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Configurations of Community and Collaboration in Online Learning: An Assemblage Approach

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Configurations of Community and Collaboration in Online Learning: An Assemblage Approach

by

John Michael Scott

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Committee in charge:
Professor Glynda A. Hull, Chair
Professor Laura Sterponi
Professor Greg Niemeyer
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Abstract

Configurations of Community and Collaboration in Online Learning: An Assemblage Approach
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Delivering engaging and rigorous learning experiences in online environments has become a key priority for higher education institutions, driving prolific innovation in tools, pedagogy, and research over the last 20 years. The design and research of collaborative, networked learning experiences in particular has been fueled both by socially-turned theories of learning as well as the meteoric rise of social media and digital networks, which have introduced radical new forms of connectivity and sharing in daily life. In this dissertation, I offer three articles that each focus on one tool in the SuiteC collaborative learning system, a set of interconnected software applications designed to foster peer-to-peer sharing and collaborative, remix composing in a gamified environment. Looking across four semesters of student usage of the SuiteC tools in an online/hybrid undergraduate education course, I employ a mixed-methods approach grounded in "assemblage theory" that leverages learning analytics mined from the SuiteC database, content analysis of student artifacts, and student feedback to explore the kinds of social interactions and collaborations that emerged in the course. Findings suggest best practices and curricular strategies for the design of peer-centered online learning courses, recommendations for software tools, and the utility of assemblage concepts in studying complex sociotechnical systems.

In chapter 1, I explore student and instructor usage of the Engagement Index, which employs a customizable scoring matrix that allows instructors to configure point values for social interactions undertaken by students in the other SuiteC tools, as well as a course leaderboard that displays the sum totals of student activity based on the scoring configuration. Looking at empirical studies related to gamification, and in particular, leaderboards and point-systems applied to social learning contexts, I use assemblage theory as a conceptual tool for mapping the complex interaction between software tools, curriculum, and students that affect how gamification tools are implemented in a course experience. Using regression models, I analyze relationships between student usage of the Engagement Index tool, their social interaction data, and their course performance to understand how representative leaderboard scores were to students' final grades and participation.

In chapter 2, I shift my framing and analysis to the Asset Library, where students upload and interact with content in a course social "feed," through like, comment, and remix media shared by peers. Drawing from various theories of networked learning, "social presence" theory, and practices of curation in social media environments, I focus on the way knowledge emerges through social

connection, specifically the nature of interaction and discourse facilitated by "NewsFeeds." I apply three lenses for analyzing student activity in the Asset Library- interaction over time, networked interactions, and discourse in comment threads- in effort to determine the nature of the social relationships and learning activities mediated by the media feed. Findings suggest that, while sharing media and interacting with peers in the feed generates important learning opportunities that augment the curriculum, discursive exchange on assets can lack depth and sustained dialogue.

In chapter 3, I analyze student and instructor usage of the Whiteboards, where students can work individually or with peers in authoring multimedia texts by remixing assets shared by peers into the Asset Library shared by peers. Weaving together new media and literacy theories to frame , I make the case that "remix" is an essential practice of meaning-making and knowledge production in digital culture that has application in formal online learning environments. Using multimodal analysis in "virtual ethnography" specifically around remix and "memes," I first consider how different kind of curriculum activities engaged different forms of remix, specifically in how existing content were connected to course concepts, personal identity and worldviews, and academic work. I look at examples from student whiteboards from across different remix activities to understand how these remix practices were taken up as acts of meaning making. Third, I analyze an occurrence of a course meme that appeared in 18 different Whiteboards, and how each Whiteboard became an opportunity to connect the asset to new ideas and for new purposes, each time expanding the connections to the asset in generating new meanings. I close by considering closely both observed challenges in adopting a remix approach in the academic classroom, as well as examples of remix that may be considered as models for successful academic remix.

In my concluding chapter, I tie together findings from across the three chapters to glean some high-level insights into the kinds of learning opportunities and social interactions that emerged during the four semesters of the undergraduate course. Based on these insights, I offer pathways for further pedagogical and technological advancement that could benefit collaborative, social learning environments

For The Pink Pony and Crossroads.

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Introduction Chapter

Traces of Impact: Social Gamification through the Engagement Index

Learning in the Feed: Curriculum, Curation, and Connection in the Asset Library

Introduction

Building a Remix Machine

This dissertation represents a long journey toward building and implementing an educational software designed to be an ecosystem for the collaborative remixing of media. Since my first months of teaching in a juvenile jail in Brownsville, Brooklyn, when I first began making digital stories with students on an old iMovie program, I became interested in how remix practices related to literacy and learning, and how software like iMovie can mediate such an experience- one where students reuse media in representing personal narrative. The development of these ideas and interests around collaborative remixing expanded during my work on the Space2Cre8 youth social networking project, led by my advisor Professor Glynda Hull. I began experimenting with global remixing- one where students braid and layer and socialize around content shared by students around the world in crafting collaborative video narratives. For a master's degree course for preservice teachers, I began integrating some of these collaborative remix projects into the formal, higher ed context. I continued refining how to tie together learning content, personal narrative, and artistic expression during my first years teaching the undergraduate education course at Berkeley.

When Professor Hull, secured funding through a Chamberlain grant to build a prototype for a collaborative learning software, we began to conceptualize what such a remix ecosystem might look like, and contracted with a web development firm to develop an application later named "Collabosphere."

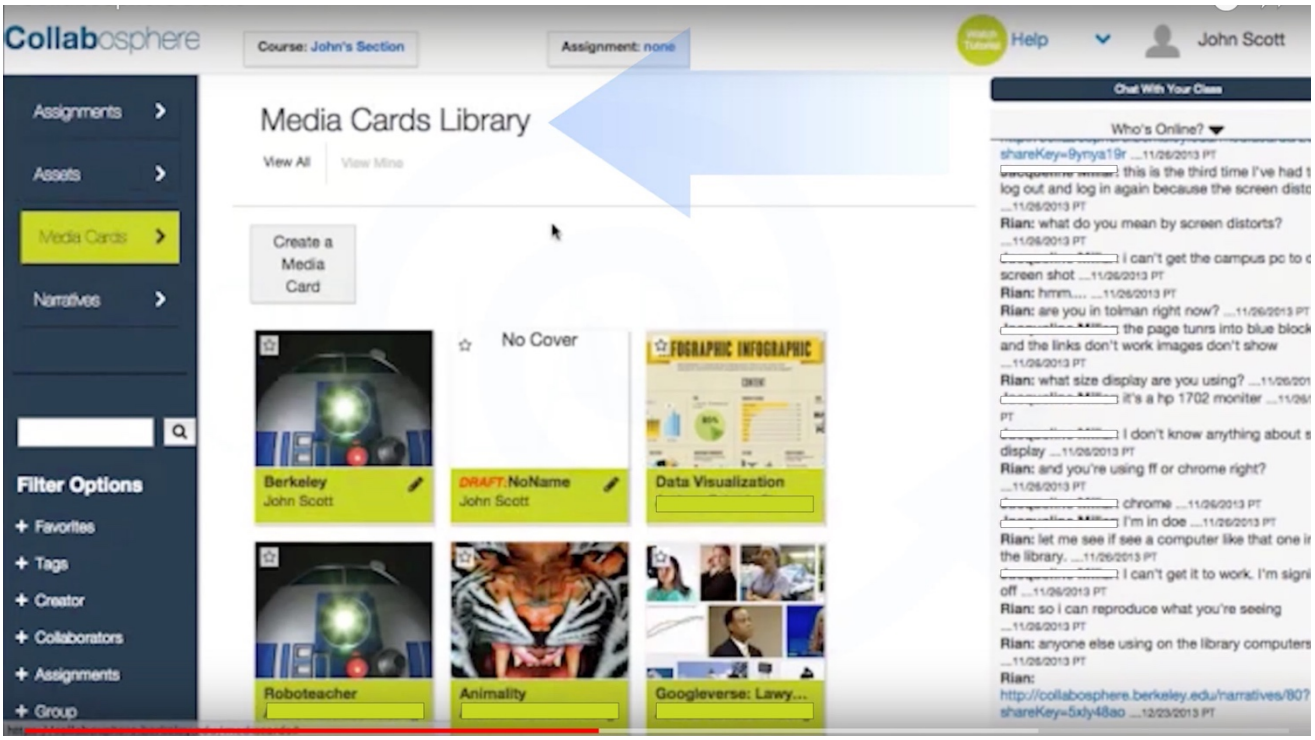

Figure 1: Collabosphere Remix Ecosystem

Collabosphere was tested in controlled environments and piloted in some projects in the Graduate School of Education, and served as a proof of concept. While working on the Collabosphere course, I was also a graduate student instructor for an online course in the art department taught by Professor

Greg Niemeyer. The course site was developed in a Drupal environment that utilized an innovative gamification tool called the Engagement Index in tandem with a social Gallery for sharing media, designed by Professor Niemeyer and his team.

Professor Hull soon discovered another funding opportunity for education technology tools through the Innovative Learning Technology Initiative (ILTI) at the University of California Office of the President. Based on our proof-of-concept in the Collabosphere prototype, we submitted a proposal to develop a more scalable, integrated suite of collaboration tools. We also proposed our tools would build off of Professor Niemeyer's Engagement Index and Gallery, which had previously received funding from ILTI. Our proposal was accepted, and we began working directly with the product development team at Berkeley's Education Technology Services to create what would ultimately be called SuiteC. Based on the initial Collabosphere and Engagement Index prototypes, the product development team facilitated user experience workshops to refine the designs and prioritize key features. We also received funding from ILTI to create an online version of the undergraduate education in literacy, which we worked on in parallel with the development of SuiteC.

The Suite**C** web apps were developed in Node JS and adhere to the Learning Tools Interoperability (LTI) standard[1], which allows for them to integrate into a campus Learning Management System (LMS). For the end user, the SuiteC tools are enmeshed with the native architecture and feature set of the learning management system, providing a seamless experience as students and instructors move across tools. The initial three SuiteC tools included the Asset Library, Whiteboards, and Engagement Index tools. They intend to provide multi-faceted collaboration and multimodal composing in a gamified environment. Students and instructors can curate content into the Asset Library in the form of media Assets as well as comment and like the Assets of others. They can collaborate in real-time on an infinite canvas in repurposing and remixing Assets from the Library with basic text and shape composing tools in the Whiteboards. And they can track their participation and their impact on the learning community using the Engagement Index scoring system, leaderboard, and weekly trends report. SuiteC's integration with native LMS tools such as Assignments and Discussions also allows for the design of learning activities that intersect directly with other tools. I describe the three tools in greater detail in each of their respective articles. During the study, the SuiteC tools remained in active development, with features and updates pushed at 3-week sprint intervals and major upgrades or changes instrumented between semesters. Mentioned throughout the chapters but introduced into SuiteC after the conclusion of this study, we were awarded a grant from the National Science Foundation to build a fourth SuiteC tool, called the Impact Studio[2]. The Impact Studio introduces a social analytics dashboard that provides each student data-driven insights into their participation, activity and trending media in the learning community, and their social ties with peers.

Prior to launching the online version of the literacy in education course, the course enjoyed a ten-plus year history as an on-ground course with lecture and session meetings weekly. As described in a dissertation about the course from the 2009 academic year, the course "is billed as a literacy course which satisfies the university's multicultural core class requirement, meaning that it focuses

[1] https://www.imsglobal.org/activity/learning-tools-interoperability

[2] This dissertation is based in part on research supported by the United States National Science Foundation under Grants No. 1623468 and 2013165362. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the view of the National Science Foundation.

on race, ethnicity, and culture in the U.S., in this case, in relation to the study of language and literacy" (Gleason, 2011). Students also enrolled in a 1-unit field work course, during which time, they volunteered as tutors or mentors in educational contexts, often in after school programs in the surrounding urban areas. In migrating the course to an online and blended delivery, in-person lecture time was replaced with video lectures and other forms of instructional media content as well as digital learning activities in the SuiteC tools and LMS environment. Students were then given a choice to enroll in a synchronous course session once per week, either an in-person discussion section or a video-conferencing section.

The activities students engage during the week in SuiteC encourage them to share or create artifacts, not only to represent key course concepts, but also to reflect their own experiences in education both past and present, as well as think critically about how these representations interact with various kinds of literacy and language. Collaborative activities in Whiteboards often ask students to reframe artifacts shared by peers in in the Asset Library or from the web to synthesize key ideas and themes across the course, engage with peer perspectives, and reflect on their experiences as students and mentors to students at their educational field work sites. Student participation and dialogue with peers around issues of race, culture, and equity in education are an essential aspect of the course experience.

Components of my Dissertation Assemblage

While each chapter explores a single SuiteC tool and subset of student activity, given the deeply connected nature of the tools and learning activities, each chapter references the other two by pulling in relevant findings and explanations to supplement the analysis. The relations between my dissertation articles create overlaps and intertextualities (Fairclough,1992), and resemble an "assemblage" in the way autonomous parts interact with each other in a system. Assemblage theory occupies a central place in the theoretical framing of my project, wherein, I refer to assemblage both as a verb ("to assemble") meaning to put together and (re)combine, and as a noun meaning "a whole constructed from heterogeneous parts" (DeLanda, 2006: p. 3). The philosophical concept "assemblage" as I use it here begins with the work of Deleuze and Guattari (1987), which they derive from dynamical systems theory in mathematics. The influence of Deleuzoguattarian concepts such as the rhizome and assemblage are far-reaching, having been taken up and expanded upon by scholars across disciplines, including education (insert education reference). In my use of assemblage concepts, I draw primarily from a vocabulary re-defined by DeLanda (2006; 2016), who has arguably put forward the most exhaustive and cohesive account of the assemblage.

The assemblage offers a useful model for perceiving complex systems- like digital learning environments- with its unique focus on relations of exteriority, or "extrinsic relations" between the autonomous components that form an emergent whole (Delanda 2016: p. 6). DeLanda (2006) explains that unlike Hegelian systems where the 'whole' forms a unity that subsumes its parts such that the identities of those parts depend on their configuration, the assemblage represents an emergent 'whole' that not does deprive the parts of their autonomy. The components of an assemblage have entered into a set of contingent relations with one another, so they remain capable of being plugged in and out of other systems, and existing in multiple systems simultaneously. Consider an educational software tool as an example of a component in an assemblage, where the same tool appears across many different kinds of course assemblages. Even though the tool itself remains unchanged in each context of use, it is uniquely taken up in relation to the course design and activities, the surrounding

technologies and applications, and other factors that influence the unfolding of a learning experience. A methodology committed to assemblage concepts. therefore, focuses on the relations between the various components that comprise a particular sociotechnical system like an online course, and how the interactions between those components produce "emergent effects"(DeLanda, 2006) which make an assemblage recognizable but not static.

I position assemblage concepts in each of the articles in a different way to demonstrate its utility in mapping the various layers of a digital environment. In the Engagement Index chapter, I organize the "course-level assemblage" into three planes- the technical, the designed, and a socio-cognitive- to map and trace their interactions with one another in effort to interpret student participation data in relation to the Engagement Index. In the Asset Library chapter, I consider the social feed as a content assemblage, where each post is an autonomous component that may appear across any number of networks, and persists within these networks in a state of *becoming*, as the post comes in contact with other posts or other people that add and subtract new layers of meaning to the post. Third, I focus on the verb form of assemblage "to assemble", and look at the practice of composing Whiteboards as the assembling of heterogeneous media elements into an emergent whole, considering the multiplicity and modularity of assets as they are assembled in a variety configurations that generate new shades or layers of meaning.

Analyzing the Contours of a Course Assemblage

Research Questions

Each chapter explores three primary questions related to the particular SuiteC tool and activities mediated by that tool.

Traces of Impact: Social Gamification through the Engagement Index

- Question 1: Were higher performing students more likely to opt-in and engage more frequently with the Engagement Index leaderboard?
- Question 2: What kinds of "gaming" behaviors emerged among students competing for position on the leaderboard?
- Question 3: What kinds of participation tracked and scored by the Engagement Index were most representative of a student's qualitative course performance?

Learning in the Feed: Curriculum, Curation, and Connection in the Asset Library

- How are changes in the curriculum, enrollment, and technology reflected in student activity in the Asset Library?
- What kinds of social ties did students form with peers through their interactions in the Asset Library around shared media?
- How did comments on assets form textual connections with other media and people interacting in the social feed?

(re)Assembling Media: Remixing Course Content in Collaborative Whiteboards

- How did course remix activities frame different kinds of media reuse and asset *transformation* in student composing practices?
- In cases where a single asset was reused many times by many students, how did each instance of remix expand or shift the meanings of that artifact from its original posting?
- How did students respond to and reflect upon their engagement with remix activities and what kinds of tensions and opportunities emerged when remix practices were introduced into the academic environment?

Data Set

Data were collected over four consecutive semesters of the undergraduate education course in literacy, not counting a condensed summer version of the course. De-identified log data were mined from the Suite**C** representing click events undertaken by students across the tools (See Appendix A: SuiteC Events). For example, accessing the Asset Library produces a "Launch Asset Library" event in the Suite**C** database. Each event has rich metadata associated it, such as student ID, course ID, timestamp. Depending on the nature of the log event, other relevant metadata will also be included. For example, a "Create Asset Comment" event contains the User ID of the person who triggered the event, the Asset ID and link to Asset in the Library, which can be further associated with the User ID who posted that Asset. In addition to click data, students' final grades were included as an indicator of performance in the course. Table 1 shows the number of students per course and some key types of activity across the system.

Table 1: Number of students and total SuiteC activity per course semester

	Course I	**Course II**	**Course III**	**Course IV**
N	125	85	95	91
Views	54,140	39,730	24,148	15,668
Assets	10,202	6,243	4,069	3,746
Likes	22,618	559	2,745	814
Comments	1,950	1,168	1,365	778
Whiteboards	2,002	1,302	1,031	1,042
EI	3,131	962	2,148	824

To supplement insights from the click data, the data set also includes students artifacts and student feedback. Student artifacts were mined from the course, such as assets shared, Whiteboards created, and comment threads. Because of the volume of content in SuiteC collected over four semesters, I sample primarily from Course II, which I felt ran a version of the curriculum and software best focused on practices of curation and remix. Student feedback includes responses on a survey (see Appendix B: Course survey) distributed during the Course I and Course II (49 total respondents). Survey items focused on various aspects of the course experience and use of the SuiteC tools, and included both open-ended and multiple-choice responses. Four semi-structured feedback sessions (see Appendix C: Interview Protocol) with students were recorded and referenced to support or challenge findings in the click data and course artifacts.

Methods

As a design-based research project, a broad research focus was established at the onset of the project, which evolved into more specific questions and attendant methodological approaches emerged during the study, and continued to be refined through several stages of analysis. Given the heavy reliance on click data and student-generated content, my analysis consists of a mixed-methods approach based in a "social learning analytics" framework (Buckingham-Shum & Ferguson, 2012). This included:

- Descriptive statistics of click data comparing usage and activity over time
- Regression models to determine significance of relationships between student engagement and performance
- Network analysis of student social ties in the Asset Library
- Thematic coding (Saldaña, 2007) of comments in the Asst Library
- Curriculum coding of remix activities
- Content analysis of Whiteboards rooted in "multimodality" (Hull & Nelson, 2005) and "remix" theory (Lankshear & Knobel, 2007) that privilege connections between modes and texts

Author Roles: Tool Developer > Course Designer > Content Creator > Instructor > Researcher

Prior to and during this study, I assumed a number of different roles and responsibilities. First, I played a lead role in conceptualizing the SuiteC tools and designed some of the initial experience sketches. I worked directly with the product development team helping to inform the user experience, feature prioritization, and testing. In parallel with the course development, I also served as the lead instructional designer in reimagining the existing on-ground education course for online and hybrid delivery. The course was deliberately designed to take full advantage of the SuiteC tools, structuring activities in such a way that students added assets to the Asset Library and reused those assets in Whiteboards throughout the semester. As content creator, I shot and edited interview style videos with leading scholars in the field, repurposed existing video and multimedia content, curated readings and other digital artifacts, and created examples for assignments. Organized by activity hashtags, this diverse archive of course materials was loaded into the Asset Library before the start of the semester for students to both comment on as well as reuse in the Whiteboards.

I also served as Graduate Student Instructor and taught both the fully online and hybrid sections of Course I and II. During my semesters teaching, I also led training and support for other

Graduate Student Instructors familiarizing themselves with the new course semester. For my role as researcher, I tested ideas and instruments in the on-ground education course one year before launching the online version, as well as participated in the *Learning Topologies*[3] research group with Professor Niemeyer exploring Asset Library and Engagement Index data collected from his course in the art department. I then led a research group of my peers, from which an initial set of research questions and foci emerged. Research design was continuously iterated upon, evolving into a coherent framework for organizing data and analysis across the three SuiteC tools. Across all these roles, I focused my attention on opportunities for remix, both in improvements to SuiteC that could enable new or more seamless forms of remix, and in the curricula through remix activities.

Connecting the Threads

In the conclusion of my dissertation, I pull together findings and discoveries from across the three chapters to gain a more holistic view of how student interaction and engagement stretched across the three tools. I zoom back from the components of the assemblage to look at the emergent whole, and the defining features elicited in the analysis of the unfolding of the course experience. I introduce supplemental insights from work that is ongoing or that was not included in the previous chapters to articulate possible futures for innovation.

[3] Work from the Learning Topologies group: https://elearningindustry.com/engagement-trees-social-learning-analytics-3d-printing

Chapter 1: Traces of Impact: Social Gamification through the Engagement Index

The Gamified Everyday

In our ongoing quest to devise new forms of pleasure, people have leveraged their imaginations and creativity to transform the laborious and the mundane into the pleasurable through games. Raessens (2006) coined the phrase the "ludification of culture" to describe the prolific infusion of games and game-like experiences across modern everyday life. While the importance of games and play in human development, culture, and education is not unique to the current digital moment (eg,: Schiller, 1795; Huizinga, 1938; Vygotsky, 1978), digital technologies no doubt shift historical notions of games and play. Beyond just the technical advancement of immersive video games that have taken the imaginative games of war played by neighborhood children with wooden sticks, and transformed them into "first-person shooter" video games that simulate war scenarios while connecting millions of players around the globe (Galloway, 2011), digital culture also ushers in the "age of big data" (Lohr, 2012) that influences the ways games are integrated into daily life. Information about our ordinary activities- exercising, socializing, purchasing, dieting- are collected by digital applications, and converted into various kinds of "points," delivered back to users as a form of currency to compete with friends, earn rewards and upgrades, and track one's progress toward personal goals (Werbach & Hunter, 2012; Hamari & Koivisto, 2015). So prolific are these kinds of data-driven game experiences that the site "LifeHacker" has published both a step-by-step guide to "incentivize everything" by transforming life tasks into games (Kalamarof, 2013) and a list of the top apps to "gamify every aspect of your life" (Henry, 2014).

The usage of game elements- like points systems, leaderboards, and badges- in non-game contexts is most commonly referred to as "gamification" (Deterding, Dixon, Khaled, & Nacke, 2011). To grasp the distinction between gamification and what are more ordinarily referred to as "games," consider the different contexts of a leaderboard. When a leaderboard appears in a sporting event or on a pinball machine, the leaderboard does not transform that activity into a game- it is a part of an activity which is itself already a game. But when that same leaderboard is applied to keeping score of how many books students read in a class or how many times someone "checks in" to a local restaurant, we may say that the leaderboard has "gamified" an activity- without the leaderboard, the activity would no longer qualify as a game. As digital apps have become more a central part of the educational environment, edu app designers have followed gamification trends in consumer apps by enmeshing them into the learning experience to foster engagement and deeper commitment to learning tasks. (Dichev & Dicheva, 2016; Dicheva, Dichev, Agre, & Angelova, 2015). This paper contributes specifically to understandings about leaderboards and points systems as "social" gamification tools (Meske et al, 2016) in online and blended courses.

In this design-based research study (Barab & Squire, 2004) I analyze data from the implementation and usage of a gamification application called the Engagement Index (EI)- one of four applications in the SuiteC collaborative learning system- over 4 semesters of an online and blended undergraduate education course. The EI features two game elements, a points system set by the instructor to automatically award points to when students engage various activities in the digital learning environment, and a course leaderboard that ranks students by their total points. Drawing from "assemblage theory" as a conceptual apparatus for the analysis of dynamic sociotechnical systems (deLanda, 2006; 2016), I explore relationships between EI usage, student engagement in social learning activities, and final course grade. First, I use regression models to explore the relationships between students' usage of EI tools and their course performance. Second, I analyze the "tactics" (deCerteau, 1984) students deploy in trying to *game* the system, or the ways students exploited certain rules or logics of the game to accumulate points and leaderboard status, emphasizing how these tactics affected social dynamics in the course. Third, I organize various participation profiles based on 4 engagement types, and use regression models again to determine if

certain participation profiles are more closely tied to student performance. Through a close examination of the EI's quantitative tabulation of student participation and the qualitative assessment of student performance by instructors represented in the final grade, I offer technical and pedagogical pathways for improving social gamification tools and feedback mechanisms in online learning environments.

Research Questions

Question 1: Were higher performing students more likely to opt-in and engage more frequently with the Engagement Index leaderboard?

Question 2: What kinds of "gaming" behaviors emerged among students competing for position on the leaderboard?

Question 3: What kinds of participation tracked and scored by the Engagement Index were most representative of a student's qualitative course performance?

Points and Leaderboards: From Arcade to Online Learning Environment

Scoring systems and leaderboards have been used to track and display competitive performance rankings since the earliest days of games and numerical systems, spanning a historical range of activities from ancient Olympic games to mechanical pinball machines. Visually, leaderboards include a graphical table with the names of players or teams displayed in rows and ranked by total points or achievements like wins and losses (Seaborn, Pennefather, & Fels, 2013). In 1978, the leaderboard went electronic, becoming an essential feature of arcade video games, showcasing the top point scores achieved by individual players during a turn at the game. Hit titles like Space Invaders (1979) and Pac Man (1980) fueled an arcade gaming boom during the early 1980s that inspired millions of teens to empty their piggy banks for a chance to add one's initials next to a top-score on a local game machine's leaderboard (Kent, 2001; June, 2013). And while the invention of the home video game console ultimately ended the reign of the neighborhood arcade, the leaderboard nonetheless persists in today's massive online gaming worlds where it displays top-scores achieved from among tens of millions of players around the globe (Rapp, 2018). Because of its longevity and ubiquity, the leaderboard has been recognized by the popular gaming site Gamesparks.com as the the "original and best social game component"[4].

[4] https://www.gamesparks.com/blog/leaderboards/

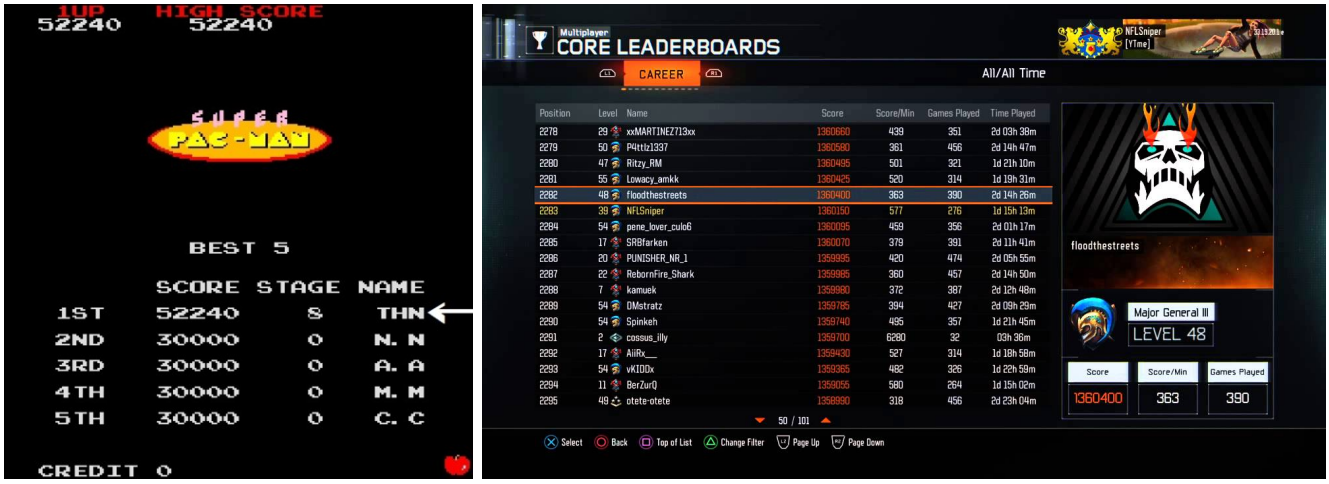

Figure 2: 1980 Pac Man Arcade leaderboard and 2015 Black Ops 3

Because of the popularity and ubiquity of leaderboards in gaming and sports activities, gamification has introduced the leaderboard in a number of non-gaming contexts, including education. In the online learning research, which spans nearly a decade (Lee & Hammer, 2011; Laster, 2010; Corcoran, 2010), Deterding et al. (2017) identify over thirty gamification studies that examine the use of points systems and leaderboards. There is, of course, already some precedent in education for competition and rankings, from the high-stakes of class ranks that can determine college admissions to the playful sticker charts of elementary classrooms. Given the computer's aptitude for counting and collecting, points and leaderboard systems are also fairly straightforward and uncomplicated to implement into a digital learning environment, making their prevalence in the research not especially surprising.

