2015). Measuring cognitive engagement with self-report scales: Reflections from over 20 years of research. *Educational Psychologist* 50(1), 14-30.
- Gresalfi, M. (2009). Taking up opportunities to learn: Constructing dispositions in mathematics classrooms. *Journal of the Learning Sciences*, 18(3), 327-369.
- Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn? *Educational Psychology Review*, 16, 235-266.
- Isöhätälä, J., Näykki, P., Järvelä, S. and Baker, M. J. (2018). Striking a balance: Socio-emotional processes during argumentation in collaborative learning interaction. *Learning, Culture and Social Interaction*, 16, 1-19.
- Jordan, B. & Henderson, A. (1995). Interaction analysis: Foundations and practice. *Journal of the Learning Sciences*, 4(1), 39-103.
- Lévesque, S. (2008). *Thinking Historically: Educating Students for the Twenty-First Century*. Toronto, Canada: University of Toronto Press.
- Martin, D., & Monte-Sano, C. (2008). Inquiry, Controversy and Ambiguous Texts. In Warren, W., & D. A. Cantù (Eds.), *History Education 101: The Past, Present, and Future of Teacher Preparation* (pp. 167-186). Charlotte, NC: Information Age Publishing.
- Nokes, J. D. (2013). *Building Students' Historical Literacies: Learning to Read and Reason with Historical Texts and Evidence*. Routledge.
- Nolen, S. B., Horn, I. S., & Ward, C. J. (2015). Situating motivation. *Educational Psychologist*, 50(3), 234-237.
- Padgett, J. F. & Ansell, C. K. (1993). Robust Action and the Rise of the Medici, 1400-1434. *American Journal of Sociology*, 98(6), 1259-1319.
- Sakr, M., Jewitt, C., & Price, S. (2016). Mobile Experiences of Historical Place: A Multimodal Analysis of Emotional Engagement. *Journal of the Learning Sciences*, 25(1), 51-92.
- Savenije, G. M. & de Bruijn, P. (2017). Historical empathy in a museum: Uniting contextualisation and emotional engagement. *International Journal of Heritage Studies*, 23(9), 832-845.
- Shopkow, L. (2017). How Many Sources Do I Need? *The History Teacher*, 50(2), 169-200.
- Sinatra, G. M., Heddy, B. C., & Lombardi, D. (2015). The Challenges of Defining and Measuring Student Engagement in Science. *Educational Psychologist*, 50(1), 1-13.
- Sinha, S., Rogat, T. K., Adams-Wiggins, K. R., Hmelo-Silver, C. E. (2015). Collaborative group engagement in a computer-supported inquiry learning environment. *International Journal of Computer-Supported Collaborative Learning*, 10, 273-307.
- Squire, K. & Barab, S. (2004). Replaying History: Engaging Urban Underserved Students in Learning World History Through Computer Simulation Games. In Kafai, Y. B., Sandoval, W. A., Enyedy, N., Nixon, A. S., & Herrera, F. (Eds.), *International Conference of the Learning Sciences 2004: Embracing Diversity in the Learning Sciences* (pp. 505-512). Santa Monica, CA: Lawrence Erlbaum Associates.
- Wineburg, S. S. (1991). On the reading of historical texts: Notes on the breach between school and academy. *American Educational Research Journal*, 28(3), 495-519.
- Wineburg, S. S., Smith, M., Breakstone, J. (2018). What is Learned in College History Classes? *Journal of American History*, 104(4), 983-93.

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