Whether in an exercise app or in an online course or mounted to a pinball machine, leaderboards intend to inspire people to evaluate their own performance in relation to other participants. Described in "social comparison theory" (Festinger, 1954) as a shared drive among people for social standing and recognition within groups, leaderboards intend to incentivize behaviors that lead to earning points and a high rank. Social comparison may focus outwardly on competing with others, but can also serve as a form of feedback for self-reflection. In absence of co-present others and real-time interactions, research has demonstrated that students both crave and benefit from increased feedback and feelings of connection to others (Przybylski, 2010; O'Donnell, 2013; Simoes et al, 2013). As a tool for inspiring this kind of social comparison and feedback, successful implementations of leaderboards in the gamification research have been demonstrated to increase learning-related behaviors such as punctuality (Costa, Wehbe, Robb, & Nacke, 2013) and participation in discussion forums (Amriani, Aji, Utomo, Wahidah, & Junus, 2014), on academic outcomes such as learning performance (Krause, Mogalle, Pohl, & Williams, 2015), and reduced attrition (Nevin et. al., 2014).

On the other hand, there are several studies that have demonstrated leaderboards to have a negative influence on the student experience, or were less successful in motivating meaningful student engagement compared to other tools (Barik, Murphy-Hill & Zimmerman, 2016; de-Marcos, Domínguez, Saenz-de-Navarrete, & Pagés, 2014). One meta-study reports twelve of nineteen studies demonstrated the gamification intervention to have a positive impact on the experience or performance of learners (Lister, 2015). Galway et al (2016) found that when leaderboard standings became too imbalanced, students felt disempowered by a low ranking causing their engagement to drop-off, essentially de-incentivizing them to participate. In one oft-cited experimental study by de-

Marcos,Domínguez, Saenz-de-Navarrete, & Pagés (2014) that compared student performance and participation in three different environments- one traditional eLearning experience, one networked experience, and one gamified experience-, the authors found that the students in the gamified course participated the least compared to the other groups. More critical perspectives on leaderboards find evidence that they seem to incentivize competition over collaboration, adversely affecting social interaction and peer relationships (Thiel, 2016; Dominguez et al, 2013).

In trying to discern between successful and unsuccessful leaderboard implementations, Hanus & Fox (2015) describe two kinds of competition: "Constructive competition" where aspiring for a higher ranking spurs a deeper commitment to learning tasks, and "destructive" competition, where students focus only on besting their peers regardless of how that behavior relates to content learning. Hanus & Fox's framing of competition can be situated in broader questions around gamification as it relates to theories of motivation. Gamification research often references the psychological concept "Self-Determination Theory," which distinguishes between two kinds of motivation. "Intrinsic motivations" encourage people to pursue achievements for their own sake while "extrinsic motivations" are oriented only around the rewards (Ryan & Deci, 2000). In SDT, pursuing rewards through achievement in the game is clearly an extrinsic motivation, which may undermine the intrinsic motivation to *learn for the sake of learning*, which has been demonstrated in the learning research to have an adverse effect on learning outcomes (Deci et al, 1999; Barik, Murphy-Hill & Zimmerman, 2016). At the same time, SDT posits that engagement may be both intrinsically and extrinsically motivated, and that extrinsic motivations may develop into intrinsic motivations under the right conditions. It has, therefore, been a point of emphasis in the gamification research to not only determine if a gamification intervention resulted in increased motivation, but also if the motivation appears more intrinsically or extrinsically oriented (Hamari et al, 2014).

While SDT and other theories of motivation have been used to measure the effects of game elements on student motivation, the inconsistencies across findings and the inherent challenge in measuring motivation suggest the need for either a revised approach to measuring the relationship between a game element and motivation (Deterding, 2017), or an alternative line of inquiry less focused on motivation altogether, as I investigate here. Without eschewing the important role that motivation plays in learning, we may still glean important insights about the utility of gamification tools and techniques through an analysis more focused on their implementation in the broader course design and underlying pedagogical values of the course, exploring how effective the game is in representing those values and outcomes in a meaningful way. Further, by emphasizing how participation in a course unfolds in relation to the gamification tool and other available tools for interaction, we may be able to better account for the emergent ways students participate in gamified environments and take up the tool as part of their learning process. In the following section, I provide a more critical reading of "social" gamification tools and techniques to uncover some best practices and potential pitfalls in quantifying and gamifying social interaction in an online course environment.

Social Gamification and Net-Working for Points

Leaderboards invoke the social through ranked comparison, but the kinds of engagement that trigger the points represented in leaderboard rankings may or may not be social in nature. For example, a points system may include activities that are completed individually, such as homework submissions (Chiu & Nah,2017), results on quizzes (Cheong, Cheong, & Filippou, 2013), or evidence of competency (Seabron et al, 2013) Or, they may include activities that are part of social interactions or other networked forms of engagement, such as participating in course discussion forums (Smith, Kavanaugh, Reidsman, 2014) or collaborating with peers on projects (Pettit, McCoy, Kinney, & Schwartz, 2015). Commonly referred to in the literature as "social gamification" (Meske, Brockmann, Wilms, & Stieglitz, 2016), leaderboards that intend to gamify social interactions appear

in professional networking apps like LinkedIn's Elevate and enterprise software like Microsoft SharePoint.

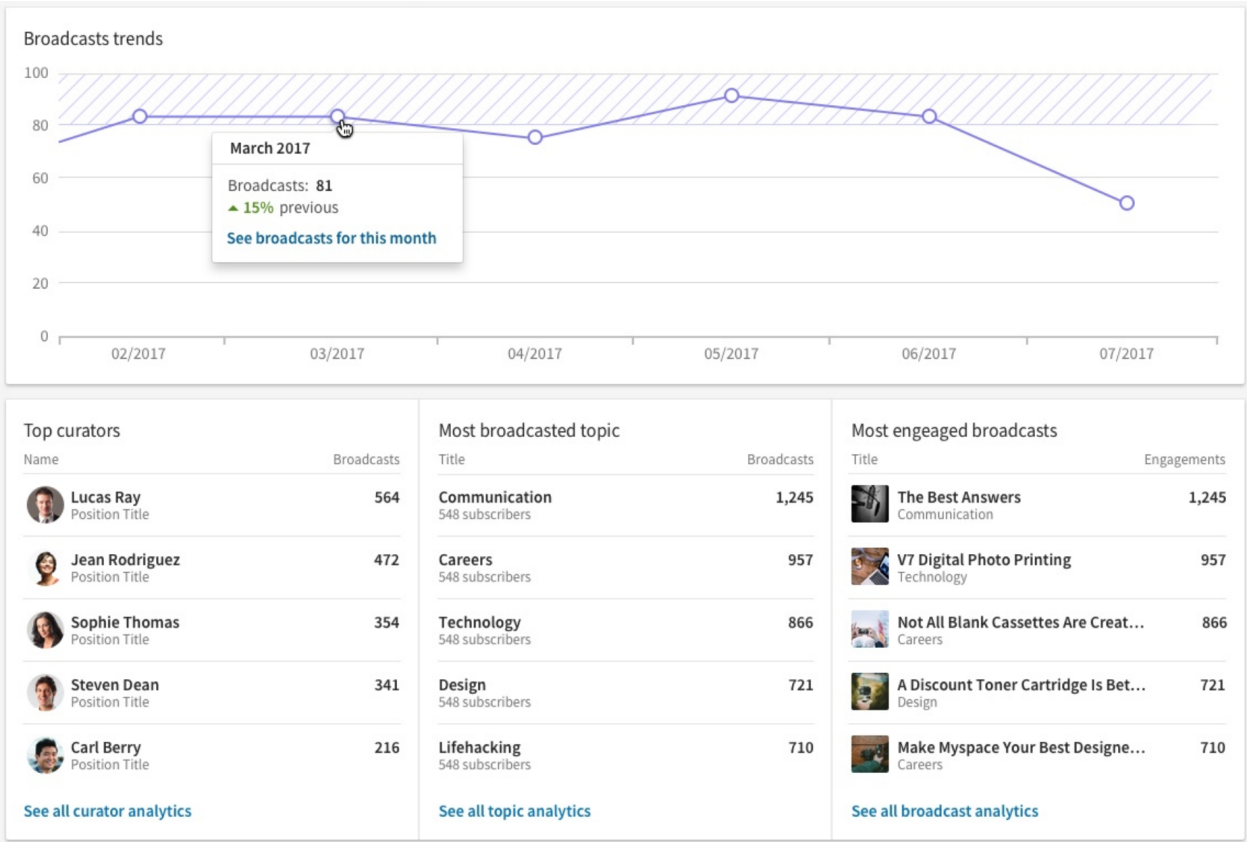

Figure 3: LinkedIn's Elevate Leaderboard

As online courses have become more networked and collaborative (Siemens, 2005; Downes, 2006) social gamification offers one strategy for potentially improving and enhancing peer-to-peer learning environments by inspiring increased participation and willingness to connect with others (Knutas, Ikonen, Nikula., & Porras, 2014). In this sense, a points-based leaderboard system attempts to quantify a student's social participation by tying those engagements to points and displaying those points (or the achievements that resulted from the accumulation of points) on a leaderboard as a way to incentivize and reward interactions with peers.

As I described in the introductory paragraphs, this quantification of social life in the age of big data is pervasive across social media and digital networking apps, which deploy extensive tools for tracking, visualizing, and incentivizing user engagement. While social media sites like Twitter, YouTube, and Instagram do not feature built-in leaderboards or convert social activities into "points" explicitly, they incentivize engagement by transforming views, likes, posts, retweets, etc. into various forms of "capital" (Bourdieu, 1984; Joksimović et al, 2015). On a video sharing site like YouTube, a video's views are converted to "economic capital" in a transaction between users and advertisers mediated by YoutTube, which determines a user's compensation based on the amount of engagement a video garners from the community (Chapple & Cownie, 2017). For the average social media user who will never receive financial reward for their uploads, users may be incentivized by the "social capital" one accrues in forming new friend connections and followers, both as tokens of popularity, sources of news and information, and validators of one's presence in the network (Ellison, Steinfield, & Lampe, 2014). One oft-cited example of the important role others play in validating one's network activity, teens have resorted to deleting their Instagram posts that do not reach a minimum number of

likes, keeping their profile well-stocked with posts that have numerous likes and views to project an image of coolness and influence among peers (Godlewski, 2016).

Of course, physical classrooms are also sites for transactions of social capital, as students develop reputations and influence through their contributions to the learning community. Assigning point values to the social activities students engage online is not unlike the way an instructor might keep track of students' discussion contributions in a seminar course, assigning them participation grades and awarding those students who consistently ask relevant questions or make important insights. Experiencing the real-time interactions among twenty people in a room over a semester, instructors and students can fairly easily track these transactions of social capital, maintaining a clear idea about which students are most engaged and offering the most poignant commentary. When these interactions migrate online and grow in number of participants, however, it becomes increasingly difficult to understand who and how participants engage with each other asynchronously across the multiple spaces of a virtual learning environment. Software, therefore, plays an important role not only in mediating social interactions through tools such as discussion forums, but also in automating the tracking of engagement to help instructors and students establish some quantitative understanding of the participation dynamics unfolding around them as well as their own standing among the group (Souza-Concilio & Pacheco, 2013).

An automated means for representing engagement in a digital learning environment with multiple tools for facilitating discourse and collaboration can open up and expand the ways students might be acknowledged for their participation in a course. Compared to the in-person seminar, where contributions are limited to real-time conversation moderated by- or at least conducted under the watchful gaze of- the instructor, digital environments can capture more direct peer to peer interactions. For example, consider a moment in a seminar when a student turns to her neighbor to ask a question and the neighbor replies with a helpful response. This interaction, which would go largely unnoticed by other students and the instructor in a physical classroom, can be captured in a virtual discussion forum and reported back to the instructor as well as to peers as a form of acknowledgement. Students who enjoy diverse opportunities to contribute to and be acknowledged for their work in the learning community may feel an increased sense of autonomy as a participant as well as help shift their focus from only performing for the instructor toward supporting their peers. This shift toward a peer-centric model through software can also be observed in the various features in digital environments for "micro-interactions," such as "up-voting" a useful discussion forum response or "liking" someone's post. Each "micro-interaction" (Rozzell et al., 2014) serves as a form of acknowledgement between peers, which can be quantified and reported to something like a leaderboard as as a way to measure and compare which students contribute most meaningfully to the community.

We can think about the peer affirmations that a student's post receives as evidence of the *impact* of a her contributions to the class community. On social media, users try to increase the scale of their impact as a way to accumulate economic and social capital. For example, they may feel encouraged to reach out to and build relationships with distant or tertiary connections in effort to expand their network and reach. They may also be more inspired to share and create novel or unique content to gain a reputation within the network as a valued source of information (Burke, Kant, & Marlow, 2011). Forming connections and sharing novel content and ideas are no doubt desirable modes of participation in a networked learning community, where students should be encouraged to contribute in ways that meaningfully and positively impact the learning and experiences of peers (Rheingold, 2003). Where many points systems in gamified course environments reward only a student's outward contributions (eg.: how many times a student posts), the engagement a post *receives* from others would perhaps better incentivize and acknowledge students for making meaningful contributions that support peer learning. Some examples of these kinds of incentive systems that try to reward impact include "reputation points," which are earned when a student's

discussion post is "up-voted" by peers (Smith et al, 2013) and "karma points" to acknowledge selfless contributions to the community (Seabron & Fels, 2015; Giannetto, Chao, Fontana, 2013).

These more specific kinds of peer acknowledgements such as "up-voting" and "karma points" imply that the student's contribution was meaningful or useful to others, but impact metrics do not always distinguish between content that is beneficial and content that is destructive to the community. The inability for machines to separate the helpful from the harmful at scale has become a significant problem of social media giants such as Facebook and Twitter, who have drawn the public ire for deploying algorithms that blindly popularize content based on engagement metrics and without regard for consequence. The popularization of content based on an algorithm's interpretation of impact metrics has contributed to rise of "fake news" distributed en masse using clickbait headlines and bots to artificially inflate the impact metrics of content. Instead of novel and well-reasoned contributions generating the most impact, it seems the extreme and the absurd and the provocative more often generate the impact necessary to emerge from amidst the white nose of the internet. Instead of expanding one's world view through globally networked connections, algorithmic recommendation has contributed to "filter bubbles" (Pariser, 2011) and echo chambers that limit perspectives and reproduce biases.

The oversight of the instructor, the more bounded nature of a course, and the lack of competing financial interests make educational environments less prone to some of the befallings of social media, but attempts to quantify and gamify peer-to-peer or networked interactions need to be mindful of similar kinds of issues. For example, if the system appears to privilege quantity over quality, students may feel incentivized to pursue engagement strategies that focus only on increasing the amount of points they receive at the expense of quality, effectively diminishing the value of peer-to-peer interactions that intend to support student learning (Meske, Brockman, Wilms, & Stiegletz, 2017). Students may feel coerced into posting certain kinds of content or voicing certain kinds of opinions merely for the sake of earning more likes or comments from peers, which would invariably diminish the quality and authenticity of the social interactions. In evaluating the effectiveness of a social gamification system in supporting rich peer-to-peer exchange, it seems necessary, therefore, to understand two questions: 1) Do the quantitative measures of performance in the game align with the qualitative measures of performance as determined by the course objectives? 2) Are the most posts that generate the most impact also the most useful or beneficial to the learning community?

Assemblage as Method: Mapping the Components of a Course

In my analysis of the Engagement Index in the online undergraduate education course, I draw from "assemblage theory" (DeLanda 2016) as a model and set of terms to describe the dynamic unfolding of a complex sociotechnical system, like an online course. The assemblage has philosophical origins in the work of Deleuze and Guattari (1987), who position the assemblage not as a "seamless totality," but instead as a kind of network organized by "extrinsic relations" between autonomous components whose interactions with each other animate an "emergent whole." These extrinsic relations between components in a system are only "contingently obligatory," suggesting they are prone to change and re-configuration, capable of moving into new assemblages or taking on relations to new components. In this way, components are both modular, in the sense that they can be plugged in and out of different systems, and multiplicitous, in the sense that they may appear simultaneously in many different assemblages at the same time. Because the relationships between components are networked and not intrinsic to their being, components do not fundamentally change as they move across assemblages. Instead, the component has "virtual properties," or invisible potential states that come into being when a component enters into a particular assemblage.

As a methodological apparatus for the study of complex systems, assemblage concepts appear useful for organizing and mapping the various human and nonhuman components that make up a course experience - students instructors, software features, curriculum tools, grading rubrics,

instructional media, student generated content, electronic gradebooks, authentication portals, etc. These components of a course do not come together all at once, but come into being at different temporal planes, each plane a reorganization of existing components with new components. For the online course, I identify three planes from which the course assemblage emerges. I call these three layers the technical component plane, the designed component plane, and the sociocognitive component plane. The technical component plane refers to the software and digital tools that have been assembled to mediate the learning experience. The designed component plane refers to how these technical components are taken up by the instructor and set in relation to various curricular and pedagogical components. And the sociocognitive plane refers to how students and instructors interact with the technical and designed components in the unfolding of the course experience, represented in their activity data captured by the SuiteC software. In the following subsections, I describe each plane in detail as a means of mapping the various technical, designed, and data components that makeup the course assemblage in effort to trace how these other components interact with the EI's technical features, its context and purpose in the course design, and its usage by students.

SuiteC and the Technical Component Plane

For the purposes of this study, components in the technical plane consist of features and tools available in the SuiteC collaborative learning applications and the campus learning management system (LMS). Depending on the focus of the inquiry, a technical plane may include infrastructure components like the wireless network and databases, or even material tools used in a physical classroom, like poster board and markers. The assemblage model is well-suited for thinking about the modern digital learning environment, which education technology consortiums like Educause and IMS Global refer to as "plug-and-play" (Brown et al, 2015) in allowing instructors to customize their course experience in choosing from among many available applications and widgets that plug into the central learning management system. The capacity of these tools to be plugged in and out of different configurations, from an assemblage perspective, is an expression of their modularity and multiplicity, as the same tool may function or appear quite differently based on its relation to other tools within the configuration.

In this study, the relevant LMS tools include: 1) Discussion forum for students to engage in asynchronous exchange around instructor-generated prompts; 2) Assignment tool for submitting assignments and receiving feedback from instructors; 3) Pages tool where instructors organize weekly activities, links to course resources, and assignments. These tools interact directly with the four SuiteC applications, which include: Asset Library, Whiteboards, Engagement Index, and Impact Studio.[5] The Asset Library allows students to upload media links or files in the form of "assets," which can include a title and text description as well as hashtags and categories for search. Once uploaded, assets enter into the Asset Library feed where they can be viewed, liked, commented upon, pinned, and remixed by other members of the course. These interaction events are tracked and displayed on each asset in the Asset Library, revealing to the community the relative popularity of an asset. The Whiteboards can be used for synchronous or asynchronous multimedia composing using simple editing tools (text, shape, free-hand drawing), as well as offer direct access to assets for remixing and concept mapping with course resources. Whiteboards can include any number of collaborators, and have a chat window for messaging between collaborators. Whiteboards can be published directly into the Asset Library for feedback from other course participants. The Impact Studio includes four visualizations of SuiteC student activities, including both their outgoing contributions (eg adding a new asset or comment) and the impacts of those contributions (eg

[5] SuiteC evolved from two LTI apps the first pilot semester (Gallery and Engagement Index) to four LTI apps (Asset Library, Whiteboards, Engagement Index, Impact Studio). The Asset Library consumed functionality of the Gallery. The Impact Studio is referenced but was released at the conclusion of this study.

receiving likes or comments on assets), as well as links to the most ‘Impactful’ assets in the Asset Library, trending assets, and pinned assets.

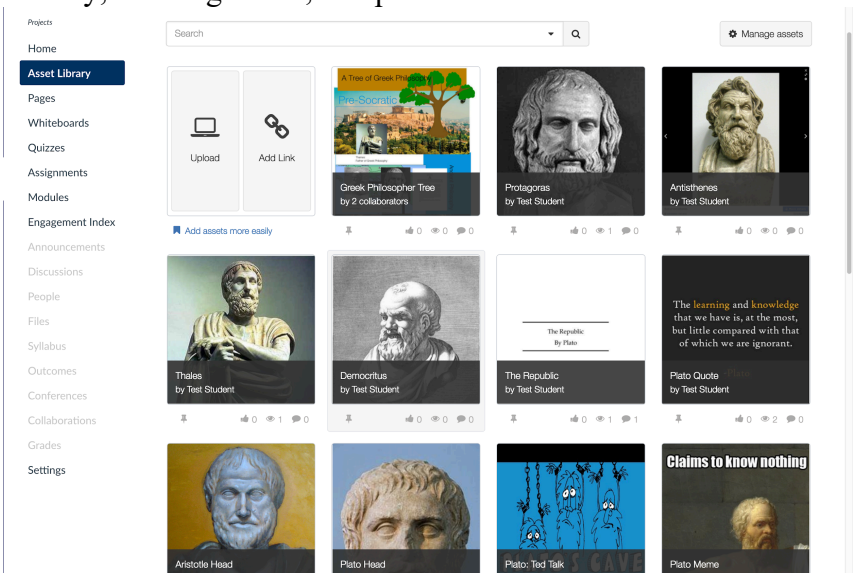

Figure 4: Asset Library main page

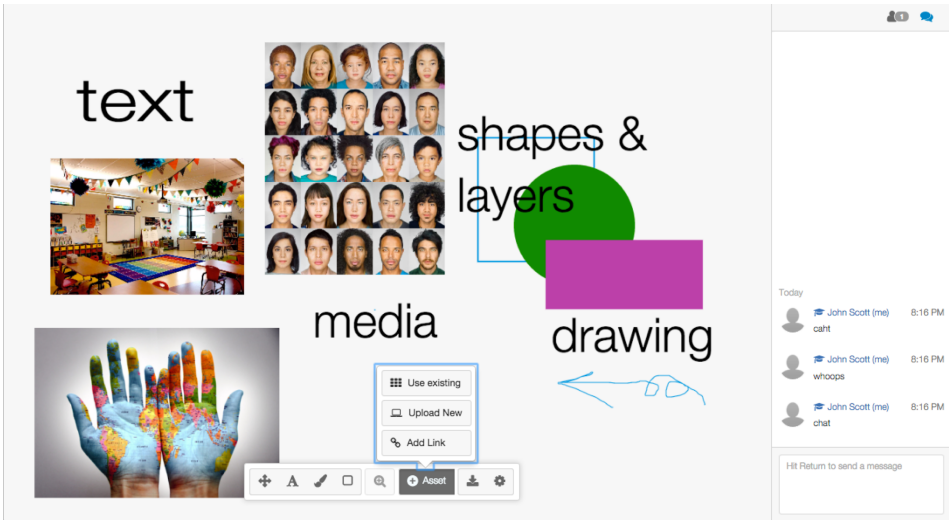

Figure 5: Whiteboards with “add asset” modal open

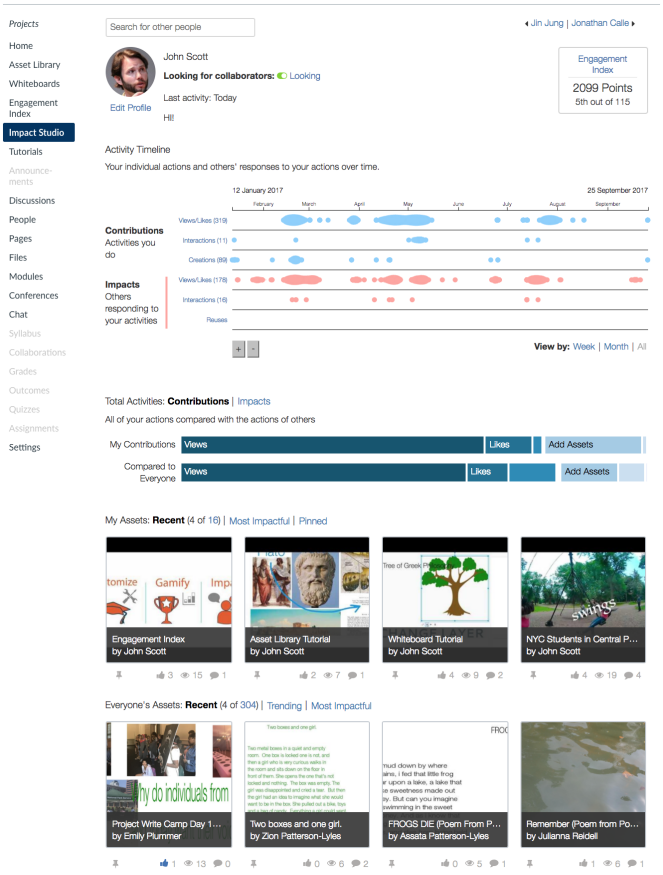

Figure 6: Impact Studio social data and trending assets

In its current state, the Engagement Index tracks 24 participation activities in the SuiteC and LMS tools, including 9 forms of "impact," or the engagements from peers students receive on their work (see Appendix A: Full List of SuiteC events). With the exception of "Assignment Submissions," all the activities tracked by the Engagement Index are social or collaborative in nature, and span a range of 21st century learning and literacy practices such as curating media, archiving and tagging media, discussing and interacting with diverse kinds of media, and composing and remixing multimedia texts (insert reference). When instructors launch the Engagement Index tool, they can set the point values for each activity and weight those values based on which activities they want to incentivize, such as in assigning two points for giving an asset comment and four points for receiving an asset comment to emphasize the value in inspiring comments from peers. Instructors can change the value of points at any time, and the total Engagement Score will recalculate all past events based on the new points configuration. They may also choose to disable events for which they do not want to award points.

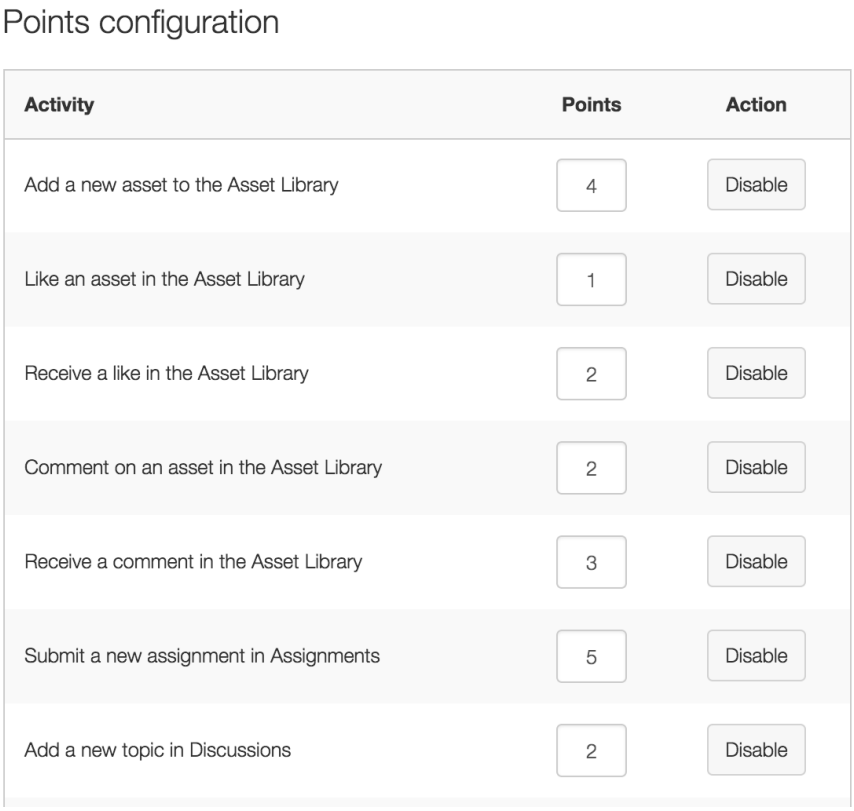

Figure 7: Engagement Index Points Configuration

Students can access the Engagement Index through their main navigation menu along with other SuiteC and LMS tools and can check the instructor points configuration whenever they launch the tool to understand which activities are privileged in the scoring. When students launch the Engagement Index tool, they are by default, opted-out of the course leaderboard, meaning their score does not appear on the leaderboard nor can they see the leaderboard rankings; only the instructor can view the score and rank of students who choose opt-out. Students may choose to opt-in by ticking the "share my score," which then launches the leaderboard, highlighting the student's position in the rankings and how their point total compares to the median point total in the course. The Leaderboard table includes rank, student name, total points, and a timestamp of most recent activity.

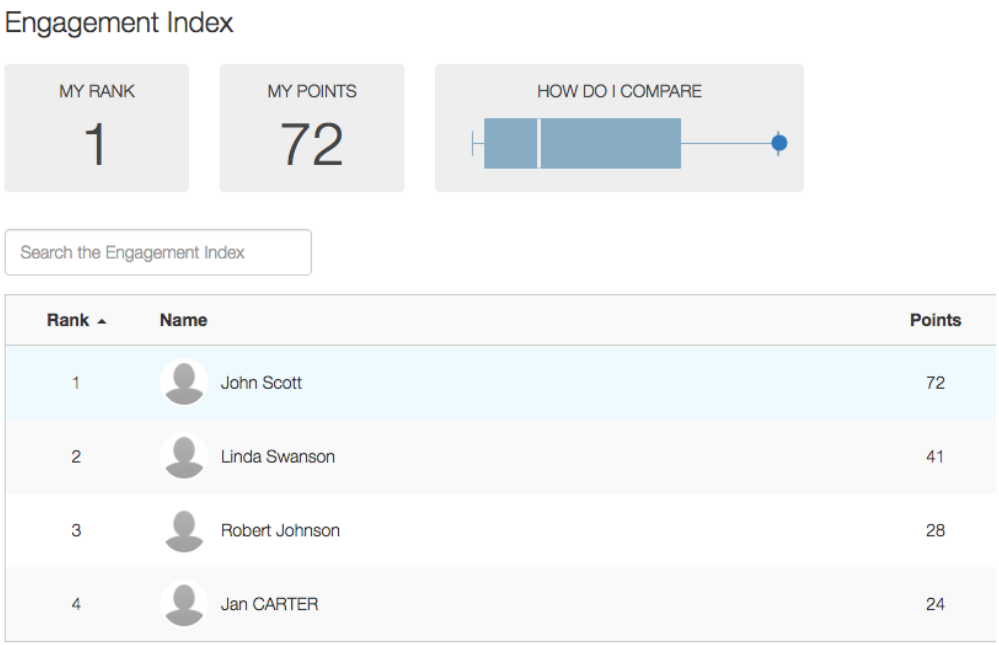

Figure 8: Engagement Index leaderboard

During the four semesters included in this study, the Engagement Index and SuiteC applications remained in active development following an "agile" methodology, during which, various software enhancements and feature upgrades were released in three-week development "sprints," saving the roll-out of more significant changes to tool functionality for a new semesters. Requests for feature changes and enhancements were most often informed directly by user feedback and analytics, and assigned as tasks by level of priority in the product roadmap. From an assemblage perspective, mapping each instance of the course as a unique technical component plane can reveal how changes to one tool shift relations among existing features, and bring into being the virtual properties of features and tools that are expressed in unexpected and emergent forms of use. Later in the analysis, I look at a specific change in functionality that increased the "cost" of liking an asset, and how altering the way students gave one another a "thumbs-up" contributed to a dramatic change how students used that feature, which in turn, also affected how students pursued Engagement Index points for the Leaderboard. Other important feature changes that could significantly shift social interaction patterns include the roll-out of an email notification that updates and links users to activity on their assets, and the ability to hide and delete assets from the Asset Library, such as decorative assets used only in designing a Whiteboard.

"Literacy in Education" and the Designed Component Plane

The "Literacy in Education" undergraduate education course explores issues of literacy and learning practices in schools, global networks, pop cultural discourses, and other diverse sociocultural contexts. The pedagogical spirit and course design try to encourage peer-to-peer learning, remix, and collaborative multimedia composing. The course design features two delivery models that share the same online curriculum: A hybrid course, where students meet weekly in a classroom section of 20-30 students with a graduate student instructor (GSI), and a fully online course, where students meet weekly in a video conference section of 5-15 students. Each week, students are asked to move through a sequence of activity phases organized in modules and delivered through the LMS Pages. These phases include: 1) **Inspire**, asks students are introduced to the theme or key questions of the week through, and often asked to post an asset to the Asset Library as well as comment on the assets of peers; 2) **Explore**, asks students engage with the instructional content of the course such as reading

PDFs and watch video lectures located in the Asset Library or linked in Pages, all organized by course hashtags; 3) **Collaborate**, asks students work in small groups or pairs on Whiteboards in demonstrating understanding and creative interpretations of weekly and course learning objectives; 4) **Research**, asks students create research artifacts documenting their field work experiences as volunteer teachers at local school programs; and 5) **Reflect**, asks students synthesize key ideas from across the course as well reflect on their own experiences, often by creating Whiteboards. At the end of a given week, students are expected to have added several assets and Whiteboard assets to the Asset Library, and to have engaged with instructor and peers' assets by commenting on them and remixing them in their Whiteboards.

As components in the designed plane, the course curriculum and participant structures interact with the technical components to produce the course experience as a series of possible and preferred pathways, which will be taken up, ignored, and blazed a new when the participants enter into the environment and engage in activity. The designed plane not only introduces the curriculum components that organize activity, it also introduces evaluative components, like grading rubrics and assignment protocols, which assign value and procedures for engaging both the curriculum and technical components. In assemblage terms, these evaluative components serve as "knobs" that adjust the parameters in the articulation of the emergent identity an assemblage. A grading rubric, for example, which provides a set of criteria for assessing the quality of an activity, plays a "coding" role in the course assemblage by encoding those criteria grammatically and structurally into other components such that components are rendered legible and consistent. In a course with a rubric that describes the criteria for writing a term paper, this consistency appears across the submitted products, such as in the tools (using a word processing program that generates a document file), the document form (defined margins, title, author, pagination), and other features of the document (length, focus, voice, content focus).

A course design that allows for only a limited number of activities, and that is also heavily surveilled by grading components that script those activities, "territorialize" the course assemblage by homogenizing the functions and interactions of the human and nonhuman components, conforming them to a more bounded and regimented space of interaction. Mapping the components of the designed plane to analyze the interaction between the Engagement Index and student participation, is a crucial step in making sense of the overlapping relationships between the gamification components and the curriculum components, the evaluative components and the curriculum components, and the gamification components and the evaluative components.

Concerning the relationship between the course curriculum and grading components, the required social and collaborative tasks engaged by students in the activity phases were qualitatively assessed by the instructors, who factor student performance on these tasks into the their overall participation grade, which is also impacted by attendance and participation in section meetings. Together, these three dimensions of participation account for 20% of the final course grade. The social, collaborative activities intend to develop student understandings of course concepts and scaffold their pre-writing process for the two major papers, the Literacy Autobiography (25%) and Case Study (30%). Among those activities, students also create a portfolio of data artifacts, primarily ethnographic field notes, which are also shared into the Asset Library as assets and account for the remaining 25% of course grade. Students who want to earn a high mark in the course, therefore, will have added a number of assets, comments, and Whiteboards to the Asset Library during the semester based on the curriculum prompts.

Like with the SuiteC software, the course design also evolved semester to semester, based on the release of new or improved SuiteC functionality and feedback from students and instructors about workload, assignment preference, and course layout. Represented in the four course assemblages as the shifting relations between components in the technical and designed planes, we can anticipate that these changes will be reflected in the student engagement data, such as in a dip in assets added as the

curriculum evolved to include less asset-adding activities. While the activities and features of the course may have changed over the four semesters, the relationship between the Engagement Index and the grading components remained consistent in so far as the Engagement Index score never contributed directly to student grade. Since the qualitatively evaluated curriculum activities undertaken in SuiteC tools whose activities have been configured to the Leaderboard scoring, Engagement Index score offers some high-level feedback to students and instructors about course performance relative to peers, and whether or not students are keeping pace with the curriculum. Of course, the score alone is not always a reliable indicator of performance, since a score also includes other modes of social participation engaged outside of or in addition to those activities mandated in the curriculum. A student, for example, who has only completed two of five mandatory assignments could still have a high Engagement Index score and Leaderboard rank if she also earns points by viewing and liking a lot of peer content.

The instructor's qualitative evaluation of student work in the course curriculum codes those activities by tying them explicitly to the participation grade, as well by setting some expectations and models for how those activities should be completed. Outside of these explicit curriculum activities, students in the education course are encouraged to engage, share, and learn from each other. The Engagement Index, therefore, intends to encourage students to go beyond what is required in the curriculum, and inspire each other to become more deeply engaged with the course content and their peers, with the pedagogical hope that this increased social engagement will also lead to improved learning experiences and outcomes. The Engagement Index codes a dimension of these social activities through the points configuration, which algorithmically assigns those activities values in relation to each other and in service of the Leaderboard rank. In the education course, the points configuration weights each activity tracked by the Engagement Index according to the anticipated amount of labor and time to complete it. For example, viewing an asset is worth less than liking an asset which is less than commenting on an asset which are all less than creating an asset. Second, for reciprocal interactions, the receiving side of the event earns more points than the contributing side, for example, adding a comment to an asset is worth less points than receiving a comment on an asset. The increased value assigned to these receiving events reflects the pedagogical spirit of the course, which desires for students to contribute content that impacts the learning community. As with the social media environments, the EI scoring is prone to manipulation, and impact points could be earned for posting inflammatory or incorrect content that generates a lot of engagement. In the online course, however, the presence of the instructor, both in qualitatively evaluating student contributions and in moderating social interactions between students, likely helped inhibit deliberate and repeated attempts to use inflammatory rhetoric and content to gain points to improve leaderboard score.

The Socio-cognitive Component Plane: Emergent Activity

In the *socio-cognitive component plane*, human and non-human actors converge as students and instructors participate in the course experience. The "emergent effects" of the course assemblage can be observed in the activity shared media and content visible in the course environment, as well as the data logged to the SuiteC database and mined in the form of "learning analytics" (Long & Siemens, 2011). Looking at these log events in relation to both the mediating tools and the designed activities to understand how social dynamics and academic work emerge in the interaction of these various components.

Because of the shifting nature of technical and pedagogical components in the course, I treat each of the four course offerings under investigation as a unique assemblage, and look for consistencies and patterns that emerge across them. As a "design-based" research study (Barab, S. & Squire, K. (2004), the changes to software features and curricula were not conducted in a controlled, experimental manner. Instead, changes and iteration were responsive to student and instructor needs and feedback, making it difficult to isolate a single change and compare it against a control. At the

same time, recognizing patterns and consistencies that emerge from unstructured, dynamic systems are meaningful given the diverse and unpredictable ways that a course experience integrates gamification tools.

From the four courses, two subsets of student learning data were mined from the SuiteC database. The first subset includes social events that resulted in EI points-10 total events, including impact events. The second subset of learning data includes events triggered when students interacted with EI features- 3 total events. Students' total EI scores as calculated through the points system, their position on the leaderboard, and final course grade were used as outcome variables and measures of student performance, the former two being quantitative assessments while the latter being more qualitative. While this study deliberately relies on the student analytics to form insights about student usage of the EI, I also occasionally draw from three student interviews and open-ended responses from two surveys administered during Course I and Course II.

Games and Grades

Question 1: Were higher performing students more likely to opt-in and engage more frequently with the Engagement Index leaderboard?

To ensure that both the predictor variables and the outcome variables satisfy conditions for the regression model, I tested their distributions for normality, and all passed except for final course grades (see Appendix D: Histograms)[6]. Given that students' grades cannot exceed 100 and the high average of the students' final grades, both a mild ceiling effect and right-skew in the distribution in the final grades category should be considered when interpreting results from the model. To determine students' level of involvement in the game, I assume "opting-in" to the leaderboard as a first-level engagement with the game, as students are by default opted-out and as such cannot see how their total score compares against others until they choose to opt-in. Figure 8 compares the opt-in and opt-out groups at the end of the semester by total EI over each of the four semesters, and reveals that the opt-in group outperforms the opt-out group each semester. Figure 9 illustrates that three out of four semesters, the opt-in group outperforms the opt-out group in final grade.

[6] I want to thank Devanshi Unadkat and Rian Whittle for their support in these analyses

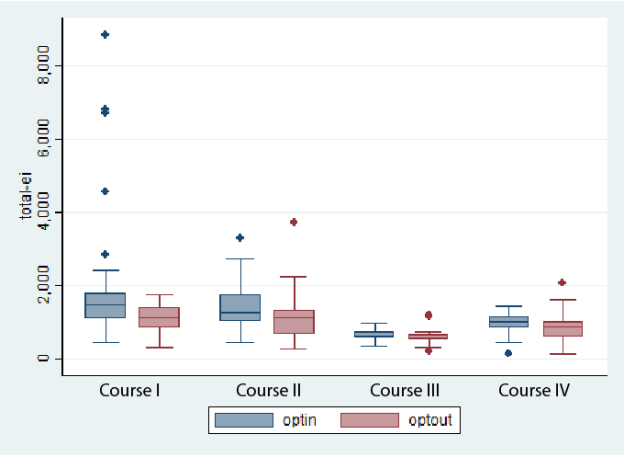

Figure 9: Total EI scores of opt-in/opt-out group for each semester

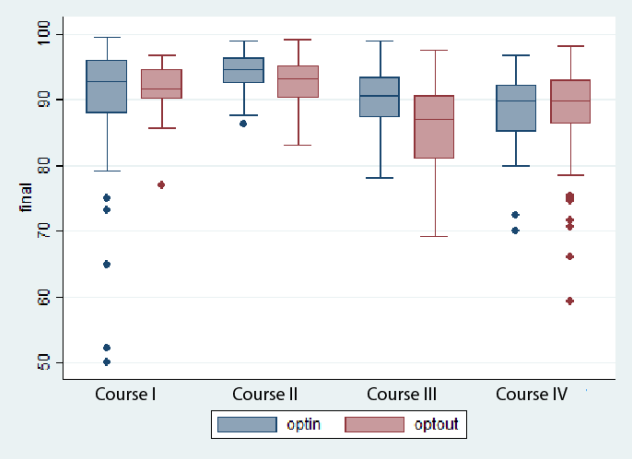

Figure 10: Final course grade of opt-in/opt-out group for each semester

Somewhat surprisingly, the analytics reveal that some students who were opted-out at the end were still using the EI features. Because students always had the choice to "opt-in" and "opt-out," it is apparent in the data that students flipped their status back and forth, perhaps in effort to see where they ranked without exposing their scores to others. Figure 11 demonstrates that students in both groups triggered the opt-in, opt-out multiple times in a given semester, and in some cases, these events were triggered more times by the opt-out group than the opt-in group, likely a result of this *peeking* at others' scores without exposing one's own.

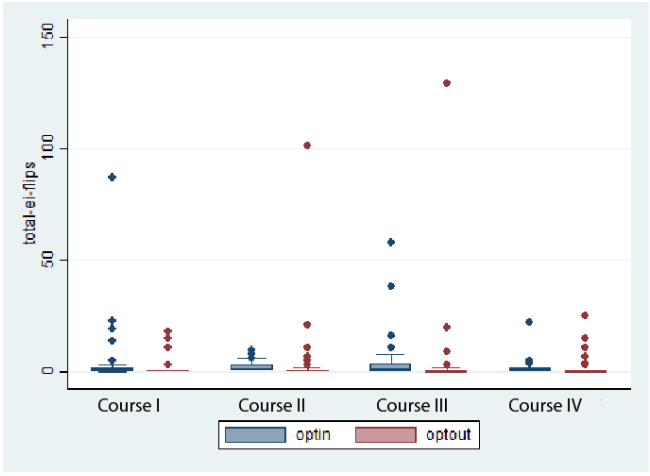

Figure 11: Total number of opt-in/opt-out events among the opt-in/opt-out groups for each semester

Though I have not been able to confirm any specific student explanations for these "flipping" behaviors, I speculate that these are often students who are interested in some periodic feedback about their overall engagement relative to others in the course. Such an involvement in the game is not necessarily motivated by a competitive or gameful drive to reach the top of the leaderboard, but to confirm that their engagement does not lag behind their peers. One student in an interview, for example, reports that she would check her EI score, and if she felt her ranking was low, she would proceed to engage in some more activities to help increase her score.

Next, I consider frequency of EI tool launches as a second-level interaction with the game, as each launch is an effort by the student to view either her own point total or, if opted-in, her standing on the leaderboard. As one might anticipate, Figure 12 demonstrates that students who were opted-in to the leaderboard checked the leaderboard much more frequently, perhaps to see if their rank changed or simply as feedback about one's engagement relative to the class average. Figure 13 indicates spikes in EI launches at the end of both course I and II, indicating that for many students in the course, the EI score and the leaderboard had some meaning as a tool assessing one's standing among the class at the end of the semester. For example, one student in the course described during an informal interview that he checked the EI to ensure that he finished the course in the top 50%, simply because this was a personal goal he set of himself and a way to ensure he kept up to pace with peers.

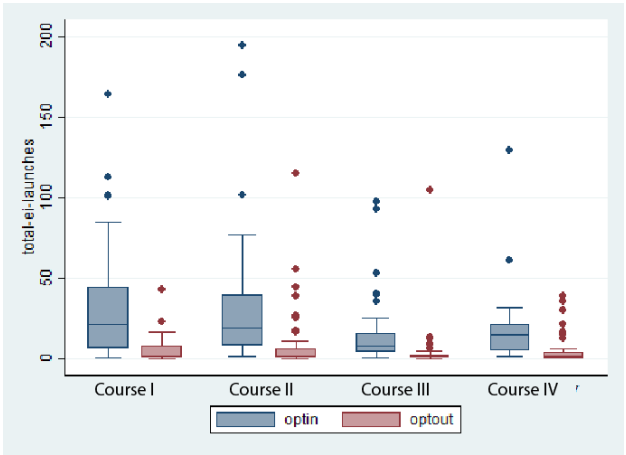

Figure 12: Total number of EI launches among the opt-in/opt-out groups for each semester

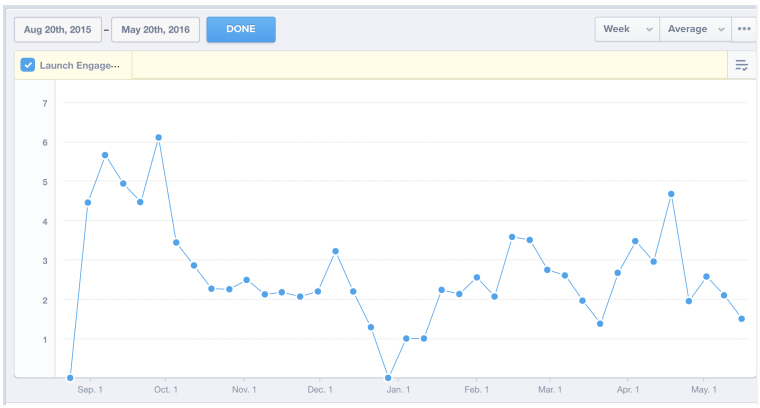

Figure 13: All students total number of EI launches per week for Course I and II. Highlighted weeks indicate end of the semester.

Figure 12 also reveals that a student in the opt-out group in Course II actually launched the EI more than any other student in both the opt-out and opt-in groups. A closer look at the student's data also revealed that he flipped his status over 120 times during the semester, as well as finished in the top-spot on the leaderboard. Clearly, this student was highly-invested in the game, flipping his status to check his standing against his peers several times at the end of the semester to confirm no one had passed him. Perhaps feeling that the instructor would see and acknowledge his rank in her assessments or simply as a matter of personal pride to *be the best*, the student, despite concealing himself from the leaderboard, nonetheless oriented his participation around maintaining a top rank.

A third-level interaction with the EI is triggered when students check the EI points configuration, where the students can see a complete listing of EI-tracked social activities and their respective point values. Figure 14 reveals that at this level, the gap between the opt-in and opt-out groups has clearly widened, though there still appear some students in the opt-out who viewed the point values on multiple occasions. As a level-3 activity in the game, checking the scoring matrix demonstrates some curiosity or desire to understand how the sum-total was calculated, and perhaps to figure out ways to earn more points more quickly. In interviews, students reported feeling that it was too easy to earn points through activities that required little effort toward actual learning. In theory, assigning values based on the amount of labor involved in an activity should help maintain some integrity in the scoring, while in practice, estimating the labor of activities and calculating a consistent value for that labor proves challenging.

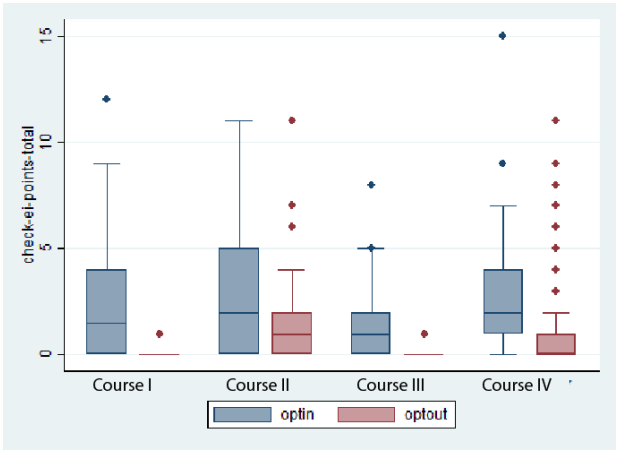

Figure 14: Total number of check EI points configuration among the opt-in/opt-out groups for each semester

Table 2 includes results from the regression model used to analyze the reliability of two forms of EI usage- total EI launches and total number of times checking the scoring configuration- as a predictor of total EI score, where total EI score represents the sum total of points earned through social activities displayed on the leaderboard. Looking at all four semesters in aggregate, Total EI launches appears significant at the .05 level as a predictor of total EI score. This significance holds for each individual course except for Course IV where EI usage overall was lower than any other semester. Frequency of checking the scoring configuration, however, was never a reliable predictor of total EI score.

Table 2: Regression table for two forms of EI usage as a predictors of total EI score

outcome variable: totalei	all semesters			Fall 2015			Fall 2016			Spring 2016			Spring 2017		
	est.coeff (std. error)	95% CI	p-value	est.coeff (std. error)	95% CI	p-value	est.coeff (std. error)	95% CI	p-value	est.coeff (std.error)	95% CI	p-value	est.coeff (std.error)	95% CI	p-value
totalei launches	13.44 (1.64)	[10.22, 16.66]	<.001	16.64 (4.06)	[8.60, 24.67],	<0.001	10.81 (1.98)	[6.89, 14.73]	<.001	3.35 (1.02)	[1.33, 5.37]	0.001	.06 (2.53)	[-4.97, 5.09]	0.98
checkei points	3.77 (17.34)	[-30.32, 37,86]	0.83	-36.26 (48.04)	[-131.44, 58.93]	0.45	27.00 (23.21)	[-19.10, 73.10]	0.25	-3.36 (13.97)	[=31.17, 24.45]	0.81	26.27 (14.91)	[-3.36, 55.90]	0.08
_cons	897.03 (45.30)	[807.96, 986.10]	<.001	1198.587 (130.47)	[940.08, 1457.10]	<.001	997.21 (63.35)	[871.40, 1123.02]	<.001	596.43 (20.27)	[556.06, 636.81]	<.001	843.1554 (42.69)	[758.31, 928.00]	<.001
N	380			115			95			79			91		
R^2	0.22			0.16			0.43			0.15			0.05		

Table 3 uses student final grade as the outcome variable, and total EI score and EI launches as the predictor variables. Whereas EI total launches was a reliable predictor of the EI score, EI launches does not appear to be a reliable predictor of the final grade, save for Course III where the correlation appears significant at the .05 level. When Total EI points is used as a predictor variable for final grade across the four semesters in aggregate, the correlation appears significant at the .05 level, and remains significant for each individual course except for Course I. The regression models suggest that students with higher quantitative EI scores tend to have higher final grades, and students who check

their EI score more frequently tend to have higher EI scores, but not necessarily have higher final grades.

Table 3: Regression table for EI usage and total EI score as a predictors of final grade

outcome variable: finalgrade	all semesters			Course I			Course II			Course III			Course IV		
	est.coeff (std. error)	95% CI	p-value	est.coeff (std. error)	95% CI	p-value	est.coeff (std. error)	95% CI	p-value	est.coeff (std. error)	95% CI	p-value	est.coeff (std. error)	95% CI	p-value
totalej	0.002 (0.0004)	[0.001, 0.003]	<0.001	0.004 (0.001)	[-0.001, 0.002]	0.54	0.004 (0.001)	[0.002, 0.005]	<0.001	0.02 (0.004)	[0.01, 0.03]	<0.001	0.01 (0.002)	[0.006, 0.014]	<0.001
totaleljaunchbas	0.023 (0.01)	[-0.05, 0.05]	0.11	0.05 (0.03)	[-0.005, 0.10]	0.08	-0.031 (0.01)	[-0.06, -0.004]	0.03	0.03 (0.03)	[-0.04, 0.09]	0.41	-0.02 (0.04)	[-0.11, 0.07]	0.67
_cons	87.32 (0.60)	[86.14, 88.51]	<0.001	88.69 (1.27)	[86.17, 91.22]	<0.001	89.43 (0.83)	[87.78, 91.07]	<0.001	73.90 (2.36)	[69.20, 78.60]	<0.001	79.14 (2.08)	[75.00, 83.28]	<0.001
N	380			115			95			79			91		
R^2	0.08			0.05			0.22			0.36			0.19		

Liking Sprees: Tactics for Points

Question 2: What kinds of "gaming" behaviors emerged among students competing for position on the leaderboard?

Using the analogy of a person walking around the city, DeCerteau (1984) articulates the distinction between the paired terms "strategies" and "tactics." He refers to strategies as the different features and technologies of urban development like sidewalks and pedestrian signs that structure and organize the movement of people. For DeCerteau, people walking on the sidewalks conform their behaviors to the city's strategies, but at times, they also improvise and devise "tactics" to subvert or modify the intended ways of moving through the city, such as a footpath that provides a shortcut between segments of sidewalk. In an online course, the designed component plane assembles various technical and pedagogical tools to map a student's intended journey, which strategizes to move students through learning content and activities toward the goals and objectives of the course. Like the footpath that shortens the distance between two points, students devise various tactics that deviate from the intended path of the curriculum, such as skipping around the activities in the modules instead of completing them in the intended order. The Engagement Index, by assigning unique point values for the various activities, implants a strategy for the game, such as pursuing activities that award more points. As students play the game, they may look for ways to exploit loopholes or vulnerabilities in the strategy of the game through gaming *tactics*.

Referring back to Figure 8 above with boxplots of total EI scores, Course I shows several outlier scores thousands of points above all the other scores. Drilling further into their activity data, Figure 15 reveals some jostling for top position among a few of the top scorers over several weeks in the early to midpart of the semester. These alternating spikes in points are evidence of social comparison resulting in competition to earn the top leaderboard spot.

Figure 15: Weekly point totals of students who finished in the top-4 on the Course I leaderboard

In their engagement activity, it was evident that these jumps in points were the result of what I refer to as "liking sprees," when students scroll through the Asset Library feed and rapidly click the "thumbs-up" icon on every Asset thumbnail, earning two points for every click.

As a tactic for earning points, liking sprees take advantage of both technical and designed components to find the most efficient path to earning points and rising to the top of the rankings. At the technical layer, the ability to like a thumbnail of an asset in the Asset Library without having to open the asset in full-view made it possible to scroll through the rows of four assets and like every one in rapid succession. Liking was also an anonymous activity, only tracked by the software as an increase in total sum leaderboard points, meaning students could engage in a liking spree without appearing to *spam* the community with unwarranted likes. At the designed layer, because the course curriculum included several asset creation activities per week, multiplied by the relatively large number of enrolled students in Course I, and by week 3 students had access to a nearly limitless pool of assets to like for points. Enabled by both the technical and designed components of the course, liking-sprees did not violate any explicit rules about engagement so much so much as take advantage of the "emergent effects" of these components interacting to produce conditions that would allow for these kinds of tactics to take root.

But why did liking-sprees only occur in Course I, and no other courses? Were students more uninterested in the rankings, and therefore unmotivated to seek out such behaviors, or were students more concerned about maintaining integrity of the game? Figure 16 reveals that from Course I to Course II, the number of likes fell by a staggering 98%. So extreme was the disparity in likes that the first-rank student from Course I liked more assets in an hour (832) than were liked by an entire class of 76 students over three and half months in Course II (654).

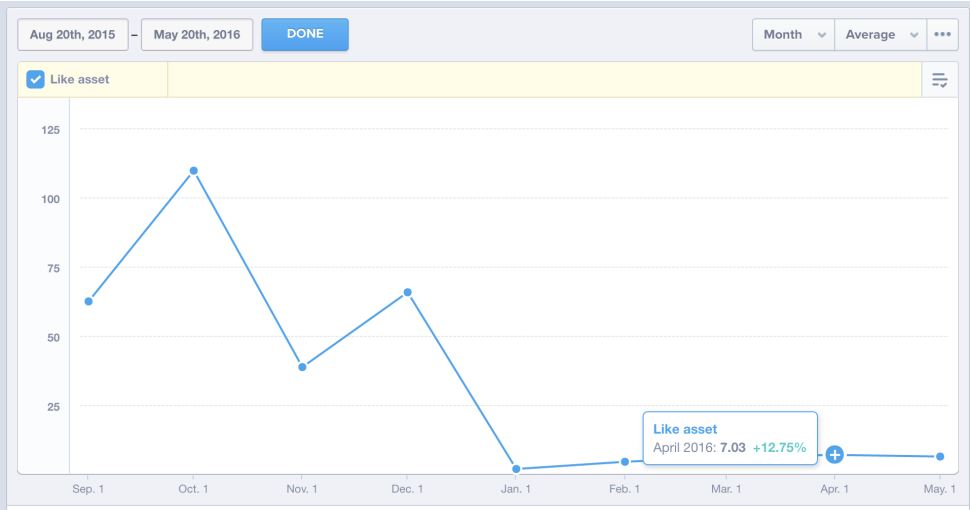

Figure 16: Sharp decline in total number of monthly likes between Course I and Course II

Although many factors could have contributed to this decline, such as smaller enrollment size and less asset creation assignments in the weekly activities, to account for the severity of the drop-off, we would need to look at a change in the technical configuration of the SuiteC software. In Course I, the ability to like the thumbnail of an asset without opening the asset in full-view made it possible to execute multiple likes in rapid succession. In fact, while the course designers assumed that a like (2 points) should have more value than a view (1 point) in the points configuration, a student could rapidly like asset thumbnails without ever actually opening the asset full-screen to trigger a view. Before the start of Course II, the liking feature in the Asset Library was changed, so that when a user selected the thumbs-up button on the thumbnail, it triggered the full-screen view of the asset automatically, and did not register the like until the user again selected the thumbs-up while in full-screen mode. Without knowledge of this subtle change in functionality in the technical component plane, we would be unable to account for the dramatic change in student usage.

Reconfiguring the Ranks

Question 3: What kinds of participation tracked and scored by the Engagement Index were most representative of a student's qualitative course performance?

The significance between final grade and total EI score suggests that the rankings are somewhat representative of a student's qualitative performance in the course. To further understand this relationship, I organized the ten social activities available in the SuiteC tools and tracked by the EI into four categories: **Engagements**- Viewing Assets, Liking Assets; **Interactions-** Commenting on Assets, Posting in Discussion; **Creations**- Adding new assets to the Asset Library, Adding assets to Whiteboards, Exporting Whiteboards to the Asset Library; and **Impacts-** Receiving asset views, Receiving asset likes, Receiving asset comments, Having assets reused in peers' Whiteboards.

As a first step, I wanted to confirm whether or not the leaderboard rankings would remain consistent if the scoring configuration only awarded points to activities within each category. In other words, if the ranks only reflect a sum of "Creations" activities or a sum of "Interactions" activities, do the same students appear in relatively the same order on the leaderboard? Figure 17 illustrates the changing leaderboard rankings in Course I and Course II, beginning with the rankings according to total EI score ("all activities") and then cross each of the four categories. Generally, these visualization show very little consistency in rankings from category to category, as only one student

appears in the top-20 of every category of rankings. In Course I, only two students in the top-20 of the total EI rankings appear in the top-20 of the "impacts" ("receive") category. The categories with the most similar rankings- the total EI score and the "engage" categories in Course I- can be explained through the liking sprees, which accounted for such a large proportion of total activity.

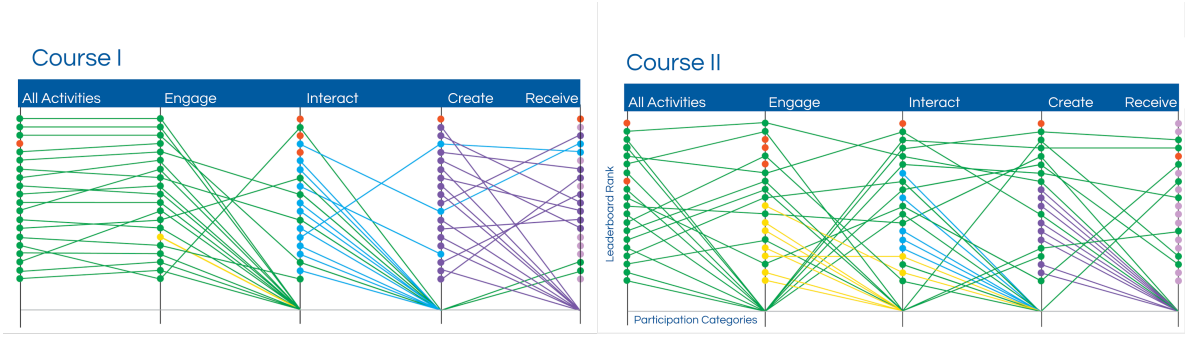

Figure 17: Comparing rankings across the four categories for Course I and Course II. Lines between categories correspond to the student's change in rank or a drop out of the top-20, a new color indicates a new student entered the rankings for that category.

If the leaderboard intends to serve as an accurate representation of student achievement, the visualization begs the question, which category of activity most closely relates to final grade? We already know that the first category in the visualization, total EI score, is a significant predictor variable of final grade in all semesters combined and all individual semesters except Course I. For the regression model, I tested the distributions of the four other categories of activity and used each category as a predictor variable for final grade. Table 4 reveals the results of the regressions.

Table 4: Regression table for four activity categories (engagements, interactions, impacts, and creations) as they relate to final course grade

outcome variable: finalgrade	all semesters			Course I			Course II			Course III			Course IV		
	est.coeff (std. error)	95% CI	p-value	est.coeff (std. error)	95% CI	p-value	est.coeff (std. error)	95% CI	p-value	est.coeff (std. error)	95% CI	p-value	est.coeff (std. error)	95% CI	p-value
engagements	0.0002 (0.002)	[-0.004, 0.004]	0.93	0.001 (0.003)	[-0.005, 0.007]	0.71	0.00008 (0.002)	[-0.004, 0.005]	0.97	-0.001 (0.005)	[-0.01, 0.008]	0.77	0.02 (0.01)	[-0.003, 0.04]	0.09
interactions	0.10 (0.08)	[-0.06, 0.25]	0.22	0.42 (0.14)	[0.14, 0.71]	0.003	0.12 (0.10)	[-0.09, 0.32]	0.25	0.16 (0.14)	[-0.12, 0.43]	0.27	-0.17 (0.33)	[-0.82, 0.48]	0.61
impacts	0.01 (0.003)	[0.007, 0.02]	<0.001	0.008 (0.007)	[-0.006, 0.02]	0.24	0.01 (0.004)	[0.004, 0.02]	0.01	0.02 (0.008)	[0.0006, 0.03]	0.04	0.03 (0.01)	[0.0001, 0.05]	0.05
creations	-0.004 (0.017)	[-0.04, 0.03]	0.80	0.002 (0.03)	[-0.06, 0.07]	0.95	0.04 (0.02)	[0.0003, 0.08]	0.05	0.14 (0.04)	[0.06, 0.23]	0.001	0.12 (0.04)	[0.04, 0.20]	0.002
_cons	85.41 (0.94)	[83.56, 87.26]	<0.001	81.68 (2.73)	[76.27, 87.09]	<0.001	86.96 (1.02)	[84.93, 88.99]	<0.001	69.52 (3.36	[62.83, 76.22]	<0.001	76.25 (2.17)	[71.94, 80.57]	<0.001
N	364			109			90			73			86		
R^2	0.09			0.14			0.34			0.31			0.30		

Across the four participation categories, “engagements” is the only category that is never a significant predictor variable for final grade at the .05 level. Looking at all the semesters in aggregate, the “Impacts” category is the only significant predictor variable at the .05 level, and remains significant at the individual course level in three out of the four semesters. For Course I, “interactions” was the only significant predictor variable, while in Courses II, III, and IV, the “creations” variable was significant along with the “impacts” variable at the .05 level. It should also be noted that the “creations” and “impacts” categories could influence each other in the model, as a student must first create assets before receiving impact points.

From Liking Sprees to Winning with Impact

Synthesizing the analysis from across the three lines of inquiry, two interesting findings emerge. First, the higher median in total EI points of the opt-in group compared to the opt-out group and the positive correlation between total EI launches and total EI points suggests that there is a meaningful relationship between involvement in the game and overall quantitative participation. This is also supported in anecdotal evidence gathered from students, who confirm that social comparison and a low rank motivate them to earn more points. However, there is also evidence that suggests efforts to earn more points for the sake of increasing one’s ranking does not motivate activities that are necessarily relevant to mastery of course content, such as the liking sprees.

That the EI total score is a reliable predictor variable for final course grade suggests that, despite these student perceptions, the leaderboard rankings did appear to reflect achievement in the course. This finding is consistent with related studies in online learning that demonstrate a positive correlation between overall engagement and performance (insert reference), though there are still other studies that find social engagement in particular has had either no effect and even negative effects on performance (insert reference). Unique to this study, the relationship between the quantitative sum of activities represented in the EI score and the qualitative assessment represented

by final course grade demonstrates that the EI score and rank can provide some rapid, useful feedback to instructors about student progress. Based on what we know about the liking sprees, it is not completely surprising that the only course where the total EI score was not a reliable predictor variable of final grade occurs in Course I. The thousands of points gained through the liking sprees clearly had an impact on the student rankings, but also resonate across other aspects of the data. For example, Course I is also the only case where the "impacts" category was not significantly related to final grade. Because so many students were receiving likes essentially *randomly* via a liking spree, the impacts category in Course I became, statistically speaking, a meaningless measure of student success.

Beyond its resonance in the data, liking sprees can also be viewed as having three deteriorating effects on the environment. First, whereas the diversity of point-earning activities tracked to the leaderboard intends to provide students options for how they participate in the game, liking sprees reconfigured the game such that in order to be competitive, a player had to engage liking sprees. Second, liking every asset without distinction or care compromises the social value and gift of affirmation that the thumbs-up intends to convey, and an altruistic act becomes a selfish act motivated by one's own desire to accumulate of points. By diminishing the quality of social interaction, the liking sprees can be viewed as a mode of "destructive competition" (Hanus & Fox, 2015) where the motivations to win no longer aligns with the spirit of the course, which is to support peers through authentic and meaningful interaction and knowledge-sharing. And third, the leaderboard became a less reliable indicator of student qualitative performance, limiting the tool's effectiveness as a source of rapid feedback for instructors and students.

While the liking sprees distorted the relationship between the impacts category and final grade in Course I, the second important finding to emerge from the analysis is the significance of this correlation in the other courses individually and in aggregate is the. Looking at relationships across the different categories of participation, we notice the more intensive activities appear more meaningfully related to final grade, such that the viewing and liking category alone does not reliably predict final grade in any courses but the creations category does in three of four courses. This serves as some validation for the weighting of the scoring configuration, which awarded more points for the more intensive activities because it was assumed that activities such as creating assets and whiteboards benefitted student learning more than only viewing and liking. When considering the impacts category, the significance is somewhat surprising because these activities were undertaken by peers, and were therefore only reflective of the student's cognitive work that would have contributed to their final grade. Of course, since students cannot receive impacts points if they do not fist create assets, we would anticipate some interaction between the creations and impacts categories. But that the impacts category emerges as the only significant predictor variable when looking at all four courses suggests that these peer-initiated activities may be a valuable indicator of student performance, perhaps more so than just the student's quantitative output.

In trying to uncover some rationale for the relationship between total impacts points and final grade, it seems reasonable to dismiss the idea that receiving comments or encouragements from peers would have had a direct effect on performance, as a cursory look at asset comments does not suggest they reached a level of depth that could have aided and advanced understandings in a significant way. One could make a case that receiving the feedback and encouragements from peers may not have contributed directly to cognitive gains but that the social affirmations could have been a motivator for those students to continue to participate and create meaningful artifacts, still this seems unlikely. Flipping the vantage point from what the impacts may have caused to what may have caused the impact, another interpretation of this finding could focus on the content, and argue that peer attention tends to be directed at the most useful and interesting content, and that higher performing students generate more useful content to the learning of others. Observationally, thumbnails that seemed funny (like a comic) or unique did appear to have more views. However, entertaining or provocative content

would not necessarily be an indicator that the content demonstrates deeper understanding of the material, and it seems unlikely students could have determined the most academically useful content only from the asset thumbnail and title.

A fourth interpretation, and the one I believe to be the most powerful explanation of this finding, suggests that high performing students develop reputations early on in the course, perhaps through their participation in the video or in-person discussion sections, and those reputations result in an increase in peer attention around those students' assets. This fourth interpretation appears consistent with online discussion forum research that finds students do indeed develop reputations in socially networked learning communities, and that these reputations may relate to student performance. In my exploration of the Asset Library in the following article, I use social networking analysis and qualitative coding of assets to better understand the different factors that may contribute to the relative popularity or impact of an asset.

Implications for Gamification Research and Software

Without a true control group and pre/post knowledge checks, it is difficult to determine the degree to which the presence of the Engagement Index altered or influenced behavior, or if it motivated engagement that led directly to cognitive gains. Even though the median final grade of the students who opted-in to the game was higher than those who opted-out, this is more likely a case of higher-performing students simply being more engaged in the course overall than a case of the EI motivating them or having some causal influence on their performance. Outside the liking sprees and anecdotal evidence of students reporting engagement directed at earning more points, it seems probable that the relative distribution of grades, participation, and even the social reputations would have remained fairly consistent with or without the presence of the EI. As far as calls in the gamification research for findings that demonstrate causal effect on motivation and outcomes, this article does little to answer to those questions.

I also believe, as I argue earlier, there is some value in taking more of a systems approach, and seeing what kinds of signals emerge from among the complex intermingling of people and tools and gamification elements that comprise a course assemblage. In this study, there is evidence that even with very little oversight or involvement from instructors, simply turning on a leaderboard as an option for students can generate various kinds of activity, such as leveraging the tool as a form of feedback or becoming involved in the competitive aspects of the game, taken even to extraordinary lengths such as with the liking sprees. Although I identified a few of these instances where the gaming behavior was not completely in line with the pedagogical goals of the course, there is enough evidence in this study to suggest that there is some benefit to offering students the option to participate in a points-based *game* as part of how they craft their personalized journey through the online portion of a course experience.

As a contribution to the research, I have tried to articulate a conceptual approach- an *assemblage approach*- to gamification specifically and digital learning tools generally that takes advantage of learning analytics and click-data to reanimate the unfolding of a course experience, from its technical foundation to the instructor's final course announcement. Focusing on the gamification elements in relation to other components in a course assemblage, I demonstrate the explanatory value of contextualizing student usage data- their socio-cognitive activities- by mapping that data to related technical and pedagogical components in the course. While the model I propose here is only a first-attempt, one might imagine mapping techniques that take advantage of more computational methods to organize and visualize instructional design components and software capabilities in relation to student usage and interaction data. Such a research project could provide some consistent language and frameworks in developing course typologies that would allow more micro research contexts and findings to be reliably connected with and compared against other studies. This could help in scaling insights into online learning and digital pedagogy without trying to

homogenize them or flatten their inherent complexity as technologies embedded in dynamic social learning contexts.

I also hope this study contributes to understandings of points-based leaderboards in social learning environments. By examining the relation between the quantitative outcomes in the game and the qualitative outcomes in the course, the research suggests some intriguing directions for leaderboard designs. How best to design micro-interactions, such as liking a peer's contribution, and fit those micro-interactions to a points-system proved challenging when limited to a static points-system like the EI. Enhancing the EI leaderboard with an "adaptive" (Barata, Gama, Jorge, Goncalves, 2013) point systems that could intelligently respond to happenings in the environment and adjust point values based on individual student engagement patterns would be one way to improve how those micro-interactions are scored on the leaderboard. An adaptive system could have, for example, deterred the liking sprees by lessening the point value for that activity once it had been triggered a certain number of times. Given the way student rankings shifted when point values for activities were adjusted, it also makes for the EI leaderboard to have adaptive rankings that can be viewed under various scoring systems so as not to limit the experience to a one-size-fits-all model (Schobel et al, 2017; Bockle et al, 2017). More insight into how sum totals were achieved on the leaderboard, such as a breakdown of activities that contributed to points, would also enhance the value of the EI score as a mode of feedback and provide some transparency around how peers' scores were obtained.

The significant relationship between a student's total impact points and a student's final grade is perhaps the most interesting finding of this study and the most fruitful area for further research. The design of points-based games that rely more heavily on peer-initiated points, and that seek to incentivize and acknowledge students who meaningfully contribute to the learning of others, has the potential to dramatically improve how we organize and scale peer-to-peer learning experiences. The finding also demands a deeper interrogation of the question "What makes an asset popular?" My suspicion that asset popularity is driven by the author's reputation as a high-performing student can be tested against other features of an asset, such as the time of posting or quality of the asset itself. If indeed reputation remains a key driver to asset popularity, then how quickly do these reputations develop and from which sources of social interaction? Further, we can begin to think about what kinds of content and student voices become popular, and if a diversity of student voices are being represented in the "popular" discourse of the learning community. This can lead to other kinds of enhancements to social learning tools like the Asset Library and the EI, improving how they leverage information about social relationships among peers to connect diverse voices and foster a more inclusive social network. As social gamification tools and networked models of learning become more fully enmeshed in online learning experiences, continued exploration of tools and user experiences that serve to enhance social relationships, information sharing, and knowledge production in a course will remain key areas for research and innovation.

Chapter 2: Learning in the Feed: Curriculum, Curation, and Connection in the Asset Library

Introducing the NewsFeed

The dawning of Web2.0 and social networks during the early to mid 2000s enabled the casual Internet user to become a content producer, creating and sharing media of all kinds at all times, resulting in a staggering amount of digital media circulating across networks. This "participatory culture" (Jenkins, 2006) privileges digitally networked connections as sources of information, affirmation, and discussion, as well as the production and distribution of media content as the means by which these connections are maintained, strengthened, and expanded. Consider today, the largest library in the world, the Library of Congress, adds 12,000 items to their collections daily[7], while Facebook users, on the other hand, upload 300 million photos each day and share 293,000 status updates every *60 seconds*![8]

In order for people to stay connected with larger, more dispersed networks that generate content daily, demand grew for a tool that could efficiently organize and deliver the content of a network to the individual. In 2006, Facebook introduced the NewsFeed to solve the problem of scaling networks (Murphy, 2013). Designed to serve as a kind of hub for networked activity, where users can view and interact with the recent activity of connections in their network without having to visit individual pages one by one, NewsFeeds are now ubiquitous components of most networked sites online (Bucher, 2013). More than just a gallery for browsing media, or a a thread in a discussion forum, social media NewsFeeds provide diverse opportunities for interaction that generate layered connections between people and artifacts.

In online learning environments, while the discussion board has long reigned as the "bread and butter" of online learning (Dunlap & Lowenthal, 2011), innovation in communication, collaboration and media production tools has broadened pedagogical possibilities for how social interaction and collaboration may be integrated into the learning experience (McLoughlin & Lee, 2007; Alexander, 2006; Anderson, 2008). This includes the use of social media tools, which mediate a different interaction experience compared to the discussion thread. Unlike navigating to a discussion forum and joining an existing thread or starting a new one to convene responses, social media sites are platforms for the continuous broadcasting of one's life experiences, journeys, interests, thoughts, knowledge, and discoveries. People connect with each other through these ongoing acts of curating their digital presence, and content becomes connected to each other through algorithmic curation, meta-data such as hashtags, and the networked activity of users.

This article contributes to the growing body of work on social learning tools by analyzing student and instructor usage of the "Asset Library" application, which features a feed where students can post content as well as view, comment, like, and remix "assets" shared by peers and instructors. Looking at data collected over four semesters of an online undergraduate education course, I apply several different lenses for understanding social interaction in the feed. These approaches include: 1) A technical and pedagogical view of the Asset Library feed implemented in the context of the undergraduate course; 2) A high-level look at six dimensions of Asset Library activity in the feed over time; 3) A social network view of ties and interactions between students; and 4) A discursive view of the student comments that emerged around the assets, focusing on the language students use in connecting their comment to a peer or artifact. Understanding more specifically the kinds of interactions and connections mediated by the feed offers crucial insights into both how these activities correspond to learning and social outcomes as well as what kinds of additional tools and activities may be useful for augmenting and supporting feed-based interactions.

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[7] https://www.loc.gov/about/fascinating-facts/

[8] https://zephoria.com/top-15-valuable-facebook-statistics/

Research Questions

Question 1: How are changes in the curriculum, enrollment, and technology reflected in student activity in the Asset Library?

Question 2: What kinds of social ties did students form with peers through their interactions in the Asset Library around shared media?

Question 3: How did comments on assets form textual connections with other media and people interacting in the social feed?

The Importance of Presence and Connection

Going back to the infancy of Internet-mediated distance learning courses, educational researchers have questioned the capacity of online environments to generate a sufficient feeling of connection between students and instructors. Wegerif (1998) details the sense of isolation students may feel in an online course:

> It is a cold medium. Unlike face to face communication you get no instant feedback. You don't know how people responded to your comments; they just go out into silence. This feels isolating and unnerving. It is not warm and supportive. (from Kear 2010 p. 2).

Questions about how well digital technologies are capable of mediating effective learning experiences persist (Bettinger, 2017). In previous empirical research, Sung & Mayer (2012) report the text-centric communication in online environments combined with a lack of real-time interactions can lead to feelings of frustration and a lower level of affective learning, while a decade earlier Rourke, Anderson, Garrison, & Archer (2001) claim that the loss of social context cues leads to inhospitable and unproductive discourse for learning (p. 4). While it is important to note here that these criticisms and findings apply to asynchronous interactions and should not be conflated with online courses that leverage video conferencing or more real-time online interactions, because part of the lure of online learning is being able to offer students the flexibility to participate whenever, wherever they choose, asynchronous tools remain important parts of online learning experiences today.

Beyond just the feeling of isolation, a lack of meaningful, sustained social interaction undermines and even vanquishes the possibility for authentic learning to occur. Learning theories that emphasize the integral role of social interaction in the learning process are often traced back to Vygotsky (1978), who famously situated learning in the interaction between people mediated by tools and signs, which in turn shape how learnings and world views become internalized. Notable concepts to have emerged from and expanded upon this premise include: 1) "Communities of Practice" (Wenger, 1998), which describe learning as a process of becoming a part of a community both through direct instruction by masters, observation, and other modes of participation; 2) "New Literacies" studies (New London Group, 2000), which describe the social and cultural embeddedness of practices of meaning-making and tool use; 3) "Activity Theory" (Engestrom, 1987), which builds directly from Vygotsky's "mediating triangle" in constructing a sociotechnical model for activity within a group; and 4) "Connectivism" (Siemens, 2005), which describes learning in a digital age as a networking process in forming new, diverse connections with people and content online. While each of these theories maintain their own unique foci and points of departure, their shared interest in exploring the inherently social dimensions of learning provides a common ground from which my own work builds.

Given this integral relationship between social interaction and the learning experience, there has been widespread innovation and research directed towards tools and pedagogy for enhancing

social interaction and collaboration in online learning environments. One such body of research has emerged around a concept called "social presence," a contested category (Remesal & Columina, 2012) that broadly represents feelings of community and emotional connectedness among distant participants (Sung & Mayer, 2012). Social presence is sometimes used to refer to the capacity of participants to "construct meaning" and share knowledge (Whiteside, 2015). Yet another definition from Garrison (2008) describes social presence as "the ability of participants to identify with the community (e.g., course of study), communicate purposefully in a trusting environment, and develop interpersonal relationships by way of projecting their individual personalities" (from Arbaugh et al., 2008, 134). Whiteside (2007) offers a useful timeline for how definitions of social presence have evolved over time, beginning in 1969 by Short, Williams, & Christie when it was first used to describe how well a communication medium mediated "presentness" between two communicators (p. 4).

Efforts to mobilize social presence include instructional interventions, such as the design of collaborative activities, and technical interventions, such as the use of innovative tools to foster more engaged interactions. Methodological instruments designed to measure social presence include student surveys and a coding matrix applied to student comments and discussion, such as interactions in discussion forums (Rourke, Anderson, Garrison, & Archer, 2001). Increasing social presence in a course has been revealed in multiple studies to increase perceived learning (Kim, J., Kwon, Y., & Cho, D., 2011), learning outcomes (Joksimović, Gašević, D., Kovanović, V., Riecke, B. E., & Hatala, M., 2015; Garrison & Arbaugh, 2007) perceived satisfaction with instructors (Richardson & Swan 2007) and increases in the amount of peer-to-peer information sharing (Leh 2001). Richardson et al (2017) provide a more exhaustive overview of the numerous studies that correlate positive course outcomes to indicators of social presence. Despite some of these promising results, questions remain about both how well social presence instruments and conceptualizations represent social interactions in the learning environment as well as how consistently measures of social presence correlate with student outcomes (Dunlap & Lowenthal, 2013; Goodyear, 2005).

Mobilizing a Network for Learning

Whether we are trying to measure "social presence" specifically or some other notion of community among peers in an online course, the dynamic and situated nature of social interactions present numerous challenges for understanding their relation to learning outcomes and learner satisfaction (Goodyear, 2005). Given the rapid and prolific development of online learning tools, online learning research has often focused on the effectiveness of the technology itself in mediating those interactions, although narrowly focusing on tools has also been critiqued for being too "technologically deterministic" (Kear et al., 2016). Referring to discussion threads, Dunlap & Lowenthal (2014) argue, "Threaded discussions in and of themselves are not inherently good or bad. Rather, their worth typically depends on how they are set up and used in any given course" (p. 7). How a particular technology is situated in a course design, and the ways a course curriculum organizes opportunities for social interaction directly impact the quality and nature of the community (or lack thereof) that emerges from those exchanges.

There are numerous examples of how technologies and pedagogies intersect in the production and mediation of social interactions for learning. Consider for one the xMOOCs, characterized by their immense scaling and open access to learning content and popularized by platforms such as EdX and Coursera (Sharrock, 2015). Even though these self-paced and largely asynchronous courses are designed to be completed individually and may be without structured or graded social interaction, they typically offer a discussion board for facilitating participation among students [see Figure 18: EdX Discussion board thread].

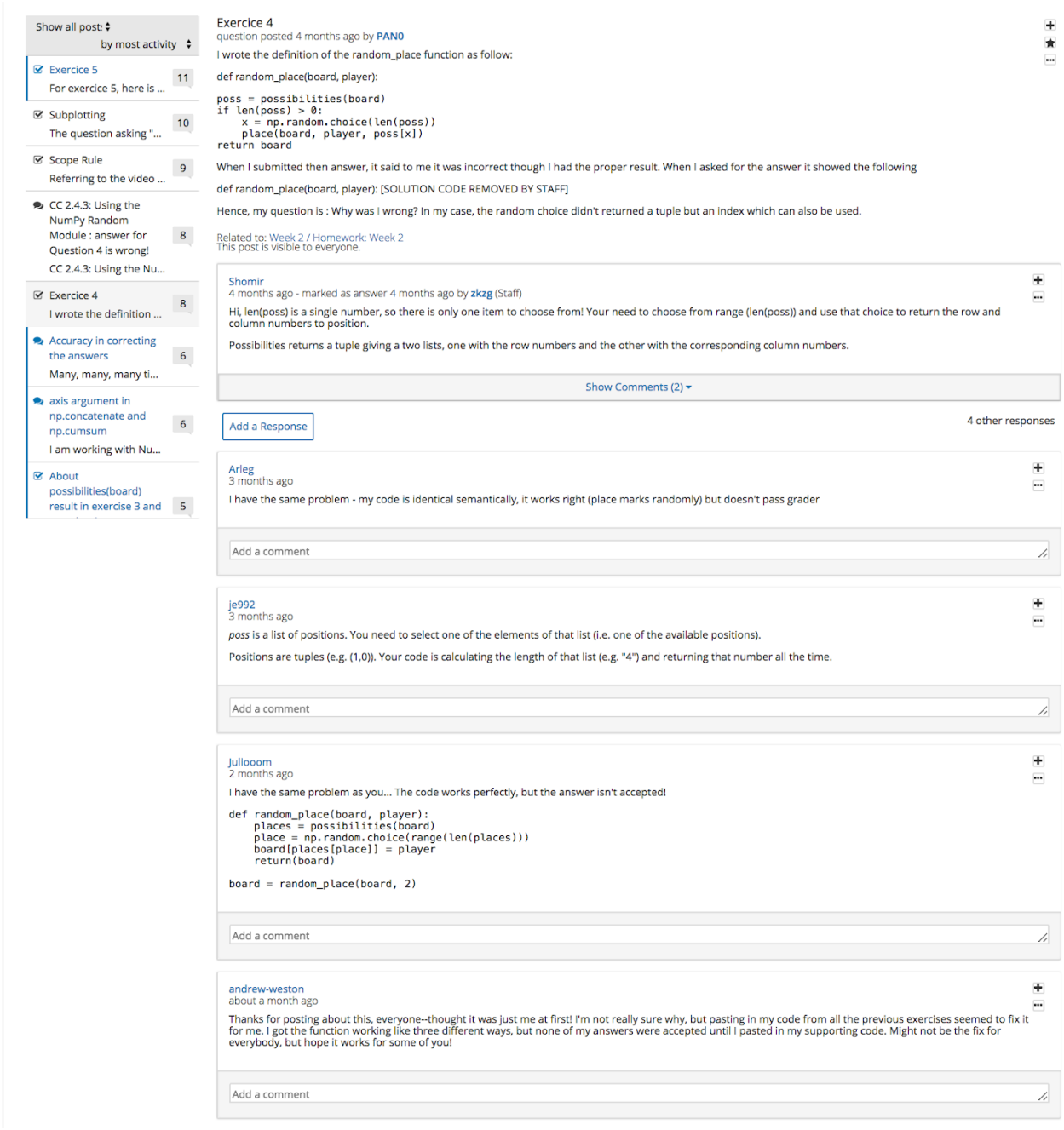


Figure 18: Discussion board from EdX course on Python Programming

Figure 18 is typical of social exchange on a MOOC discussion board, where the "thread" begins with one student posting a question, often related to a challenge of finding the right answer to a particular problem. While there is always the possibility a question will receive no response, MOOCs takes advantage of their massive scale to enable the "wisdom of the crowd" (Surowiecki, 2005) to both supply an answer and confirm that answer. In this case, a question was posted, and the same month (exact dates are not available) the question received a reply. Each month since the question was posted, others have chimed in or echoed sentiments. To verify the correct or the best answer, contributors use the "up-vote" feature to drive a reply to the top of the thread, making it easier for others to quickly find an answer when searching that particular topic or question (Melville, 2014).

Over time, the forum becomes populated with common questions and best responses, allowing future users to more easily find a solution to their challenges.

The idea of "crowdsourcing" (Howe, 2006) information to solve a problem through a kind of public forum has been a persistent feature of Internet discourse since its earliest instantiations. Whether a person has a question about a medical symptom or the instructions for IKEA furniture, Internet users rely on the connectivity of the masses to mobilize around a challenge to help discover and validate a solution. In the online learning research specifically, terms such as "distributed" learning (Dabbagh, 2005), "networked" learning (Jones & Steeples, 2002), and the more recent "learnsourcing" (Kim, 2015.) all privilege the capacity for Internet-enabled communication to mobilize the crowd as a resource for learning. Participants may form deeper one-to-one connections with others through extended turn-taking in a *nested* conversation within the larger thread or dialogue sustained across threads. But in more dispersed, asynchronous participation environments like an xMOOC, the interaction structure favors a kind of one-to-many model where participant inquiries are directed towards an invisible crowd and not any one individual.

Other models for organizing social interaction in an online learning environment may focus less on the cooperation of the crowd, and more on the collaboration between participants in co-constructing (new) knowledge (Dawson, 2008; Dillenbourg, 1999). Drawing from more "constructivist" pedagogies that position learning as a process of making meaning or constructing knowledge in the world (Haythornthwaite, 2011), " Collaborative Learning" (CL) research (Chen, J., Wang, M., Kirshner, P., & Tsai, C.C., 2018; Salomon & Perkins, 1998) and "computer-supported collaborative learning" (Stahl, Koschmann, & Suthers, 2006) focus on both opportunities for and evidence of social interaction undertaken toward shared goals. Compared to the interactions in a massive forum, which tend to be more a series of transactions between the individual and the crowd, CL privileges more small group or paired interactions that are generative in the way collaborators create meanings together (Ryberg, T., Buus, L., & Georgsen, M., 2012). In an activity where the goal of the interactions is the co-production of an artifact, for example, social exchange becomes a process of turn-taking and sense-making of each other's contributions, resulting in a new text or artifact inseparable from the unique series of interactions that produced it. Course "wikis" are a common example of collaboratively authored texts in online learning environments (Zheng, B., Niiya, M., & Warschauer, M., 2015).

Online course designers certainly do not need to limit how they facilitate learner interaction to either crowdsourcing or CL models. I contend that effective online learning experiences organize diverse tools and activities for social interaction that work across various scales, modes of discourse, and collaborative meaning-making practices. In terms of scale, the cMOOCs, for example, have taken up "connectivist" (Anderson & Dron, 2011) learning principles that privilege the relationships within a network as sources for information sharing and knowledge production. cMOOCs are designed for participants to negotiate different communication and authoring tools to effectively leverage their collective resources as a network to form new understandings about topics of interest (Downes, 2005; Mackness & Bell, 2014). While a larger network is not guaranteed to be more diverse, scale in a cMOOC intends to assemble a network of nodes each with their own (potentially) diverse sets of connections and experience to enhance the collective knowledge capital of the participants (Thompson, 2016; Mcloughlin & Lee, 2007).

The capacity for people to sustain larger networks of "weak ties" with valuable, diverse forms of social capital (Granoveter, 1973; Glibert & Karahalios, 2009) has powerful pedagogical potential in a socially-turned theory of learning. At the same time, a decade into research around social media, scholars also point to evidence of "echo chambers" (Flaxman, Goel, & Rao, 2016) and networks that appear more homogenous in the kinds of resources and perspectives they generate than scholars and educators previously imagined or hoped. Amidst findings that suggest social networks are perhaps not connecting diverse voices or democratizing information as once imagined, there are clear

concerns about integrating commercial social media tools into formal educational spaces (Tess, 2013; Friesen & Low, 2011). Further, while the kinds of media sharing, viewing, liking, and commenting enabled by social media tools can be an effective mode of discourse for keeping large networks of people connected with each other, these kinds of "micro-interactions" (Rambe, 2011) do not necessarily lead to deeper, more sustained discourse and co-creation. To better understand the underlying pedagogical value and limitations of networks, and in particular NewsFeeds, we need to take a closer look at the kinds of discourse and interaction that emerge around content curated into a networked community.

Discourse and Curation in the Feed

Whether referred to as NewsFeeds, timeline, stream, or feed (as I refer to it here), their essential function is aggregating and displaying content shared by connections within a network. The order that content appears in the feed may be largely chronological, based on user preferences, and customized by algorithms. In aggregating the content shared from across nodes in a network, the feed is really the lifeblood of the network, serving as a "hub to organize one's mediated experience" (Mathieu Pavléckova, 2017: p28). Each content item that flows through it, whether a single 'sad' emoji, a status update about the traffic, a picture of a newborn, a political meme, an old film clip, an article about exercise, "constitutes a place designed for settlement" (Webb at al, date: p5), or a site inhabit by sustaining interaction with others, which in turn, help maintain and strengthen their network ties. Many social media interfaces allow users to interact with content directly in the feed; however, the flow of scrolling through content is suspended when a user *zooms* into a "place" in the stream, such as in engaging with lengthier comment threads or more complex shared artifacts.

Most users do not interact with every content item that flows through their feed. Instead, they are more or less selective in determining what or whose content to engage, and the type of interaction feature with which to engage it, such as choosing to view something but not like it, or like something but not leave a comment. Users may choose to focus their feed engagement within a slight-knit group of "consociates," such as in keeping in touch with family, or orient their engagement toward content shared by "contemporaries" such as journalists, celebrities, or more distant nodes in their personal network (Mathieu Pavléckova 2017: p433). This kind of network administration that users engage through preference setting in the application and their interaction patterns with certain people in their network serve as form of audience management, where users carefully control how they are perceived by others online and the kind of presence they produce or perform. (Marwick & boyd, 2010). The feed, therefore, represents an amalgamation of two different types of curation practices that generate the content experience of networked participation.

A user curates their "digital body" (boyd, 2009) by posting status updates, sharing media, and engagement on the site. This curated persona can typically be seen in its entirety by visiting a user's profile page to view all of the content they have generated over time on the site. These "presentations of self" (Goffman, 1954) may include direct representations of self- quite literally by posting selfies- or media shared from other websites that represent a user's tastes, beliefs, interests, and moods. This kind of ongoing curation of a digital presence is not the kind of "object-centered" curation one would ordinarily associate with "curating" in a museum. Instead, "personal stories and community knowledge become significant components of the communication of cultural knowledge, [and] objects become the props and not the central message (Russo, 2009, pg. 159). In other words, while an individual post, such as a video about a political issue, has meaning and relevance as an object in itself, it also becomes situated in the ongoing narrative authored by the user as part of a string of posts, status updates, and comments.

As the user curates her own presence, she also assembles a network of connections with others on the site or in the community (eg.: by adding friends or gaining followers), who are each curating their own digital presence. A user could visit profile pages of her connections individually to

read each of their curated bodies of media and to stay connected with them, but this would be a laborious and inefficient process as a network grows. Instead machines and users co-curate the feed with content. Users participate in this curation by configuring various settings and content filters available in the environment- such as labeling ties as family, friend, classmate, or coworker- to better control whose content they see prioritized in their feed by appearing at the top. As users proceed to interact with content and people in their feed, machines then use this information to further refine who or what content is prioritized in a person's feed through what are now infamously known as "recommendation algorithms" (Naik, 2017). Like a personalized museum gallery, the result of this co-curation is an ordered collection of content representing the activity of the network and tailored to the particular tastes and interests of the user. Of course, recommendation algorithms have come under intense scrutiny from governments and the public for *prioritizing* fake news, click-bait, and extremist rhetoric and behaviors that critics argue have become corrosive to the public discourse (Lazer et al., 2018; Fuchs & Sandoval; 2014).

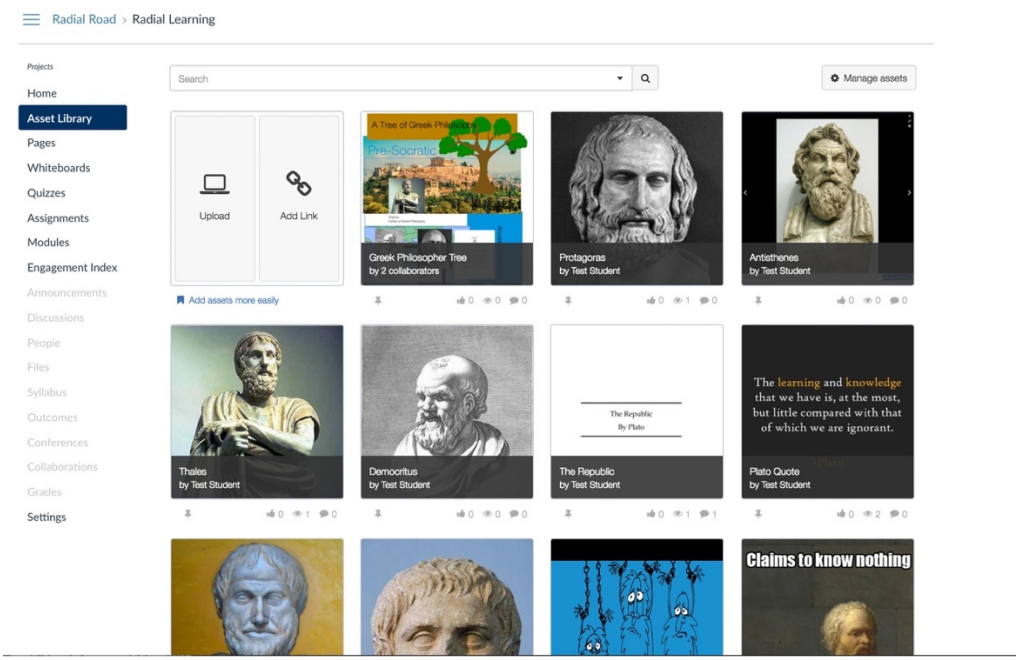
Depending on the social media tool, a user may choose one of several ways to interact with content in their feed. Naming conventions aside, most sites allow a user to view, like, comment on, and reshare media. "Lightweight" interactions such as likes can serve as affirmations for content sharers, and though quantity of likes matters to some, users tend to value and care more about likes from specific people within one's network (Scissors, 2016). Content in the feed may therefore be considered sites of "gift giving," or micro-contributions that signal to others a sense of care or altruism (Skageby, 2010). Quantitative accumulation of likes, views, and connections may be an indicator of reputation and popularity, as well as leveraged for financial gain, as social media providers financially compensate popular users because they have built-in audiences to market products. In this sense, content in the feed is a rich site for the exchange and accumulation of social capital, in terms of reputation and relationships with others, as well as economic capital, transacted between users and brand marketing campaigns (Bourdieu, 1985). In my chapter on the Engagement Index, I discuss in some detail a spectrum of values that can be assigned to different action types around shared content, such as likes being more valued than just a view, or a re-share being the most valuable because it exposes the post to a new network.

Receiving comments on one's post is a valued type of interaction, as it requires the user to go beyond the single click of a like icon to compose a message. While the technical functionality for commenting on content in a feed mostly resembles that of a discussion forum, they may facilitate somewhat different kinds of discursive exchange. For instance, as can be seen in the above discussion forum post from EdX, the prompt is a question, and the thread that emerges from that prompt is an effort by the network to supply an answer to that question. Though people do post questions to their Facebook networks, prompting a thread of replies that read similarly a discussion forum thread, people also often post photos, novel media, or announcements that do not intend to provoke a series of replies directed toward some kind of answer. The kind of comments that emerge around social posts, therefore, reflect the diversity of artifacts flowing through the feed. For example, in a study of comments on users' "pinboards" on the social media site Pinterest, Hall & Zarro (2012) find 55% of the comments were focused on sharing an opinion or judgement, such as "That's cool!" On a site like Facebook, user posts about career or personal accomplishments would be likely to receive similar forms of praise in comments such as "Congratulations." They also found 19% of comments were aimed at engaging dialogue (such as in posing a questions about a post), 15% of comments were of users sharing their personal history with the media in the post, and 10% of comments added narrative details relevant to the posted image. Often less pragmatic and focused than the replies in a discussion forum, the comments that emerge around content in the feed tend to reflect the varied and sometimes whimsical character of the posts themselves.

Learning Assets in the Asset Library

The Asset Library was developed to provide the campus learning management system (LMS) with a tool that resembles the features and user experience of social media environments that orient social engagement around networked media sharing. The term "assets" tries to emphasize that they are valued resources, which can be taken up and interacted to generate new understandings. The front page of the Asset Library features the feed of assets, and includes a search bar at the top, icons to add a new asset via link or file, and asset thumbnails in rows of 3 or 4 depending on window size. The asset thumbnails contain the title, author, and social stats- pins, views, likes, and comments added by peers or instructors.[9] By default, assets will appear in order of most recent, and the user can scroll down to go back in time to the earliest added assets. Typing key words in the search bar will yield asset results that contain those keywords somewhere in the metadata associated with an asset, such as title, author, description, and hashtags (search will not mine the document itself for keywords). For more advanced search, users can select from a number of different filters, including various popularity metrics, category tags, course section and users, and asset type.

[9] The asset pinning feature was released after this study



Full-View mode of asset below

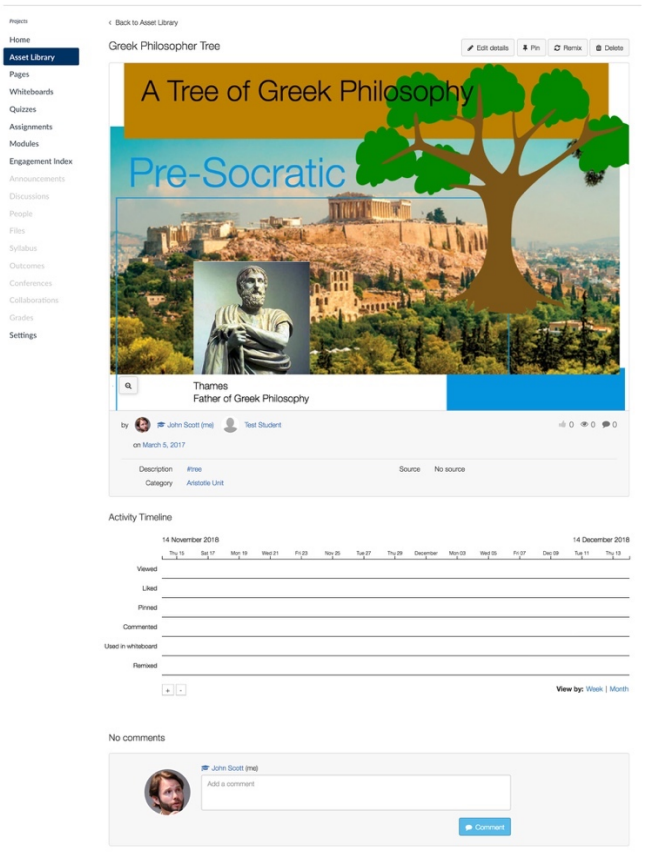


Figure 19: Asset Library feed and asset in full-view mode

When adding a new asset to the Asset Library, users select whether they want to add a link copied from the web, such as the url for a YouTube video, or a file from their device, such as a Word doc. Once they have chosen a file or link, the Asset Library will automatically generate a title (based on file name or url information) as well as a thumbnail preview (a screen grab of the content). Users can edit the title, add a text description, add hashtags (#hashtag) that can be clicked to filter for other assets with the same hashtag, and add a category tag from a drop-down menu. Categories are created by instructors, and can be tied directly to assignments tracked in the gradebook of the LMS. Once uploaded to the Asset Library, the asset can be engaged by all the participants in the course, beginning by clicking an asset thumbnail for a full-screen view of the asset. If the asset is an embedded YouTube video, it can be played in the full-screen view, and some embedded websites retain their interactive features as well. If the asset is linked from the web, the full screen view will include a 'source' link that takes the user to that website url. Users can like the asset by clicking the thumbs-up icon, read the description, and add a new comment or reply to existing comments.

The Asset Library interacts with other SuiteC tools as well.[10] In the chapter on the Engagement Index, I describe how social interactions undertaken in the Asset Library can be gamified by instructors, who can assign point values to the different social activities, which are tracked by the Engagement Index and summed as a point total displayed on a course Leaderboard. The Asset Library is also tightly integrated with the SuiteC Whiteboards, where students can work individually or collaboratively in designing multimodal compositions. While composing in the Whiteboards, users can search the Asset Library and add assets to their Whiteboard canvas in the form of editable thumbnails that link back to the original asset in the Asset Library. Users can export their composition to the Asset Library, adding a title, description, and category tags as if adding a file or link. Once in the Asset Library, other users can engage with the exported Whiteboard just as they can with other assets, and use zoom features if the Whiteboard is larger than the asset window. When viewing a Whiteboard in the Asset Library, a user may also click an icon to 'remix' the Whiteboard, which will allow a user to open the Asset as an unpublished Whiteboard to edit or modify the existing media elements. While this article focuses only on Asset Library interactions, it is important to note that these interactions represent only a subset of collaborative activities engaged in by students in the course, and that those interactions may be shaped and augmented by engagement with other tools such as the Whiteboards, Engagement Index, and discussion forums.

The features and user experience of the Asset Library feed differ from social media feeds in a few important ways, some of which have been intentionally designed for pedagogical reasons, and others of which have simply been beyond the scope of SuiteC development. One pedagogical design decision included avoiding features for "friending" or "following" other users in the Asset Library. Although forming explicit connections with others is an essential feature of social media environments, where people construct their personal network from among a vast and mostly unfamiliar user community, in a course context, the network is defined by whoever is enrolled, and while a clusters of connections will emerge from this course network, all the participants are connected by a common purpose- to complete the course. Including a feature for friending or following in the Asst Library could help students prioritize with what and with whom they want to engage, but could also lead to popularity contests aimed only at accumulating connections, devaluing the qualitative relationship and tokenizing others, as has been observed in social media environments where (Kreps & Pearson, 2008). Friend connections may also result in social cliques that exclude others for various reasons and serve to undermine the class community as a whole. The Asset Library

[10] I limit my description of the Asset Library's interactions to the Whiteboards and Engagement Index in this section because the fourth SuiteC application, the Impact Studio, was not available at the time of this study, However, I reference the Impact Studio to consider potential ways this new functionality could influence or change user interactions in the Asset Library.

allows users to filter by participant names and course section to see the recent activity of specific people, but tries to focus asset search more around the content than the people.

The Asset Library provides users options for filtering and searching assets, but otherwise, the order of assets is determined by most recent, and the platform does not include any kind of sophisticated algorithm to curate the order of assets. As I discussed in the section on curation above, the machine learning algorithms that rank and display networked activity in feeds play a crucial and controversial role in social media experiences. Implementing algorithms for the Asset Library was outside the scope of development, but given the tendency for social media algorithms to create "filter bubbles" and spread "fake news," implementing recommendation algorithms optimized for diverse peer-to-peer exchange and constructive dialogue demands some alternative solutions. Whereas commercial social media sites engineer their algorithms more to sell ads than to diversify perspectives (Noble, 2018), social learning algorithms for educational feeds like the Asset Library could leverage data about network activities in order to, for example, diversify student interactions with peers, or amplify voices of students whose contributions are not receiving engagement. Ensuring that students feel included and part of the conversation through algorithmic recommendations offers intriguing pedagogical value in a peer-to-peer oriented learning environment.

A third important distinction between many social media environments and the Assert Library is the absence of a profile page in SuiteC at the time of this study. In social media, the feed serves as one site for interaction with posts, but posts and activity are also archived to a user's profile page, which may include a list of past activities, profile photo, biographical information, cover photos, and other relevant network information and profile customizations. Friends who share a connection on a site might visit each other's profiles from time to time to send them a personal message or look back at past posts. In early versions of the SuiteC software, filtering by or clicking a student's name anywhere across the SuiteC tools opened an Asset Library page displaying all of the student's assets in their familiar rows of thumbnails. The decision not to include a profile page in early versions of SuiteC reflected both the prioritization of other features for development and the aforementioned pedagogical desire to orient activity around content instead of people.

The Feed as Assemblage of People and Content

The Asset Library plays a central role in the online undergraduate education course curriculum, as almost everything that students create as part of their learning activities and assignments is shared into the Asset Library feed. Before the start of each semester, the Asset Library is stocked with tutorial media, PDFs of course readings, instructional videos, supplemental materials, and assignment examples. All of these instructor assets include unique hashtags and weekly assignment categories that map back to the curriculum modules. Instructor assets are linked to in the course modules, and are included in the Asset Library because instructors can efficiently monitor engagement with the course content as well as reply to comments and questions. Further, instructor assets include common course hashtags, making them easy to find and reuse in Whiteboards to organize and remix course resources over time. Pedagogically, the adjacency of student-generated content and instructor-generated content in the feed symbolizes the prioritization of what Rheingold (2012) called "peeragogy" or "P2P, " which privileges student voices and their content as part of the instructional material in the course.

For each weekly curriculum module, students move through five activity phases, which often require them to add assets of various kinds to the library with the relevant hashtag and weekly category tag. Asset adding activities include curating content from the web to represent ideas or self, publishing a Whiteboard authored individually or with a partner, and uploading research and field note documents. Learning objectives for Asset Library activities may be specific to the content being explored in the weekly module, but also often supports one of three learning and social interaction goals for the course. The first goal is for students to make connections between their own cultural

identity and experiences and the course themes and concepts. Second, as they interact with assets curated by others, they begin to form networked connections, where they become exposed to diverse peer perspectives and "funds of knowledge" (Moll, Amanti, Neff, & Gonzalez, 1992) that augment or even challenge the instructional materials. Third, when remixing assets in the Whiteboards, students make connections between knowledge resources in the course to demonstrate higher-order understanding of course concepts. Participation in the Asset Library and completing asset-related activities represented 25% of a student's final grade. With the existing instructor assets and the several assets students add each week, the feed of the Asset Library is continuously evolving and growing with diverse kinds of media. Scrolling backwards in time, a user experiences the texture of the collective work of the network, where each thumbnail represents a "place" for social interaction to unfold between students and instructors [See figure 19].

While network analysis of social media environments often focuses on the connections that emerge between people, feeds also create connections between content. Shared keywords and hashtags, for example, create connections between media that become legible when users search and filter content and those media artifacts appear adjacent in search results or the feed itself. In the Asset Library, as key terms and ideas resurface throughout the course, search results begin to include assets from various points and activities of the semester. As students continuously revisit and reuse assets in their Whiteboards, the Asset Library tracks these instances of reuse and links from the original asset to Whiteboards on which the asset appears. Visually these connections of reuse can be seen when scrolling the feed, such as a particular asset reappearing in a number of Whiteboards published days or weeks later [See Figure 21].

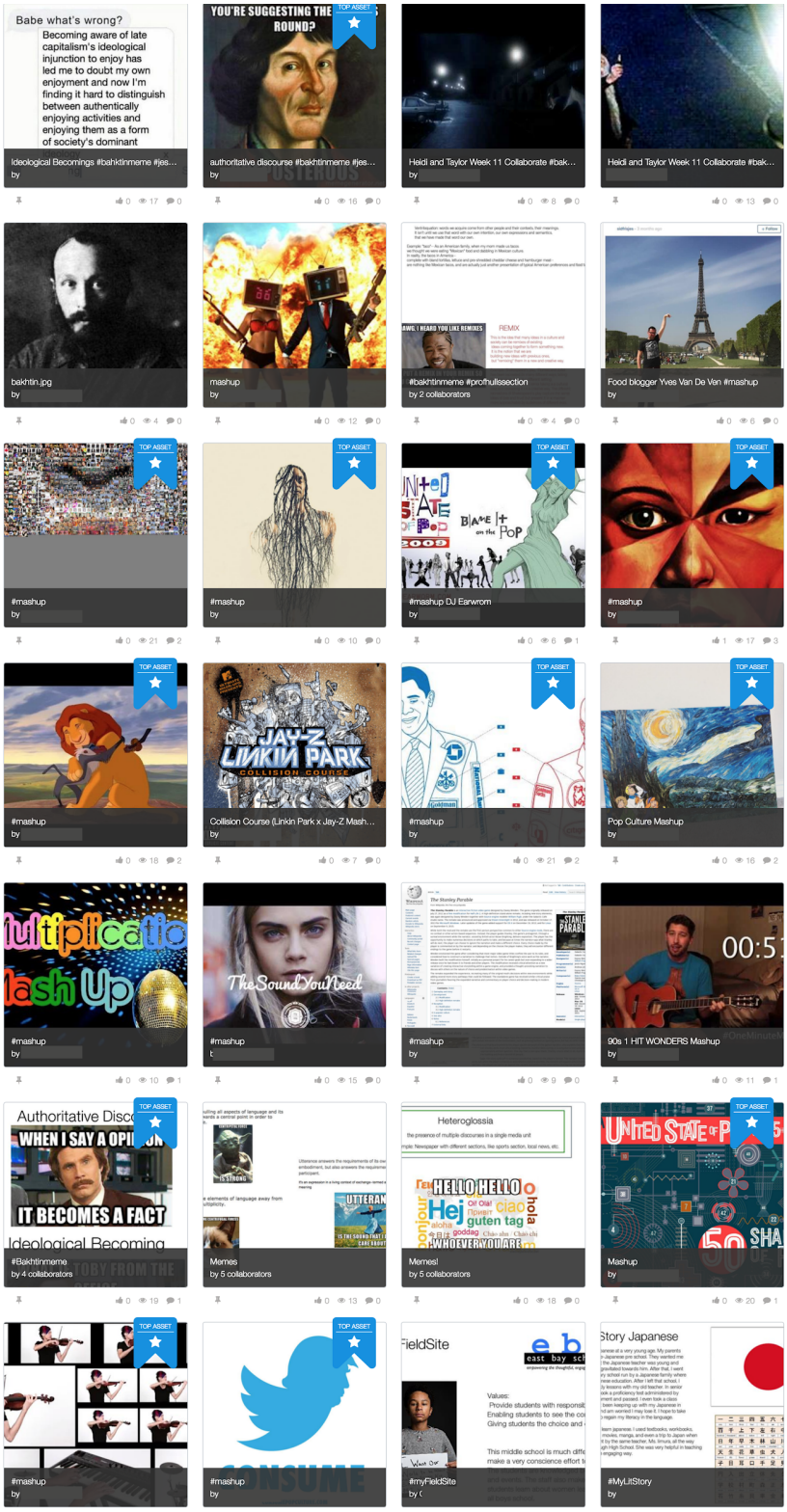


Figure 20: Hashtag search of "mashup," an activity that asked students to find an example of a digital mashup that exemplified two or more discourses in tension, in preparation for their reading later in the week about the "dialogical" nature of texts (Bakhtin, 1978).

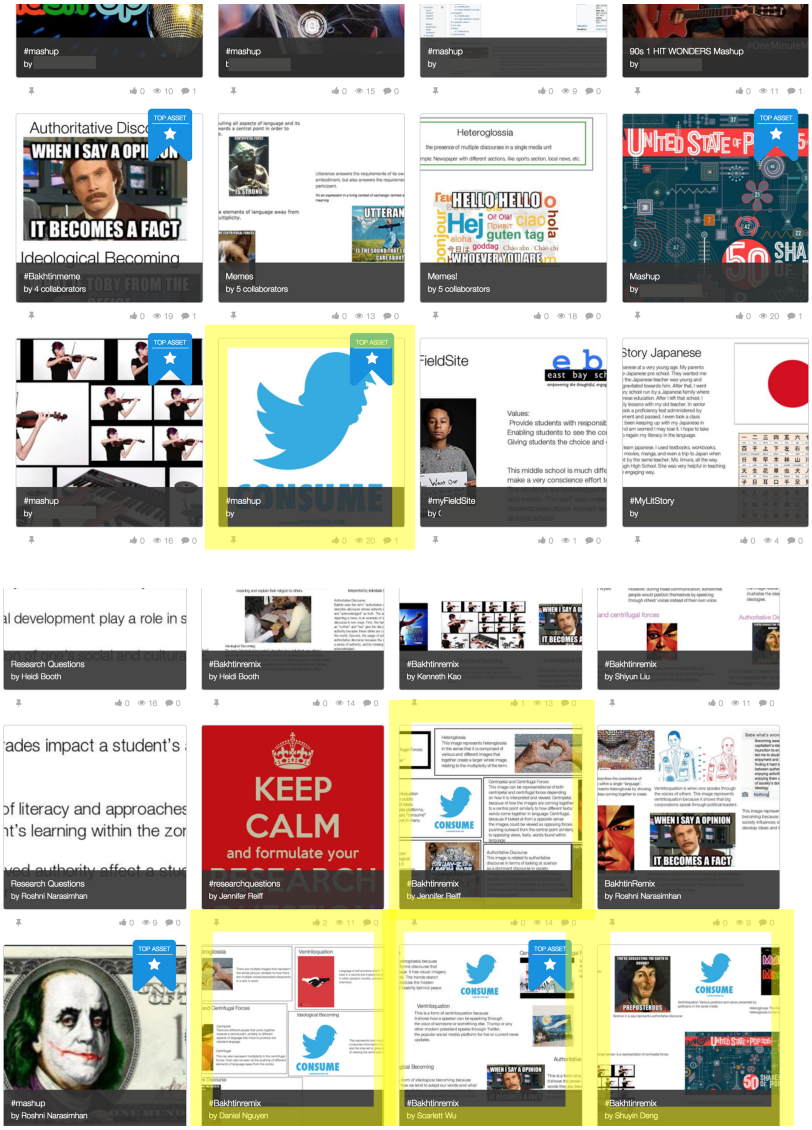


Figure 21: [top image] Highlighted in yellow, a "mashup" asset that combines the twitter logo with a silhouette profile of Donald Trump with the phrase "Consume." [bottom image] 7 rows later in the Asset Library, the asset begins reappearing, now in published Whiteboards [highlighted in yellow] that contain other assets along with text description, shapes, and freehand drawings.

Assets continue to accumulate connections throughout their lifespan in the Asset Library, through people interacting and leaving traces of their presence on them, and through associations and links to other assets. The feed, as an emergent, evolving entanglement of people, artifacts, and software protocols, resembles what Deleuze & Guattari (1968) famously referred to as an "assemblage" and their notion of "becoming." Applying Deleuze & Guattari's notion of becoming to education, Semetsky (2006) argues "the dynamics of *becoming"* can be *"*described by a process in which any given multiplicity 'changes in nature as it expands its connections' (p. 3). In the case of assets, while they are autonomous artifacts in the sense that they can be read and engaged with independently of any other assets on the site, they form contingent relations to other content and people, from which new meanings and ongoing meaning-making emerge.

For example, an asset may be viewed in relation to other assets of the same hashtag, which together communicate the range of student ideas, perspectives, and understandings about a particular

topic or prompt. That same asset may also be viewed as part of an individual student's own collection of assets, which represents an important aspect of a student's digital presence in a course. An asset like the Twitter-Trump mashup may also be viewed in relation to its instances of copy and reuse, such as by looking at how different students use the same asset in combination with different assets, text, and design elements to generate new "emergent effects" (DeLanda, 2006) or new meanings that emerge from that particular configuration of assets and media elements. I explore one such example of an asset becoming a kind of *meme* in the article on Whiteboards. The asset itself has not been changed or been altered, but rather it exists in a state of becoming, as part of a multiplicity of digital copies that are continuously being connected with new people and content.

Analyzing Learning Activity in the Feed

Given the complex and layered connections that form across a social feed, I employ a mixed-methods approach that takes up those relations from different analytical vantage points. First, to understand the unfolding of the feed, or its chronological accumulation of content and interaction traces, I first look at some high-level student usage patterns over four semesters of the course offering. As discussed in detail in the article about the Engagement Index, the course curriculum, enrollment, and technology all changed and evolved during the four semesters, and thus, my analysis of Asset Library activity takes these changes into account.

Second, I select six students with a grade distribution from 97 to to 83, and analyze their social ties through a network graph that is part of the SuiteC Impact Studio. I focus on both interactions initiated by peers and those initiated by the student, and consider both the depth of those ties based on number of occurrences as well as the reciprocity of the tie. While a selection of six is not large enough to draw conclusions across the entire class, I am interested in exploring the students' unique personal networks and relationship formations.

Third, I examine comments that students added to each other's assets, both in terms of the quantity of comments per asset, as well as qualitatively, by using thematic coding techniques (Saldaña, 2009). For the coding (see Appendix E: Coding Table), I analyzed comment threads on a set of assets, and focus on one particularly lengthy thread of comments (18 in total) that emerged around a single asset. I also look at comments that were authored in reply to a peer comment. To organize the analysis, I used a thematic coding matrix that draws from the aforementioned "social presence" (Rourke et al, 2001) and Pinterest (Hall & Zarros; Van Hooland, S., Rodriguez. E.M.m. & Boydens, I., 2011) coding schemes, emphasizing four ways a comment connects with an asset: 1) Connect with author, such as in saying the author's name or complementing their work; 2) Connect with semiotic resources, such as by interpreting or expounding upon what is being represented in the asset; 3) Connect with self, such as in describing how the asset relates to the commenter or commentor world view and understandings; 4) Connect with course concepts, such as in relating the asset to a specific course concept or term. I also consider in my analysis of comments their relation to prompts in the curriculum. While I do not compare the results from the discourse analysis of assets directly to a discussion forum, I do consider findings in relation to some identified best practices for classroom learning discourse broadly.

Activity over Time: 6 Dimensions of Asset Library Engagement

Figures five through ten look at the weekly participant activity across four semesters of the online undergraduate course. Figure 22 represents the number of unique users who launched the Asset Library each week. Course I had the highest enrollment and thus the highest number of weekly users. Across all four semesters, user log launches do see steady declines at various points throughout the semester, with some upticks in launches at the end of the semester, likely as students scramble to submit missing assignments. For those familiar with the American holiday calendar, the dramatic

drop-off in participation one week each semester coincides with Thanksgiving break in the Fall and Spring break in the Spring.

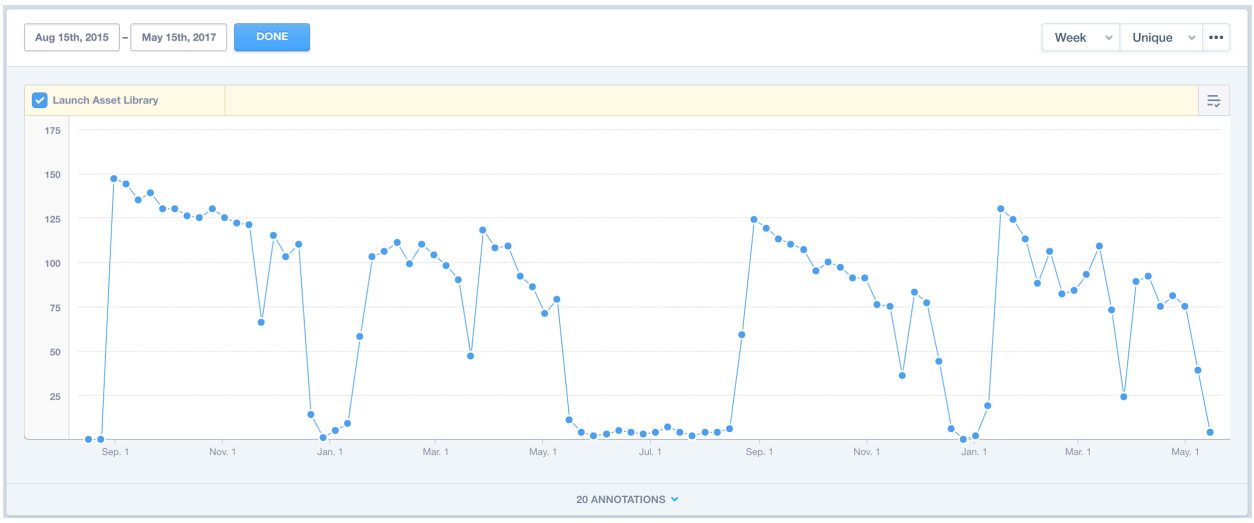


Figure 22: Unique users who launched the Asset Library over 4 semesters

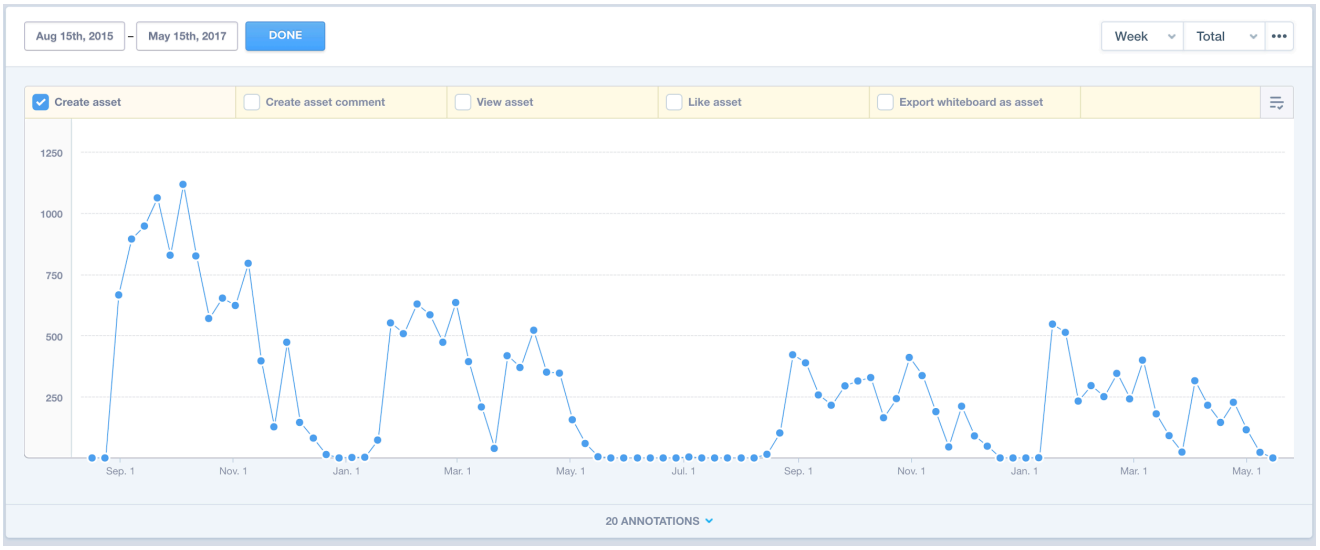


Figure 23: Total Assets added to the Asset Library over 4 semesters

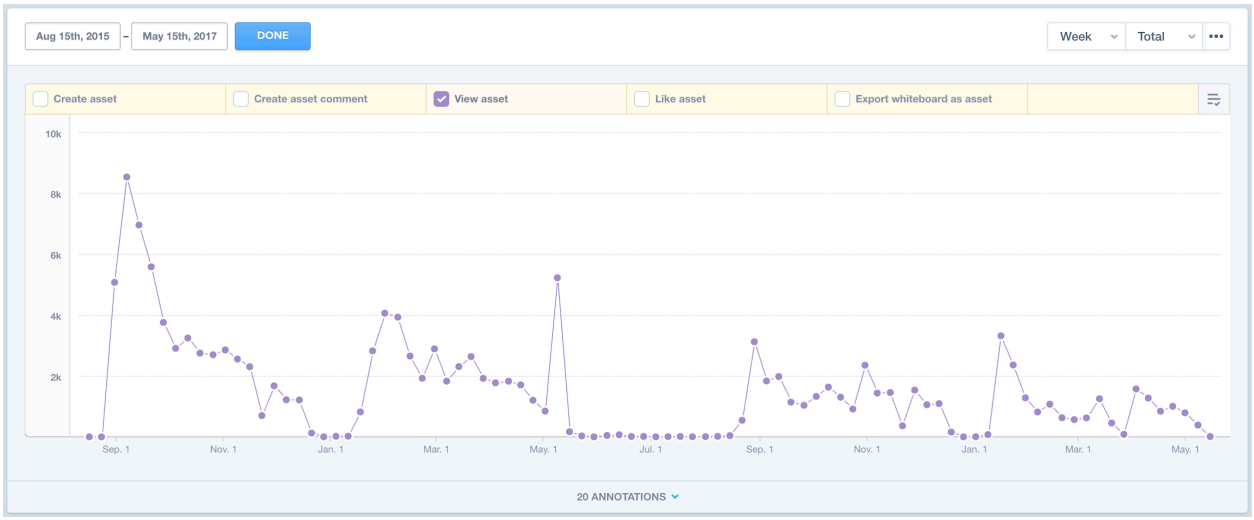


Figure 24: Total Asset Views in the Asset Library over 4 semesters

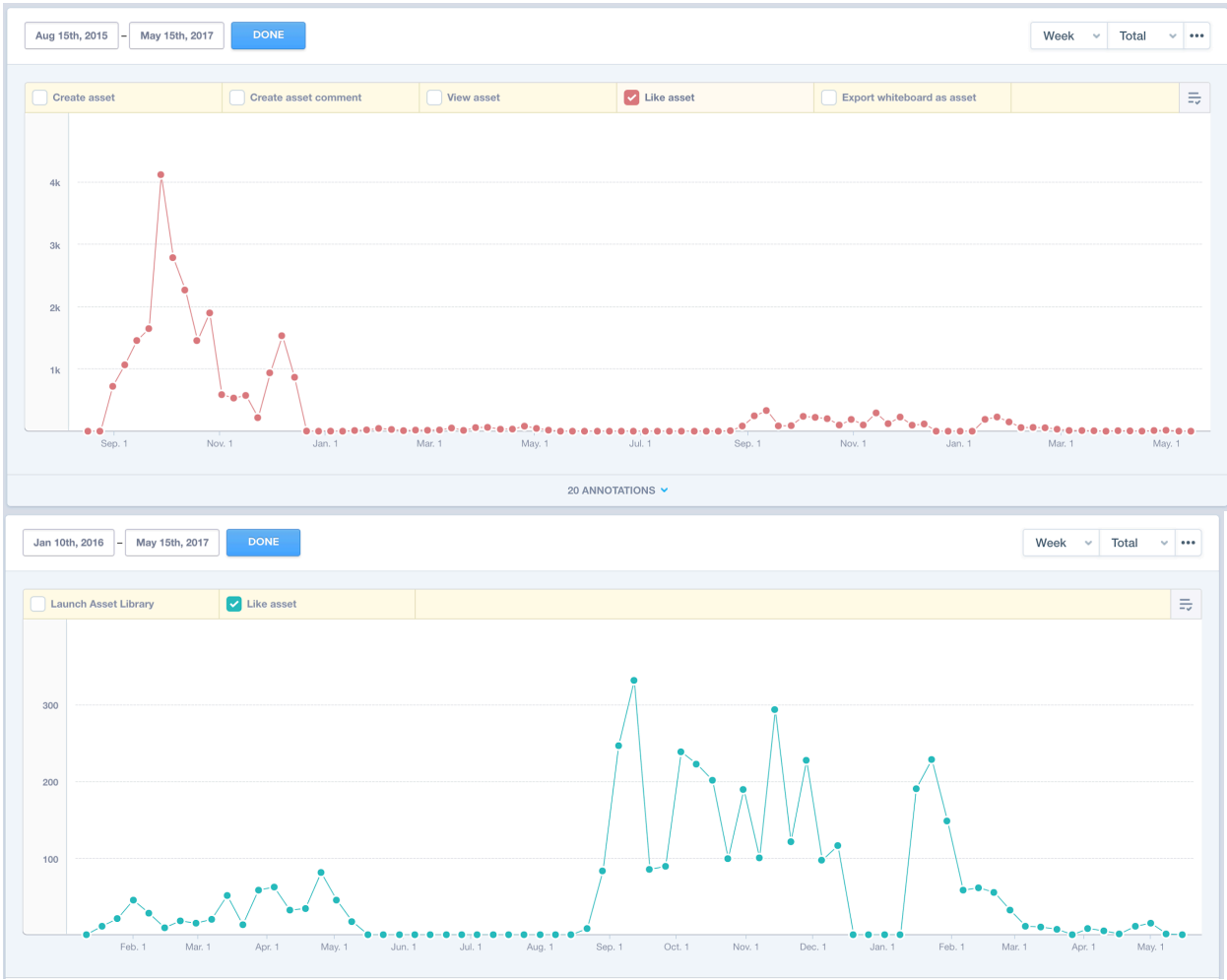


Figure 25: Total Likes over 4 semesters. Top graph includes Course I, and bottom graph does not to provide clearer picture of usage during Courses II, III, and IV. The reason for the high number of likes in Course I compared to the other courses is explained in detail in the Engagement Index article,

which describes a “shift in the technical configuration” when SuiteC functionality was adjusted to increase the *cost* of giving a like.

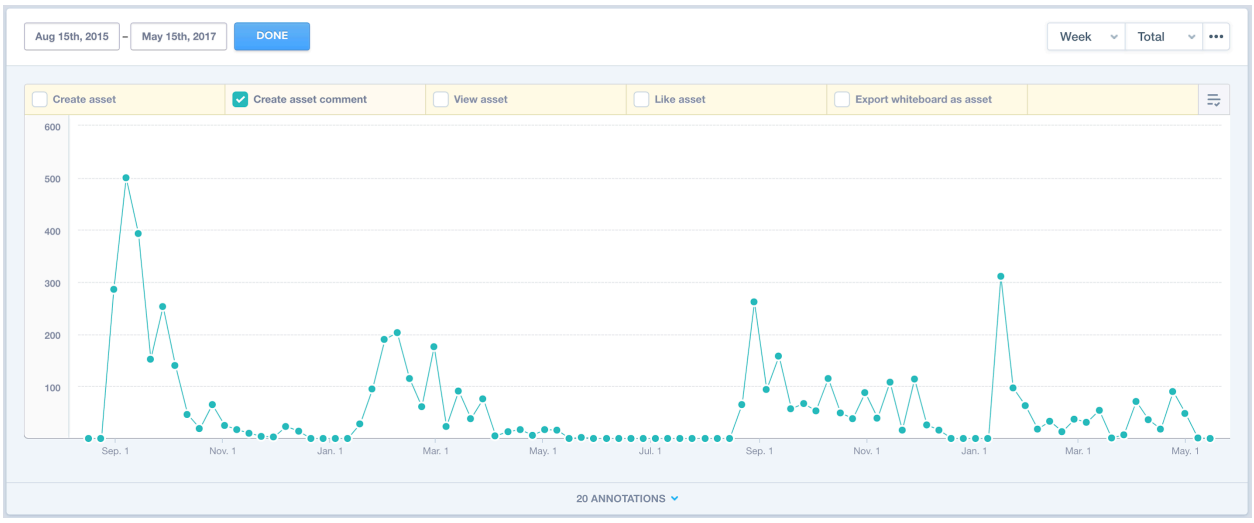


Figure 26: Total Asset Comments in the Asset Library over 4 semesters

Figure 27: Total Whiteboards exported to the Asset Library over 4 semesters

The relatively large number of students enrolled and active in the early weeks of Course I resonate across the other representations of activity. Because it was the first semester the course was offered in this new format, there was a greater amount of student turnover (drops-adds) and course observers that helped contribute to this number. However, changes in the course curriculum are also evident in the different engagement patterns, in particular with the Total assets added (Figure 23) and Total Whiteboards added [Figure 27]. Based on feedback from students and an effort to bring more variety to the activities engaged by students, the number of required asset-added activity decreased from Course I to II and again to Course III. The weekly spikes and drops in assets added and Whiteboards exported as assets also reflect week to week variations in the curricula within a given semester, where one week we might anticipate eight assets per student based on the activity prompts and the next week we might anticipate on four.

Commenting activity is similarly latched to the curriculum prompts in the sense that, quite predictably, when the curriculum mandates that students comment on a peer asset for a certain hashtag, a spike in overall commenting activity is observed in the data. For example, Module 1, completed by students during the first and second week of each course instance, asks students to add at least two comments on peer assets, as a way of orienting them into the habit of commenting. As the only course module that requires students to comment twice and combined with the higher number of active users early in the semester, weeks one and two predictably show the most commenting activity. The steady decline and near disappearance of commenting activity in Course I due to a lack of mandating commenting activities in the curriculum was observed by course designers and instructors, who responded by adding more comment prompts in the final several weeks of the semester. Courses II, III, and IV reflect this intervention, resulting in slightly spikes of commenting activity during the final weeks each semester absent from the Course I data.

The one dimension of activity in the above figures that has no direct relation to activity prompts in the syllabus is Figure 25, which represents liking assets. I say no direct relation because at no point in the course modules are students asked to like a peer's asset; rather, it is a completely voluntary action students can take to complement a peer or more selfishly, gain Engagement Index points to improve their ranking on the course leaderboard. My article about the Engagement Index describes in greater detail how during Course I, students were able to like an asset without opening the asset in full-view mode, which made it easy to like many assets in rapid succession to increase one's points without meaningfully engaging with the content. Between the end of Course I and the beginning of Course II, this functionality was changed resulting in a predictably large drop-off in liking engagement. However, when looking at Courses II, III, and IV, there is much less consistency across semesters than we see in other dimensions of activity. Course III, for example, more than doubles the amount of weekly liking of Course II, while Course IV shows a surge of likes early and then a sharp drop-off with no recovery.

Activity through Connection: 6 Student Networks

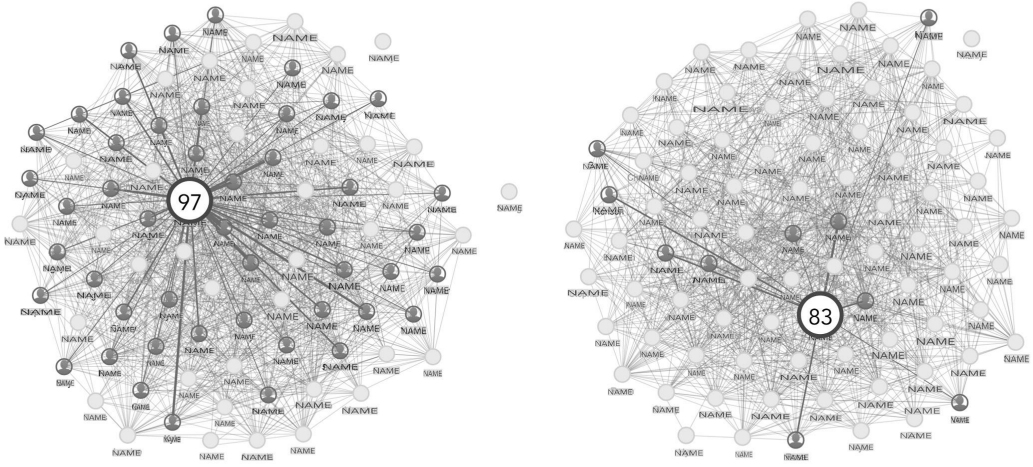


Figure 28: Social ties of student with 97 final grade compared to student with 83 final grade, where each dark line represents a connection with a peer. Screenshots of network visualizations taken from SuiteC Impact Studio.

Table 5 below includes the interaction networks of six students. Included in the tallies are the total number of views, likes, and comments both given and received by the student.

Table 5: Social network interactions of 6 students

Student Grade	97	93	90	87	83	83	
Total Number of Connections	47	33	36	22	22	10	170
Outgoing Interactions	67	12	97	13	16	5	210
Incoming Interactions	30	40	15	21	12	13	131
Total Interactions	97	52	112	34	28	18	341
Reciprocity Score	-37	22	-80	7	-2	8	-82
Percentage of One-way connections	77%	85%	94%	82%	91%	80%	85%

Represented in the first row of the table are the six students' final grades at the end of the semester. Represented in the second row is the total number of connections with peers the student made during the semester, where a connection is established when either a peer engages with the student's asset or the student engages with a peer's asset. These engagements are broken down in rows three and four as outgoing interactions (engaging with a peer's asset) and incoming interactions (peer engagement with student's asset), and include liking and commenting on the asset. These interactions are summed in row five as the total number of interactions. Row six provides a reciprocity score, calculated by subtracting the outgoing interactions from the incoming interactions. A negative score indicates that the student had more outgoing interactions than incoming interactions, whereas a positive score indicates more incoming interactions than those outgoing. The last row represents the percentage of connections with which there was no reciprocated engagement, or one-way connections, such as liking a student asset but never receiving a view, like, or comment in return.

Again, while the sample here is not large enough to draw firm conclusions about the relationship between grade and social network, the total number of connections does indeed decrease as their final grades decrease. If we consider this trend in relation to the regression analyses conducted in my article about the Engagement Index, which finds a significant correlation between total amount of engagement and final grade, and if more engagement results in more connections, then we may also expect to find a correlation between final grade and number of connections. The assumption that greater engagement leads to more connections would be misguided if we saw evidence that connections tended to form around a small group of students and continue to be reinforced through repeated interactions with the same students. However, given that interactions seem more dispersed across connections, evidenced in the ratio of total connections to total interactions, Asset Library activities do manifest as a form of presence of both individuals and the collective work of the community, but they only generate limited sustained comment dialogue between peers on they have entered the feed.

Looking at the relationship between incoming and outgoing interactions and the resulting reciprocity score, there are fluctuations in activity across all students. Two of the top performing students, for example, have reciprocity scores on opposite ends of the spectrum. The student with an 83 grade and a -2 reciprocity score came closest to a reciprocity score of zero, which we might consider to be an indicator of well-balanced interactions with community. Digging deeper into the data that led to these scores, there are clear rationales for the kinds of participation patterns that contributed to the score. The student with a 90 final grade and -80 reciprocity score, for example, liked many more assets than the average student, including liking and interacting with one's students assets 52 times, compared to receiving just two interactions back from the students (a -50 reciprocity score). Similarly, the highest performing student with the 97 final grade was one of the most avid commenters in the course, which is reflected in his 67 outgoing interactions that push him into a negative reciprocity score. Conversely, the student with the 93 final grade and the +22 reciprocity score had several assets that were considered "Top Assets" in the Asset Library because they generated some of the highest amount of engagement from peers. There does seem to be a trend that the higher performing students generally appear to receive more interactions from peers, and this trend in the six network profiles is also supported in the Engagement Index article, which finds a correlation between total amount of interactions received on assets and final grade. Of course, this could also be a cause of higher performing students adding more assets to the Library, and therefore, having more opportunity to receive engagement from peers, though it could also be a signal that students develop a reputation as a high performing students, which draws others to their assets as models for success.

We also observe that a high percentage of connections with peers consist of only one-way connections, usually established by a single like or comment on an asset. In the following section, I look more closely at commenting practices, but there is also a lack of evidence in the network graph of sustained dialogue through commenting on assets. While students could see who commented on their asset, they could not see who liked their assets during this study. Likes were only tallied in the social information displayed on the asset, so students could not reciprocate a like because they would not have known from whom that like was given. Therefore, while the lack of dialogue in the comments might be somewhat surprising, a lack of reciprocity in liking practices would not be. Following this study, SuiteC did begin to reveal who viewed and liked whose assets, both on each individual student's "Impact Studio" page as well as on an Asset Activity Timeline. In the case of the student who liked 52 assets of another student, it would be interesting to see first, if exposing these interaction data would inhibit this student from liking so many of another student's assets, especially if those likes went unreciprocated, or if receiving some initial likes and seeing who gave the likes, if the student would have begun reciprocating those likes in growing their connection.

Commenting on Assets in the Feed

In the activity over time and networks sections, I describe asset commenting activities in terms of their frequency across all students as well as their occurrences between students. In this section, I look more closely at features of discourse around assets. During Course II, for example, while students shared 6,243 assets in the Asset Library, a total of only 1,168 comments were added to those assets. Of those 1,168 comments, 29 were in the form of a reply to a previous comment, meaning they intentionally used the "reply" button in the asset commenting user interface and did not just refer to a previous comment by adding a new comment. The top-ten most commented on student assets averaged 10.1 comments per asset, with a high of 18 comments and a low of eight comments.

As expected, the most commented on assets were associated with hashtags that also included a required comment in the curriculum. In reviewing comments within particular hashtags, the language and form of those comments reflected the curriculum prompts. For example, the #mashup activity asked students to share a media artifact that is an example of a unique, purposeful

combination of two or more discourses, and to to comment on a peer's #mashup asset by providing a critical reading about how the #mashup reflects that juxtaposition of power relations between discourses . We expect and find comments that are primarily focused on the "Connect to semiotic resources" code, where each comment provides an interpretation or reading of the artifact. Similarly, the first activity, #mylitworld, asks students to both post a media artifact that represents literacy, as well as add two comments, one on an asset representing a similar notion of literacy, and one representing a much different notion of literacy. Comments in this case generally contain a phrase, such as "Your asset is like mine because" or "Your asset is different from mine because," and are therefore coded as "Connect to Self." "Self" in this example reflects students' prior knowledge and beliefs about literacy.

From the Course II assets, I selected the asset with the most comments to conduct a close coding of the discursive features of that thread. The asset was associated with the #storytheory Whiteboard activity, which asked students to work with a partner and connect some aspect of their partner's literacy story to one of the theories from the course. The activity was designed to help scaffold idea development for their Literacy Autobiography paper (25% of final course grade). Students were also asked to comment on a #storytheory asset, and explain how the Whiteboard helped them "better understand the connection to a course concept" (Course module: Week 6).

Of the 18 comments, 15 were coded as "Connect to author", accounting for 22 instances of the code in total because some assets contained more than one different connection to the author. For example, five comments contained both the subcodes "Personal address," where the commenter referred to the authors by name, and "Complement," where the commenter offered some kind of affirmation to the author. Even though complementing and connecting personally to the author was not a requirement in the curriculum or deliberately stated in the comment prompts, this thread is representative of an unspoken, shared etiquette around complementing peers when commenting on their work that appears in other comments as well. This etiquette may have been observed in the instructor practices, who would also comment on students assets' as a form of encouragement and to further probe their ideas.

The next most common discursive feature of the comments in the thread was "Connect to concept," which appears in 15 out of 18 comments. Given the prompt deliberately asks students to describe how the Whiteboard contributed to their understanding of a course concept, we would anticipate students to directly reference key terms or readings. Indeed, every comment gestured to a concept in the course, but only those comments that included a specific key term were counted in the coding. In this case, the term students most often referenced in their comments was the notion of "discourse" and "dominant discourses," key terms from a course reading (Gee, 1989) referenced by the Whiteboard authors in framing their own literacy autobiography stories. In most comments, students cite that the Whiteboard has helped them to better understand the different kinds of discourses in which people *become literate*. The Whiteboard authors specifically describe becoming literate in the discourses of art and dance, which becomes a focus of many of the comments. For example, one comment reads:

> I loved how your whiteboard seemed to really emphasize the importance of different types of discourses, not just the standards. Art, especially dancing, is a way of communicating emotions and ideas with all types of people, universally, and is a discourse that is not traditionally thought of. I, myself, have been playing music from a very young age and I know that forms of art are forms of languages that can connect others outside the discourse as well. We can also relate this to the reading and videos regarding Hip Hop and graffiti in the African American community.

Following the complement ("I love"), the student reiterates how the Whiteboard frames art and dance as discourses that may critique or challenge dominant discourses, then elaborates on this point by

talking about art as "language" and notions of art as critique of dominant discourse was discussed in previous course readings. In another comment, a student pulls in a key term from yet another reading, so in combination with the previously discussed comment, the authors of the Whiteboard have received two suggested readings for further developing ideas for their paper.

The example above also contains a "Connect to Self" occurrence, as the student describes his own experience playing music, which he explains helps him understand art as a kind of discourse. Six of the 18 comments contained such a connection to self. Of the six, one comment is a reference to the student's own literacy story, while several other comments reference student's own worldview or beliefs. For example, one student comments:

> I really do truly believe that dance is a creative way of connecting with people because you show emotions that are difficult to vocalize. It is a great way of expressing problems in society such as dominant discourse.

The apparent personal connection this student feels for dance as a means of expression, emphasized in her phrasing "I really do truly believe," establishes a relationship between her own worldview and the work of the authors. Still other comments do not turn inward, but remain fixed on the artifact itself, providing a deeper reading of the meaning of the artifact. I observed five occurrences of the "Connect to semiotic resources" where students analyzed and expounded upon the images and ideas developed in the Whiteboard itself, such as in summarizing a key part of the text or interpreting images.

It is noteworthy that of the 18 comments, none connect to or address an existing comment in the thread. Every comment is directly or indirectly addressing the authors of the Whiteboard and no one else in the thread. This causes a considerable amount of repetition in the comments, as each one expresses mostly the same key attributes of the Whiteboard. Selecting from random assets with comments and scanning the threads, I found few instances of comment threads where comments were directed at other comments. This may be because the curriculum prompts students to comment on peer assets, but does not prompt students to reply to peer comments. A number of the replies that do appear in the data were authored by instructors in the course, trying to stir up more conversation within the thread.

Noise in the Feed as a Barrier to Deeper Dialogue

The volume of weekly asset creation and interaction activity, the breadth of social ties formed around assets, and the visible connections between assets and published Whiteboards serve as evidence of the connections that were drawn between people and between assets through the feed. Once uploaded to the Asset Library, each asset served as a site for social interaction and connection to emerge, and as a component in assemblages of assets that represent both the collective activity of the course participants and the unique digital presence of each student. Assets in the feed are indeed observed in a state of *becoming* through this ongoing articulation of connections to other assets and to other students, the result of which I think resembles various layers of dialogue that contribute to a feeling of social presence and begins to sew the fabric on a learning community in the course.

For students, open-ended responses in the survey (45 total respondents) provide some evidence that these connections were valuable to their experience. In describing what they enjoyed most about the course, several students spoke positively about the opportunity to engage with the perspectives of their peers. Two students remark, "I like taking pictures of objects that I believe is related to the topic at hand and comparing them to other pictures that were taken by other students to see how they differ from my point of view" and "I can see multiple varied examples of topics." Students even reported different strategies for how they entered into these layers of dialogue. For example, several students describe that they would almost always check the Asset Library for peer

assets before uploading their own asset for a hashtag, looking at peer assets for inspiration, for models, or to avoid duplication. Still other students reported that they would post their asset first to avoid being influenced by peers, and then view peers' assets to see how their thoughts or understandings compared. More than just visual adjacency in the feed, the relations between assets are deliberately constructed by the participants as they use other assets for inspiration or validation, giving those assets meanings that emerge from their connections to each other.

Not all students found the activities in the Asset Library to be so useful, however. Similar to the student feedback shared in my article about the Whiteboards, some students did not see the value of the social activities to their learning. But more so directly related to how effectively the course curriculum facilitated activity in the feed, some students felt that the amount of asset posting had a negative effect on the quality of interaction. Two students remark, "Sometimes there is just too much to upload that I don't get to explore others or think critically about what I am going to upload because there are so many already in the asset library" and "However, I think the amount of assets are overwhelming and do not allow me to dig deeper into the content." This perceived imbalance between producing assets and deep engagement with the assets is evidenced in the fairly low ratio of comments to assets, and the lack of many comments in reply to existing comments in thread. As I mention above and as the activity data illustrate, the curricula was modified several times, and many of these modifications involved cutting down the number of activities that required asset or Whiteboard production. In place of those activities, more prompts for commenting were added to support more in-depth conversation around assets.

Cutting down the number of asset activities not only allowed for the introduction of other kinds of activities, but also helped reduce the amount of assets in the feed. Like everyone speaking aloud at the same time in a physical classroom, some students felt the feed turned to noise with so many assets. One student exclaims in the survey, "The asset library is a mess!!! Although I know it can be sorted by week, or by user, I still find it hard to access different posts." Without algorithmic curation and follower/friend connections, relying on hashtag searches and filters was necessary to make sense of the noise, and even then, hundreds of assets could be associated with as single hashtag. Because thee feed only displays the asset thumbnail image, title, author name, and social stats, this lack of richer information about an asset for making a decision about what assets to engage perhaps limits opportunities for more spontaneous or surprising interactions with content that lives beneath a layer of thumbnails.

Still, even from amidst this noise, there are examples where peers rallied together to inform and educate each other. In one particularly salient instance that included two direct comment replies, an inciting comment sparked the conversation. The original asset- a flag of the Chicano Labor movement- was shared and described by a student as a symbol of the desire of Chicanos to lay claim to their own identity in the face of suppression. The first comment that appears in the thread, however, chooses to focus on the aesthetic of the flag itself, and his visual parallels the Nazi flag. He writes:

> I am surprised (and disturbed) by the resemblance of the flag on the left to the Nazi flag - both have a red base with a centered white circle containing a geometric black logo; furthermore, the Nazis used a similar-looking eagle in other designs. Do you know if this was intentional? I'd be curious to learn more about where/when/why the particular design seen on the left was created.

His close reading of the image, which would be coded as an occurrence of "Connect to semiotic resources," and his reaction of being "surprised and disturbed" by what he sees as a resemblance to Nazism seem to ignore the historical context of the image offered in the asset author's description. Just a few hours later, the author replies directly to the comment:

> I definitely see the resemblance, but the particular image I posted is the symbol of the United Farm Workers (UFW), a labor union during the 1960's. This particular union is said to be the beginning the Chicano rights movement, therefore I think it's an essential symbol of Chicanos. The eagle in the middle, to my understanding, is the Aztec eagle which is also located in the Mexican flag but I don't know if the circle and geometric logo was intentional or not.

The student first acknowledges the similarities in colors, but goes on to to explain in more detail the specific significance of the flag and the symbology it employs to represent Chicano culture. A few hours later, another student replies directly to the first comment, this time taking a less hospitable posture. He writes:

> Hi [name], why are you disturbed by the flag's image? While I do think there is some resemblance to the nazi flag in colors, I do not see too much resemblance beyond that. Frankly, I am disturbed at your lack of knowledge of this particular flag.

The parenthetical "and disturbed" in the original comment becomes a focus point of the reply, which makes clear that equating a movement focused on the empowerment of an oppressed group with a fascist, genocidal political party based on some insignificant visual similarities is irresponsible and ignorant. The same student adds another comment, this time in reply to the asset, and provides further historical insight into the significance and meaning of the flag. Although the original commenter never posts a response, the inciting comment sparked a deeper explanation of the historical significance of the asset that provided a peer with new understandings.

Opportunities For Innovation

In orchestrating a peer to peer learning model, moments like the comment thread above about the Chicano flag represent part of the pedagogical ambitions of the course, where the collective intelligence and experience of the network augment the instructional content with emergent and unanticipated opportunities for learning. Still, there are apparent shortcomings and unaddressed challenges in relying on the feed to consistently facilitate deeper interaction with course content, such as the lack of back-and-forth dialogue. This article does not look at discourse and interaction in the Asset Library in relation to the other kinds of communication and activity across the other SuiteC tools and course, which may provide evidence that interactions in the feed serve as a catalyst for deeper relationship formation and meaning-making in the Whiteboards, where two people or more peers collaboratively revisit and reuse assets from the Library. For example, the Chicano Labor movement asset also appears in three Whiteboards, each of which continue to elaborate upon and generate new social and semantic connections with the asset.

The problem of trying to ensure the feed has both enough assets to maintain a consistent flow of new contributions and not so many assets that the feed becomes overwhelmed with noise is not unique to our educational context, as social media companies are continuously tweaking their recommendation algorithms and developing technical solutions to improve the relevance and value of the content that appears in a user's feed. During the four semesters, SuiteC also introduced new features to improve engagement in the feed, such as more robust filtering options, the ability for students to restrict assets from entering the feed if they were only being used in Whiteboard, interaction history visualizations that render visible who viewed and liked a particular asset, and the Impact Studio, which provides several more visualizations of interaction history, trending content, and social ties as a more strategic entry point into the feed.

Beyond the technical challenges of the feed, issues more specific to the peer-to-peer or networked pedagogy emerge around the curriculum. As the findings suggest, student activity

predictably maps to the curriculum prompts, both in the quantity of those engagements (e.g.: number of assets posted) and the content of those engagements (e.g.: discursive features of comments). When those social interactions remain fully oriented towards satisfying course requirements and one's own course success, they risk losing their authenticity, their vitality, and ultimately their value. Building in more prompted comments, for example, may help increase the amount of comments, but does not ensure that those comments incite further dialogue and opportunities for learning. Overly scripting every micro-interaction is both difficult from a course design perspective and seemingly antagonistic to the spirit of peer-centered pedagogies, where the learning opportunities and engagement should be more self-directed.

Perhaps technological innovation can still play a role in more effective social learning course design. Where "adaptive" learning courseware have been used to personalize learner pathways through instructional content via structured interventions based on past student performance, perhaps there is a way to use machine-generated recommendation to guide social interaction. For example, instead of each week all students moving through the same shared set of activities and prompts, software could generate weekly participation goals based on past interaction history. If the previous week, the student's activity profile oriented more around asset-production, goals for the following week might focus more on commenting and generating dialogue and feedback around those articles. If the software detected an overall decline in asset viewing and liking, it may prioritize those activities for everyone the following week. As opposed to the narrow adaptive learning pathways designed for moving a student quite deliberately towards a fixed learning objective, this kind of social activity recommender would provide suggested domains of activity focused on both the individual developing a broad repertoire of social engagement and the overall health of the learning network.

When it comes to the health and utility of a learning network, I contend that the first priority must be to ensure that the community is inclusive, and that participants feel welcomed and supported to share and explore each other's contributions. Leveraging technical and pedagogical innovation to fold diverse perspectives and cultural resources into the classroom discourse not only supports those individual students in establishing social ties that can enhance their feelings of connection and ultimately help them succeed in the course, but also generate important learning opportunities for peers who are exposed to those perspectives. As the scrutiny and criticism being lobbed at established social media giants continue to increase, educators are in a unique position to use their pedagogical understandings to rethink how social media tools like the feed may be most effectively designed and implemented into both formal and informal learning contexts.

Chapter 3: (re)Assembling Media: Remixing Course Content in Collaborative Whiteboards

Transforming Meaning from Analogue to Digital

Roland Barthes (1967) famously refers to the text as a "tissue of citations" (p. 4). While Barthes means tissue in the sense of fabric, I this the metaphor can also be applied to tissue in the body, especially when we consider the dynamic, *living* state of digital media. The biological image of elastic bands woven together, mediating the flow of oxygen, flexing and stretching to keep organs in place, resembles the way literary citations, forms, and ideas are strung together and stretched across a page by an author in mediating the flow of meaning from one sentence to another. Barthes' metaphor challenges both the autonomy of the text and romanticized notions of the author as a solitary genius, and while his ideas predate the digital, they resonate in the multimedia texts that permeate across social networks and online environments, assembled by *remixers* who stitch together, manipulate, and layer existing fragments to create *new* media.

Though a precise definition of remix appears elusive because the practice itself is so divergent, remix generally involves the process of sourcing existing materials and *transforming* them into something new (Edwards, 2016), where transforming may involve any number and variety of changes to the existing material. Many trace the first usage of the term *remix* to 1970s dance culture in New York City, where DJs began releasing mixes of and loops of popular dance tracks for play in clubs and discos, a practice which can also be traced to 60s reggae and ska music in Jamaica (Borschke, 2017). For Lawrence Lessig, renowned remix scholar and advocate, remix can be observed broadly across cultural practices throughout history (Lessig, 2008). Consider, for example, pre-writing societies, where passing stories from one generation to another involved the continuous transformation of stories, as the teller made various adaptations and modifications to the previous version to fit the present moment (Ong, 1982). In the artworld, Duchamp's "readymades," epitomized by his 1917 "Fountain," reveal another form of remix, where, by taking everyday objects produced through industry and re-situating them in the art gallery, Duchamp brings new meaning and perspective to the objects while challenging traditional notions of art, originality, and creativity (Goldsmith, 1983).

In digital culture, because of the modularity and multiplicity of digital media- a concept I will return to later- as well as the availability of digital tools for editing, curating, and manipulating media, remix has exploded upon the cultural imagination. From the audio mashups of contrasting musical genres by artists like GirlTalk to sites like "Meme Generator" which allow anyone with Internet access to remix different images to create jokes and social commentary, remix practices are now thoroughly embedded in both popular art forms and vernacular activities. But beyond entertainment and leisure activities, I argue here that remix practices have also emerged as important

forms of literacy, meaning-making, and knowledge-building that deserve attention in the educational experience of students.

Looking at examples of students' individual and collaborative remix activities in an undergraduate literacy in education course, I explore the pedagogical and social dimensions of remix as an academic practice. The particular course under investigation is unique in that it deployed an innovative software-called SuiteC- optimized for remix, allowing students to remix course media "assets" shared by peers in a social media library to design multimedia pieces as well a curriculum that intentionally creates opportunities for ongoing remix of past assets. Through analysis of student artifacts, analytics captured from the SuiteC software, and feedback from instructors and students, I focus on student composing practices in taking existing assets shared by peers and reusing them in digital "Whiteboards" to expand upon and create new meanings in developing understandings of course content and connecting with others.

Research Questions

Question 1: How did course remix activities frame different kinds of media reuse and asset transformation in student composing practices?

Question 2: In cases where a single asset was reused many times by many students, how did each instance of remix expand or shift the meanings of that artifact from its original posting?

Question 3: How did students respond to and reflect upon their engagement with remix activities, and what kinds of tensions and opportunities emerged when remix practices were introduced into the academic environment?

Ripe for Remix: The Modes of Media

Although Thomas Edison's 1922 prediction that the moving picture would replace all textbooks within a generation was never fully realized, video and multimedia play an increasingly important role in the educational- and in particular- the online learning experience (Oppenheimer, 2004). In assessing the value of recorded instructional videos delivered in virtual learning environments, proponents of online learning argue that, beyond just saving the university on space and costs, videos and other forms of digital media mediate a more effective, interactive learning experience compared to sitting in the audience of a live lecture, especially for so-called "digital natives" primed for engagement with the screen (Gu, Zhu, & Guo, 2013; Jones, Ramanau, Cross, & Healing, 2010). Because of the central role video content plays in online and blended learning instruction, research into video learning experiences have developed sophisticated means for tracking engagement, including eye-tracking software and clickstream analytics to identify the optimal duration of videos and other means for increasing attention and retention (Kim et al., 2014; Schitek et al., 2005),

Not only are students consuming more video and multimedia content as a part of their learning experiences, but innovations in multimedia production tools are also amplifying opportunities for students to produce multimedia content (Beer & Burrows, 2010). For educators and course designers whose pedagogical orientation focus on learning as a generative process- one where students actively produce or *construct* meanings and understandings about the world- Web2.0 offers a rich new landscape for such learning to thrive (Lankshear & Noble, 2014; Rosen & Nelson, 2008). The turn in literacy theory toward "multimodal" (Kress, 2004) frameworks directly challenges print-centric notions of reading and writing, and calls for educators to take advantage of digital tools to promote literacy practices that include combinations of sound, image, voice, the body, and other available modes of expression (Katz, 2014; Jewitt, 2008;). From SnapChat filters that augment selfies with texts and graphics to blog posts with animated GIFs and embedded videos, orchestrating

and decoding multiple digital media formats in combination has become an essential literate capacity in the digital moment (Vasudvan, Schultz, Bateman, 2010; Hull, 2003).

Of course, multimodal forms of meaning-making occur throughout human history, though print-text has no doubt been the preeminent mode of school-based literacy and professional knowledge production in the modern age (Jewitt, 2012). But the rise of digital technologies marks a profound shift in how we produce and interact with multiple modes of media, because with digital media, we only experience those modes as simulations- binary code wrapped in a format or codec (jpg, mov, mp3, pdf, docx) and projected on a screen (Manivech, 2014). Recognizing the "computer as a mode of simulation" (Galloway 2004) the material distinctions between physical modes- a written letter, a photograph, or a film reel- appear only as changes in the underlying software code performing those media. A digital image and digital movie are not different kinds of materials, only different kinds of information engineered to simulate their material parallels. An illuminating example of this simulation effect can be observed in the practice of "datamoshing," or "the process of manipulating the data of media files in order to achieve visual or auditory effects when the file is decoded[11]," such as tampering with the raw data of an image file to create visual glitches and distortions, even transforming the image file into a sound file.

The bytes of information that perform media are also capable of being rapidly serialized and combined with other information to form new media (Manovich, 2005). Practices such as stitching together snippets of code from open-source software repositories like GitHub, ReTweeting a video clip on Twitter, and designing a collage of images in Photoshop are all made possible because of the relative ease of copying and pasting the information underlying digital media. Although graphical user interfaces disguise many of these processes from the end user by implementing an iconography that represents familiar physical tools (or in some cases, exclusively-digital tools), underneath the hood, users are only manipulating information coded to perform those abilities (Manovich, 2014; Drucker, 2014). Consider the "scissors" icon available in most media editing programs. End users deploy this tool with the familiar purpose of "cutting" out part of an image, as one would do with a page from a magazine. But because they are not cutting a material artifact, but rather subtracting information from the code simulating the artifact, they can very easily undo or redo this cutting by preserving that information through copying, versioning, and other features baked into the software interface.

In recognizing the underlying similarities across modalities and formats of digital media, I do not mean to outright dismiss important distinctions between modes. The experience of watching or editing a time-based media like a digital video compared to reading or composing a long-form text in a Word document is significantly different, as are the compositional strategies an author employs in creating various forms of media. Digital media formats can also be distinguished by the machine labor required to produce and consume them. Calculated in bytes, a digital video file contains more complex information than a text file, and therefore requires more machine labor to process, consistent with their material parallels in the way a film costs more to produce and distribute than a paper novel. However, innovations in file compression, wireless infrastructure, and processing chips that combined serve to reduce the size and cost of bytes have transformed the early print-centric and low-fidelity media web worlds into multimedia-rich landscapes. Everyday digital communications between people online are no longer simply lines of text, but they are texts infused with emojis, GIFs that express emotional states, and even augmented reality states such as the iPhones latest "Animojis"[12] feature that allows the user to *become* an animated animal in a video message.

The multimedia capabilities rendered possible through innovations in the way information circulates, combined with the tools to rapidly copy, paste, and modify the information simulating

[11] See datamosh.com for examples of this practice

[12] https://www.theverge.com/2018/6/4/17426092/animoji-update-memoji-announced-apple-wwdc-2018

media on our screens make the current moment ripe for remix. The central role remix plays in digital culture resonates across many aspects of social and economic life. Copyright and intellectual property laws have needed revising with the rise of digital piracy and the ease of file sharing, yielding new methods of enforcing copyright, such as the algorithms on YouTube that identify unauthorized use of copyright-protected music in user-uploaded videos, as well as new remix-friendly forms of intellectual property attributions, such as copyleft and creative commons (Rimmer, 2017; Lessig, 2004). Journalistic practices have shifted toward aggregating and curating media resources captured by everyday people shared to their social media profiles and discovered by others through trending hashtags (Bakker, 2014). The funny, the tragic, the heroic, and the extraordinary become situated in a seemingly endless parade of remixes that etch an event into public consciousness and popular culture. In the sections that follow, I outline two aspects of remix that are both central to a remix culture and relevant to my investigation into the SuiteC Whiteboards: Remix as information sharing and Remix in multimedia composing. For the former, I describe the ways digital information flows through networks of individuals through practices of media curation and "redistribution" (Edwards, 2006), and how these shifts in the way people consume and produce information privilege and demand certain kinds capacities which schools and educators could play an active role in supporting. For the latter, building remix practices deliberately into a course experience offers students opportunities for collaboration and sense-making as they assemble diverse kinds of artifacts in expressing understandings of course concepts.

Information Sharing

The ubiquitous presence of social media in the daily activities of people with access to smartphones and Internet has changed the way we access and engage with news media and information of all kinds, evidenced in reports that claim two-thirds of adults consume some of their news via social media (Shearer & Gottfried, 2017). For daily social media users, a push notification on their phone from Twitter or Facebook may serve as an initial point of engagement with a breaking news story, from which they may search a trending hashtag that organizes related media content, or they may scroll through their newsfeed to see how networked connections are responding to media about the event. Soon enough, users may find themselves meandering down a rabbit hole of hyperlinks and commentary about the happening, engaging with media shared by friends with pithy captions, articles and videos posted by journalists from major news outlets, and even humorous memes parodying the event as it unfolds.

Whereas in the television broadcast model viewers consume content distributed through several channels controlled by a few large corporations, in an online network each individual node serves as a point of distribution. A peer-to-peer distribution model helps to shape a "participatory culture" (Jenkins, 2004) in which individuals contribute to the spread (and virality) of media and media events, often through practices of curation performed by both people and machines. Social media users curate their network by forming and managing connections with people and brands. Machines curate News Feeds through sophisticated recommendation algorithms that organize and display content generated by a network. And people curate a digital identity or "digital body" (boyd, 2004 p. 34) over time through posting photos and status updates for their network. In stitching together a digital presence, people curate information through sharing and re-sharing media content to members in their network, or followers (see chapter on Asset Library). This kind of curation practice, what Edwards (2009) refers to as "redistribution," is fundamental to the ways people discover information about the world and their communities in social media environments.

The redistribution of media performs a remix by introducing an artifact into a new context (c.f. Bauman, R. & Briggs, C.L., 1990) or sharing it with a new audience (Edwards, 2016 p. 23). When social media users share an artifact, it reaches a (potentially) new network of nodes, who often make sense of the artifact in relation to what they know about the connection who shared it. With

each unique caption or commentary social media users add to an artifact, the artifact acquires an additional layer of meaning, traces of which travel with the artifact when re-shared by someone else, and someone after that. A Facebook post, for example, can have several temporal layers of activity and authorship etched around the origin artifact- traces of remix events. In other cases, a person may deliberately erase those historical layers. By downloading or 'ripping' online media onto a local machine, users can sever the chain of iterations, and proceed to alter or modify the artifact itself to articulate new meanings and incite a new trajectory of redistributions and remixes. Digital media even sometimes show the wears and tears of reuse over time, as downloading, uploading, screen grabbing, watermarking, photoshopping, and file compressing contribute to lost pixels and warped dimensions that compromise the quality of an image or audio file (Zhang, 2015).

With each redistribution, media are copied, modified (however slightly), and circulated anew, resulting in (potentially) millions of modified copies making their way through digital networks. This process can be observed with "image macros" (Shiffman, 2014), where the same image permeates across the web with different captions and remixed forms, such as "The Most Interesting Man in the World" meme (see Figure 29: Most Interesting Man in the World meme), which has been copied and remixed dozens of time to critique and satirize politicians, professional athletes, pop culture icons, global fads, ethnic and religious groups, other memes, and even itself.

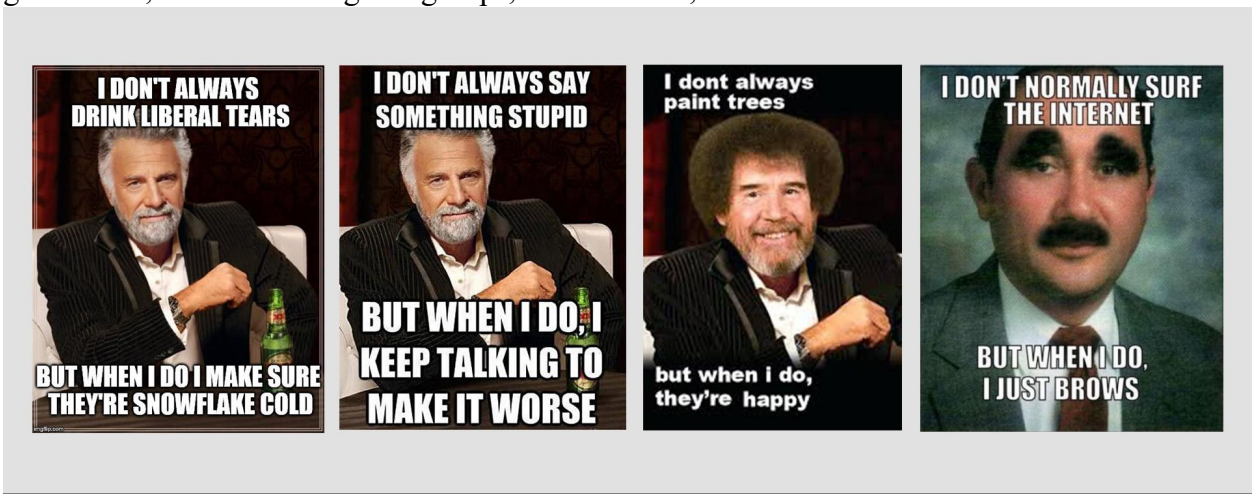


Figure 29: Most Interesting Man in the World meme

Because digital media *desire* to be remade and move through networks as modified copies, digital media are more akin to energy forces, emergent in form and dynamic in meaning, than static material artifacts (Tavares, 2015). The capacity for digital media to be updated and edited at scale in real-time, and for it to be endlessly copied and modified provide a rich new kind of information sharing landscape that is also vulnerable to manipulation and misrepresentation, such as "fake news" that deliberately spin inaccurate information (Tandoc, Lim, & Ling, 2018) and "bots" that inflate views to drive engagement around inflammatory content (see Engagement Index chapter).

Effective, critically-alert social media users read across multiple layers of content and its history of usage and evolution, establishing relationships between the content and the person or brand posting content, verifying the authenticity and reliability of the content by looking at past and parallel instances, and reading comments threads to perceive how the crowd is making sense of the content (Pangrazio, 2016). Part of making sense of this complex information landscape often requires users visiting sites that serve as a kind of meta-layer that organizes media histories for users. TinEye[13], for example, allows a user to reverse-search an image to see where it first appeared and where else it has

[13] https://www.tineye.com/

appeared. Sites likes Snopes[14] allow visitors to verify the degree of authenticity of viral media, such as a Twitter post that claims falsely claims some statement of fact. For tracing the history of a popular meme, like the "Harlem Shake," "Know Your Meme"[15] explains the origin of the meme, offers various popular examples of different replications of the meme, visualizes popularity metrics of the meme over time, and even identifies offshoots of the meme that may have contributed to other viral events.

For educators, this shift toward a social information age, where students navigate fluid arrangements of people and machines circulating and generating data, calls for pedagogies that both take up these new practices of learning and knowledge sharing as well as prepare students to ethically and critically navigate networked environments in their personal lives. Education technology consortiums like the International Society for Technology in Education (ISTE) have devised various "21st century learning standards"[16] that focus on the skills and dispositions students need to effectively wade through streams of information and media, and to discern between different kinds of information with ambiguous contexts shared by unknown sources that may or may not even be human. Even in the earlier days of digital computing, scholars across the learning sciences began to reimagine learning, literacy, and cognition theories to better account for a new information paradigm. For example, cognitive psychologist Rand Spiro proposes "cognitive flexibility theory" (Spiro, 1992) as a model of cognition that expresses how people make sense of and learn in "hypertext" environments that are highly unstructured and prone to change. later, a consortium of linguists, cultural anthropologists, literacy scholars, and educators convened as the "New London Group" to reconceptualize notions of literacy and textuality for a digital age, proposing that "new" literacies encompass a broader range of texts and tools for meaning-making than have been traditionally reified by educational institutions.

These early theories of digital literacy and learning could only imagine the kind of radical new connectivity and media sharing enabled through smart phones and ubiquitous computing. The rise of the digital network began to spring forward theories of learning like "connectivism" (Siemens, 2005), which privilege the ways connections between people are generative sources of knowledge. In these sharing networks, users frequently curate media from sources across the web to represent their lives, interests, their interests, and their perspectives (O'Neill, 2012). Curating is, therefore, commonly identified to as a key "digital" literacy skill for today's students (Cohen & Mihailidis, 2013). In order for students to be effective curators and contribute positively to both public and classroom discourse, educational professionals have become tasked with preparing students to be critical participants in an information sharing culture (Nagle, 2018).

Engaging these practices of information sharing and redistribution in online learning environments has become more common, where, beginning with some early versions of the discussion forum, course designers and product developers pursued tools and activities that invite students to share their opinions, questions, insights, and resources with each other (See Asset Library chapter). Integrating popular social media tools like Twitter, Facebook, and Tumblr has been one strategy used by learning designers to facilitate information sharing practice in a course experience, as those tools offer some familiarity for many students, and may help them think critically about their social media practices as they take up those tools in an educational context (Salmon, 2015; Dunlap & Lowenthal, 2011). At the same time, students, instructors, and administrators may be reluctant to incorporate commercial tools because of their overlaps with participants' personal lives and conflicting financial interests that create numerous privacy concerns as well as a lack education-specific features and clear connections with other educational technologies in the course, such as the

[14] https://www.snopes.com/

[15] https://knowyourmeme.com

[16] https://www.iste.org/standards/for-students

campus learning management tools (Friesen & Lowe, 2012). Social and collaborative eLearning technologies, like the social pinboard Yellow Dig and the popular discussion tool Piazza, have tried to fit together social media features and pedagogical features, though these edtech tools may lack the intuitive user experience and robust functionality offered by more well established and well-funded social media companies.

Remix in Multimedia Composing

Where redistribution as a remix practice focuses on the movement of a media artifact (information) as it circulates from one context of viewing to another, we may also consider how it becomes entangled or enmeshed with other media. In other words, a Twitter user might retweet a video without altering the video itself, or she may edit a snippet from that video together with snippets from several other videos and then tweet out a "new" compilation video. Edwards (2016) refers to this remix practice of stitching media together, or "compiling, aggregating, and juxtaposing existing texts" as "assemblage" (p. 41). Given the plasticity of digital media, software applications abound that offer users a variety of tools to assemble and disassemble media into remixed texts. Users may drop images and video clips into a timeline interface to produce time-based media like videos and podcasts. They might organize thematically-related blog posts, news articles, and video clips into a "story" to compose a meta-narrative about a topic or event (Fincham, 2011). Or, they might arrange media elements spatially and over-lappingly on a digital canvas, to create a media collage of a pop culture icon, to organize a schematic of the relationships between media elements, or to design a powerpoint slide. Whichever tool a user chooses for slicing, combining, sequencing, and mapping media, practices of remixing media involve sampling from aesthetic features and semiotic information from different media sources, and assembling that content into some new composition that more or less resembles the media from which it has borrowed.

Though Edwards limits his description of assemblage to a mode of remix, "assemblage theory" provides an ontological framework for explaining complex sociotechnical systems that is useful for understanding the ways people assemble media content when composing remixed texts. DeLanda (2005), building upon the seminal works of Deleuze and Guattari (1987), describes assemblages as "emergent wholes," and as shifting configurations of heterogeneous, autonomous component parts- people, technologies, media- capable of being plugged in and out of many, multiple systems (p 5). DeLanda stresses that when components enter into an assemblage, they do not dissolve into a mixture, but form "exterior" relations to other components that bring into being their "virtual" or potential properties. Depending on the configuration, the same component may function or appear differently from one assemblage to another, such as the same "viral" video clip remixed many times over, each remix a new assemblage of media with unique meanings.

Assemblage theory can also help to situate composing practices in relation to the larger networks that mediate them, or "assemblages of assemblages" (DeLanda), such as the vast technologies engaged with users when remixing media. Consider, for example, digital storytelling, a popular digital composing practice that takes many forms. While some of the first digital stories were composed by remixing personal photographs to narrate a story (Lambert, 2013), another popular form of digital storytelling feature video montages with images download from web searches, sequenced, and edited together with a voiceover to narrate a personal story (Hull & Nelson, 2005). Each component image contributes some semiotic, emotional, or aesthetic information that, when assembled together and juxtaposed against the audio layer, express the narrative as an "emergent whole" (DeLanda, 2015) A crucial and tedious part of this composing involves searching for images, often by typing keywords into Google Search, browsing the images that the Google algorithm surfaces, then choosing and downloading the most fitting image, and finally adding it into the software's editor timeline. While the composer may be quite deliberate and pain-staking in searching for just the right image and in orchestrating connections between images, the Google algorithm

makes a number of decisions about the order of those results by pushing content to the top based on popularity, recency, and the user's browser history, none of which may be immediately relevant to the semiotic or aesthetic attributes sought by the remixer (Pan et el., 2007).

Assemblage theory remains alert to these entanglements by emphasizing that the relations between components are only "contingently obligatory", and that they come together in unpredictable ways to animate an assemblage, such as in the way images of a digital story are sourced through algorithmic search. I have described elsewhere cases of youth digital storytelling in South Africa, where search algorithms acted directly upon composers' selections to create unanticipated meanings, as with one student who used a famous photograph of retired African-American football player OJ Simpson in a courtroom during his murder trial (Hull & Scott, 2014; Castek et al, 2015). The student did not know who Simpson was or the historical context of the image, but the notoriety of the image pushed it to the top of the results page when searching "lawyer" on Google, and was also one of only a few images that included a man of color. Coupled with the student's audio narration, the courtroom background directly expressed his desire to be a lawyer without needing any specific awareness about Simpson, and for most of his South African peers, the image did not have any meaning beyond this representation of a lawyer. But for those familiar with the image and with the Simpson trial, the photograph captures the turning point moment in the trial orchestrated by Simpson's not pictured attorney, long-time civil rights lawyer Johnnie Cochran, leading to a reasonable (but not actual) interpretation that the student chose the image because he aspired to be the man *behind* the image, not the man accused of murder *in* the image. An unintended expression of the relationship between the composer and the algorithm, information not pictured and not even known to the composer made its way into the narrative by way of remix, as an effect of copying and pasting digital information from one media assemblage to another. As the same artifact appears as a component in multiple assemblages, its meaning can be located in the historical layers it accumulates as a text in motion.

Although the "emergent effects" (DeLanda, 2014) of these contingent relations may be unexpected at times, effective remix composers communicate their meanings through a deliberate process of preserving, erasing, and combining the information underlying digital media. In some cases, a composer might be in need of a specific color or texture for a composition, and remix a photograph with the intention of only preserving and multiplying a small swatch of pixels, erasing or cutting-out everything else from the image. At the other end of the remix spectrum, the composer may choose to retain all the information in an image, such as with the digital storyteller who, by dropping an image from the Simpson trial into his timeline, uses the entire image to represent a moment in his story, remixing the image by combining it with other information- his audio narrative, the adjacent images in the sequence, and visual effects- to firmly establish the relation between the image and his personal story. In this instance, the composer frames the remix of the image as purely representational, but other instances of remix may intend to foster a more analytical framing of the image. Someone composing a timeline of events in the Simpson trial in the Storify program, for example, would likely use this same photograph, though not to connect it to a personal narrative. Instead, by adding information such as temporal markers, blocks of text, and other media, the composer, visually and with meta-commentary, organizes insights and connections across key moments from the trial to analyze the historical event.

Because assembling remix texts demands complex composing practices by their authors, educational and new media scholars have called for the increased inclusion of remix activities in school-based activities. Literacy scholars Knobel and Lankshear (2007) elaborate on the central role of remix as a mode of meaning-making in digital culture, and highlight examples of classroom learning activities like music remixes and pop-culture remixes that both preserve the "ethos" of remix culture and demand highly literate abilities to compose effectively (31-32). Classroom activities may also maintain this remix ethos by encouraging students to take up positions of resistance and critique in designing "critical" remixes that purposefully reappropriate dominant cultural representations to

subvert or challenge them (Gallagher, 2018). Remix composing can also prompt students to connect with their own personal and cultural worlds, either through narrative forms like digital storytelling or in more conceptual forms, such as students remixing "funds of knowledge" by drawing connections between cultural resources and learning content (Moll et al, 1992).

Further, collaborative remix composing can become sites of dialogue between students, as they make sense of cultural resources shared by peers to expand upon their understandings of course ideas and foster more diverse perspectives. Remix composing tools designed specifically for use in learning contexts, therefore, should be designed to both satisfy institutional policies governing academic integrity while also mediating diverse forms of remaking and reusing information resources in developing and demonstrating understandings of course objectives. Using markers, chart paper, and visual media photocopied from textbooks and magazines to design timelines and concept maps have long been part of pre-digital classroom curricula, helping students organize the various parts of complex concepts or events (Wanga et al, 2017). However, the more radical and creative forms of copying and sharing that color new media practices often appear in tension with academic integrity policies that adhere to more traditional notions of authorship and originality, limiting the potential for remix practices to play a more central role in facilitating learning experiences (Jenkins, 2004). The potential for a new kind of tool intentionally designed for academic remix in a curriculum, therefore, may help in both resolving these tensions and expanding the possibilities for remix activities in the classroom.

Sharing and Composing in the Asset Library and Whiteboards

Knobel and Lankshear (2007) use the phrase "endless hybridization" in describing how every remix results in a new opportunity for another remix. Memes and viral media express this endlessness through their continuous replication and modification. In trying to design a learning technology to mediate this endless hybridization in an online course environment, the SuiteC applications organize media content in an uninterrupted loop between a social sharing, curation space- the Asset Library- and a collaborative composing space- the Whiteboards. In the Asset Library, students "redistribute" media by curating content from the web or uploading media from their devices, adding hashtags, titles, and descriptions to a media post, and sharing it as an "asset" into the Asset Library. Once in the Asset Library, assets enter into a social feed, viewed in rows of thumbnail preview images organized by most recent, and filterable by popularity, hashtag, author, and media type.

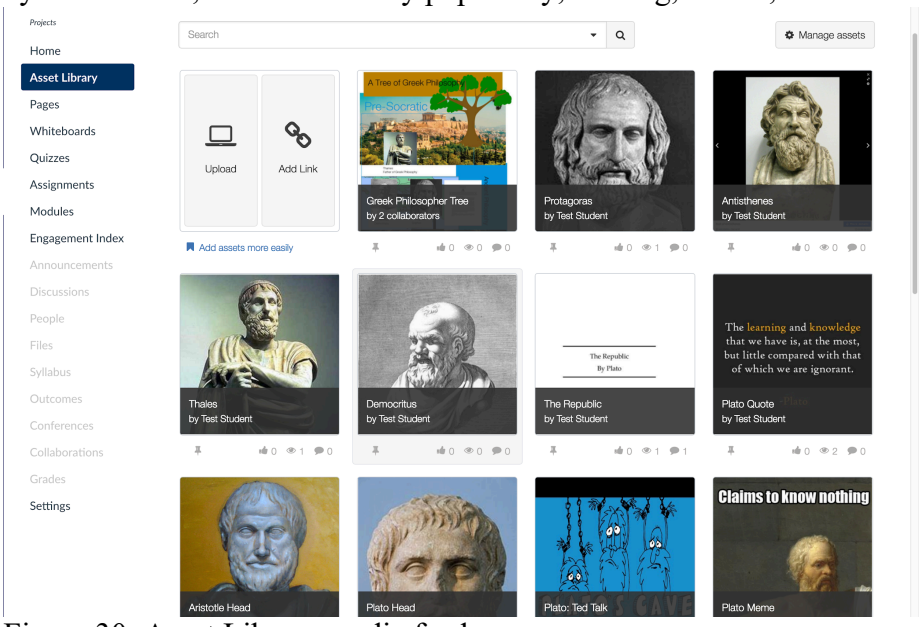


Figure 30: Asset Library media feed

Assets in the Asset Library include all kinds of media content- text docs, video links, images, animated GIFs, presentations, and website previews- visible to all the participants in the course environment. When a participant clicks an asset in the feed, the asset opens in full-screen view, where they can then comment and like it with a "thumbs-up" as well as view the total amount of engagement an asset has received from others.
In the Whiteboards, students can work independently or in groups to design multimedia artifacts. Students can search and add assets from the Asset Library to their Whiteboard canvas while composing, which is a key feature that supports the remix ecosystem, s.

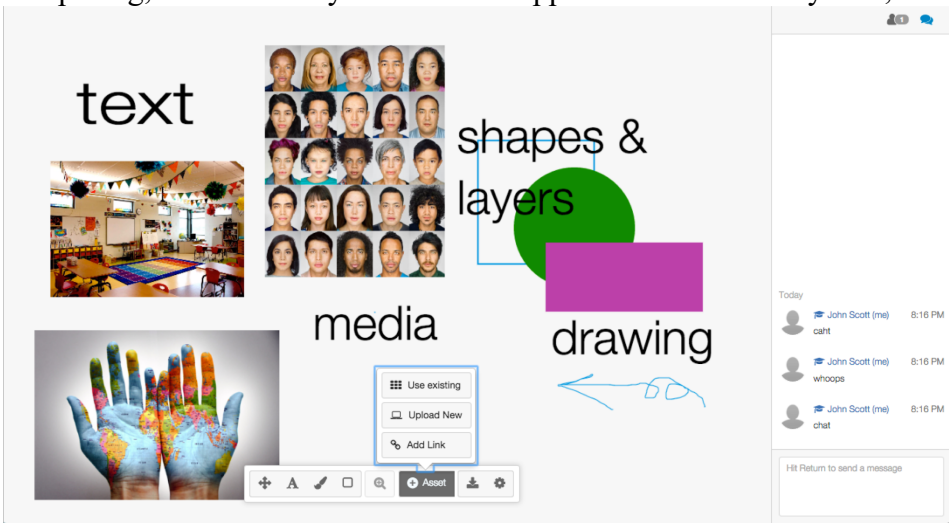


Figure 31: Whiteboards composing tools with "Add Asset" tool open

Assets added to a Whiteboard canvas appear as their Asset thumbnail previews, which include a direct link back to the original asset in the Asset Library. The link back to the original asset serves as a means of citation as well as a way to revisit the asset's description, social metrics, and comment threads. Students can resize and layer assets on their Whiteboards with other design elements, such as colored shapes, free-hand drawings, and text. Students can invite peers to collaborate on their Whiteboard, which they can work on asynchronously or synchronously while communicating via a built-in messaging feature. Once they have finished their Whiteboard, students can export their creation to the Asset Library, where it will appear as an asset that can be interacted with and remixed by others in the course. When viewing an asset that has been reused in a Whiteboard, students can link directly to those Whiteboards, and interact with them like other assets. Remixing a Whiteboard asset allows students to open an editable version of the Whiteboard, where they may proceed to add new elements or modify existing elements. Because the SuiteC software builds in citations and links that maintain connections between an asset and each iteration and type of remix, students can readily observe the different ways an asset is taken up by peers, as well as helping ensure that remix practices taken up in the classroom do not violate the spirit of academic integrity policies.

In an effort to take advantage of this ecosystem for remix, the online undergraduate literacy course in education intentionally organizes student learning activities that include opportunities to both redistribute media assets from the web and then to reuse those assets later in the Whiteboards. For example, during "Inspire" activities," students are tasked with curating or "redistributing" media into the Asset Library, such as in finding an image or video to represent "what it means to be literate in the world today." During "Collaborate" activities, students work jointly in small groups or pairs to design a Whiteboard, often assembling together new assets or reusing existing assets shared by peers during the Inspire activities. During "Reflect" activities, students may be tasked with visually organizing instructor and peers assets from over several weeks of the course to build connections

between course ideas and readings, or deepen connections between their personal experiences and the course topics.

Generally, the remix practices in the Whiteboards do not involve the intensive alteration or manipulation of visual media. The lack of "cutting" tools and the inability to adjust colors or add filters to assets limit opportunities for this kind image editing. Instead, assets are typically mapped onto the canvas and connected to each other visually through the shapes, lines, free-hand drawing, and text tools available in the Whiteboard editor. A composer may layer design elements on an asset as a means of directly manipulating the asset image, such as in coloring over an image with the freehand drawing tool. However, in the education course, remix practices were more focused on spatial mapping in the ongoing process of assembling and reassembling knowledge assets in the course. In their description of students' collaborative concept mapping using analogue tools, Wolff-Michael Roth & Roychoudhury (1994) describe "the map's emerging structure as part of a taken-as-shared problem space...in which the participants can refer to common objects by means of words, drawings or gestures (p 439)." As a "shared problem-space," Whiteboard activities intend to foster connection and ideation among students, scaffold understandings of course content, and tap aforementioned "21st century skills" like multimodal design, collaborative thinking, and critical analysis of different media forms and content sources.

Texts in Motion: A Meme Methodology

Anthropologists have long been interested in understanding practices of meaning-making in a given community or cultural group, generally employing ethnographic methods to form a detailed picture of how tools, interests, beliefs, values, and power intersect in social discourse (Heath & Street, 2008; Geertz, 1973). As these communities and practices have migrated to online environments, scholars have attempted to revise ethnographic techniques for "virtual" and "networked" spaces (Miller & Slater, 2000; Postill & Pink, 2012). Where the traditional ethnographer embeds herself physically in the space of a community and experiences social activity in the real-time interactions of the group under observation, the collapse of geographical space and temporal distance in online environments demands the ethnographer rely more heavily on traces of digital presence, or the media artifacts that people assemble in social exchange and the production of this virtual presence.

Because remix practices in the course are mediated by the activity prompts, I begin my analysis by organizing a simple taxonomy of remix activities from the course curricula. The categories of the taxonomy focus on the ways that the remix curricula ask students to both source media or assets from the Asset Library or web, as well reorient the meaning of those artifacts, such as in representing some aspect of their life or in representing key ideas from the course. Recognizing how the curriculum prompts students to frame media from the web or existing assets in a particular way or for a particular purpose is a crucial step toward analyzing how the remix transforms or re-contextualizes those media to produce new meanings. I draw from multimodal analysis (Hull & Nelson, 2005) techniques to interpret the diverse ways semiotic and discursive materials are taken up by authors in their meaning-making practices. Selecting three Whiteboards as examples, I focus my analysis on how students used combinations of image and text to demonstrate understandings of course concepts, connect with peers, and bring their own cultural narratives into the course community.

I also examine one instance in which an asset became a kind of meme in the course, reused and remixed by many students on many Whiteboards over a duration of time. I employ techniques used in the analysis of online memes and viral media (Knobel & Lankshear, 2006; Schiffman, 2014) to trace the circulation and recontextualization of an asset as it proliferates across the learning community. I visualize the event as a kind of timeline or map of connections between Whiteboards that all share a common, remixed asset. Further, I analyze the Whiteboards individually to understand

how each instance of remix sets the asset in unique combination with other media elements and assets to generate new meanings. Looking at each Whiteboard as an assemblage and each asset and media element as a component of that assemblage, I consider how instances of reuse expand upon or reproduce meanings from the source of the remix. In other words, we might think about more creative and inventive instances of remix as those acts of composing that add rich new layers of meaning and connection to an artifact- to transform it- compared with composing acts that more simply implant an artifact in a new context without expanding those meanings in a significant way - to reproduce it.
I then analyze student and instructor feedback about the collaborative composing and remix practices engaged in the Whiteboards. Drawing from student survey responses, student interviews, and anecdotes from instructors, I consider the effectiveness and relevance of the collaborative remix activities as learning activities that intend to support students in making sense of and critically engaging with their course content. To organize participant reflections on the value of the remix activities, I distinguish between the pragmatic and the pedagogical. The former includes student commentary directed more at the efficiency and logistics of the activities, such as features of the SuiteC tools that support collaboration with peers. The latter includes student commentary directed at the perceived value of the remix activity to the overall experience of the course, such as its perceived impact on their learning or enjoyment in the course.

Activities for Remixing

Focusing on the syllabus for Course II[17], students engaged in a total of 18 Whiteboarding activities over the 16 week course. In identifying both the source and the purpose of reuse outlined in the activity prompts, I first determine from where or from whom assets were harvested and added to the Whiteboards. Across the 18 Whiteboard activities, assignment prompts ask students to source assets for Whiteboards in four ways: Past Self-Authored Assets, or assets that a student uploaded to the Asset Library herself at some earlier point in the course; Past Peer-Authored Assets, or assets that other students uploaded to the Asset Library; Past Instructor-Authored Assets, or the instructional assets in the Asset Library like course readings and videos; and Direct from the Web, or assets added directly from the web to the Whiteboard.

While the specific objectives or learning outcomes for each activity are unique, the activities prompt students to remix or reuse assets in four ways: Self-representation, or sourcing assets to represent aspects of cultural identity; Learner-representation, or sourcing assets to represent or reflect on one's own learning; Concept-representation, or sourcing assets to represent course concepts, ideas, and vocabulary from readings; and Writing-representation, or sourcing assets to organize ideas for writing assignments such as the "literacy autobiography" and "case study." Applying this coding matrix to Whiteboard artifacts, I analyze three examples of student work from the course that represent these various forms of remix activities.

[17] The course curriculum and Whiteboards activities evolved during the 4 semesters. Course II was selected because it was the course instance most focused on orchestrating remix activities. The course evolution is discussed further in the implications section.

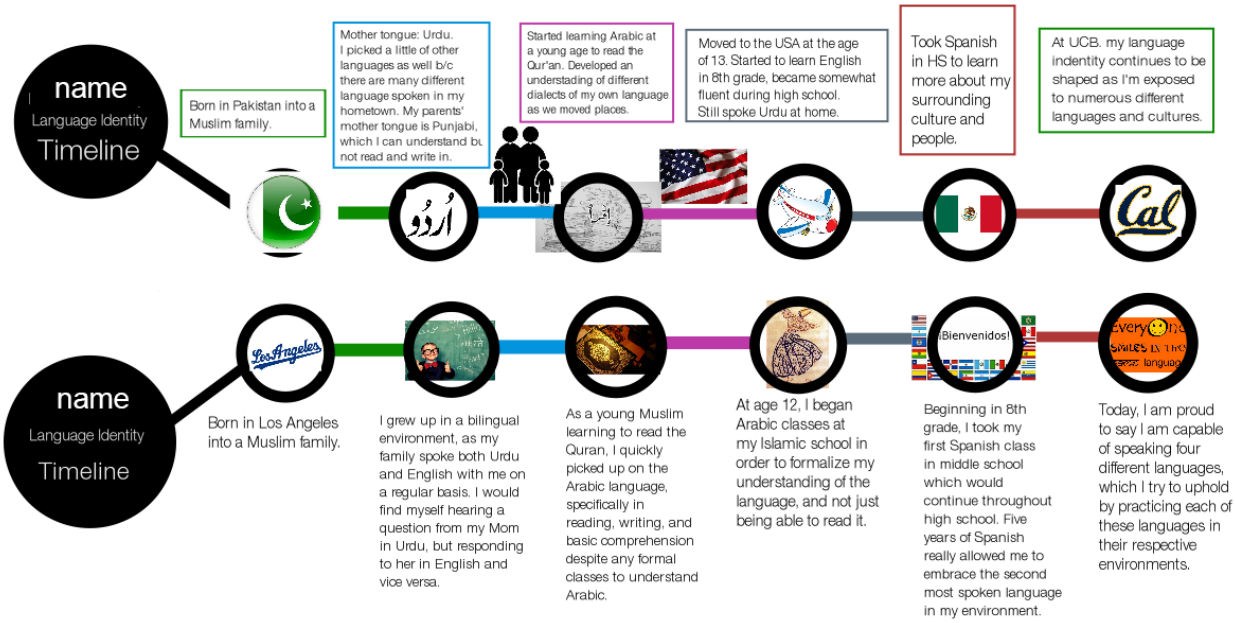


Figure 32: Collaborative Whiteboard "Language Map" coded as Direct from the Web > Self-Representation

For one of the course's collaborative Whiteboard activities, students are asked to work in pairs to create a "Language Map," using images mined from the web to represent aspects of their linguistic identity. In this case, the source is a web artifact transformed for self-representation. The activity is part a course curriculum module that explores the relationship between language and identity, and the variety of languages or discourses one develops or acquires during one's life as well as how those linguistic repertoires are not static and bounded, but rather fluid, hybrid, and grounded in social context. The objectives of the course activity are therefore threefold: 1. To express these ideas about language through one's own life journey; 2. To connect with peers around one's own linguistic identity as a means of developing community; and 3. To draw from existing media resources online to design a multimodal narrative that also connects the two students' stories together.

Figure 32 above is an example of one such Language Map. As a visual story, the row of circles with embedded images create a chronological symmetry between their stories, each circle depicting a similar point in their personal history. Following from the first black circles that contain the students' names (removed here for protection of student identities), both their second circles contain a consistent textual structure "Born in [blank] into a Muslim family." For the student on the bottom, the Los Angeles Dodgers baseball team logo is used to represent being born in California, where the student on top uses the flag of Pakistan to represent being born in Pakistan. These parallels continue throughout their timelines, as they discuss their multilingual home life, learning to read the Quran, learning Spanish as part of their participation in California Latino communities, and ending in the present day by recapping the various linguistic repertoires they have developed and continue to develop at the university. The key point of distinction in their stories is revealed in the middle, where the American-born student on the bottom describes attending Islamic school to formalize her understanding of the Arabic language, and the Pakistani-born student on the top uses an image of a plane and an American flag to represent her immigration to the US. The symmetry in their stories is a clear demonstration of their collaboration and connection around shared or similar experiences, and once their Whiteboard is published into the Asset Library, it becomes a social artifact through which their peers may both learn more about them and find other kinds of commonalities. While the images the students remix are fairly literal representations of the events in their stories, the text provides

insight into how the students frame those images to tell a more complex story about their multiple and hybrid language identities, demonstrating that they have begun to grasp some of the key concepts from their course readings.

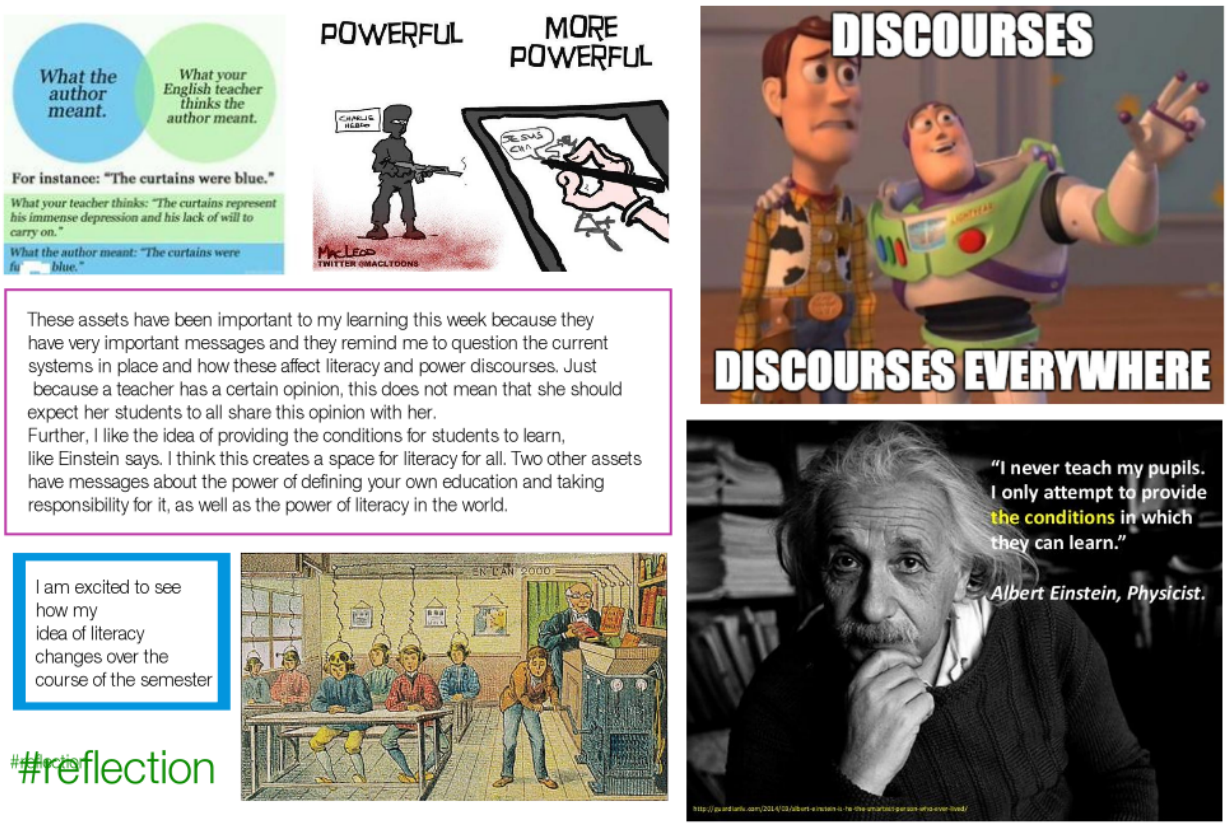


Figure 33: Solo Whiteboard "Reflection" coded as Past Peer-Authored Assets > Learner-Representation

A recurring Whiteboard activity in the course asks students to reflect on their learning at the end of a module, focusing either on content specific to that individual module, or through synthesizing content from across modules. In Figure 33, the activity asks students to work individually to create a Whiteboard using assets shared by peers or by the instructor during the week to summarize what they have learned or what remains confusing to them. Assigned at the end of the first week of the course, the reflection activity is designed to: 1. Prompt students to explore each other's shared artifacts from across the week in an effort to both expand their ideas and form connections; 2. Reflect on how their initial understandings of literacies changed or expanded through course readings focused more broadly on literacy as a socio-cultural practice of meaning-making; 3. Provide course instructors insight into student understandings and misconceptions that may need to be addressed in a discussion session the following week.

In Figure 33, the student includes five different assets shared by five different students during the week, arranging those assets around three text boxes. Picking up from key themes from the week's readings, the student focuses on the tension between literacy as both a liberating practice and literacy in schools as a mode of control or domination. The student uses a key vocabulary term- discourse- in both the visual asset "Discourses… Discourses Everywhere" as well as in her text, which she refers to as "power discourses," otherwise referred to as "dominant discourses" in the course reading (Gee, 1986). While each image shared by her peers would have been used to express a single idea, such as the science-fiction image of the students hooked up to 'brain-feeding machines'

as a representation of the way school restricts students to certain kinds of literacy or learning practices, her use of collage combined with textual explanation go beyond the single idea to express a more complex tension. Her second block of text points to her future learning interests, and reinforces a main theme and objective of the course, which is for students to continually revisit and complicate relationships between meaning-making practices, cultural identities, tools and technologies, and education.

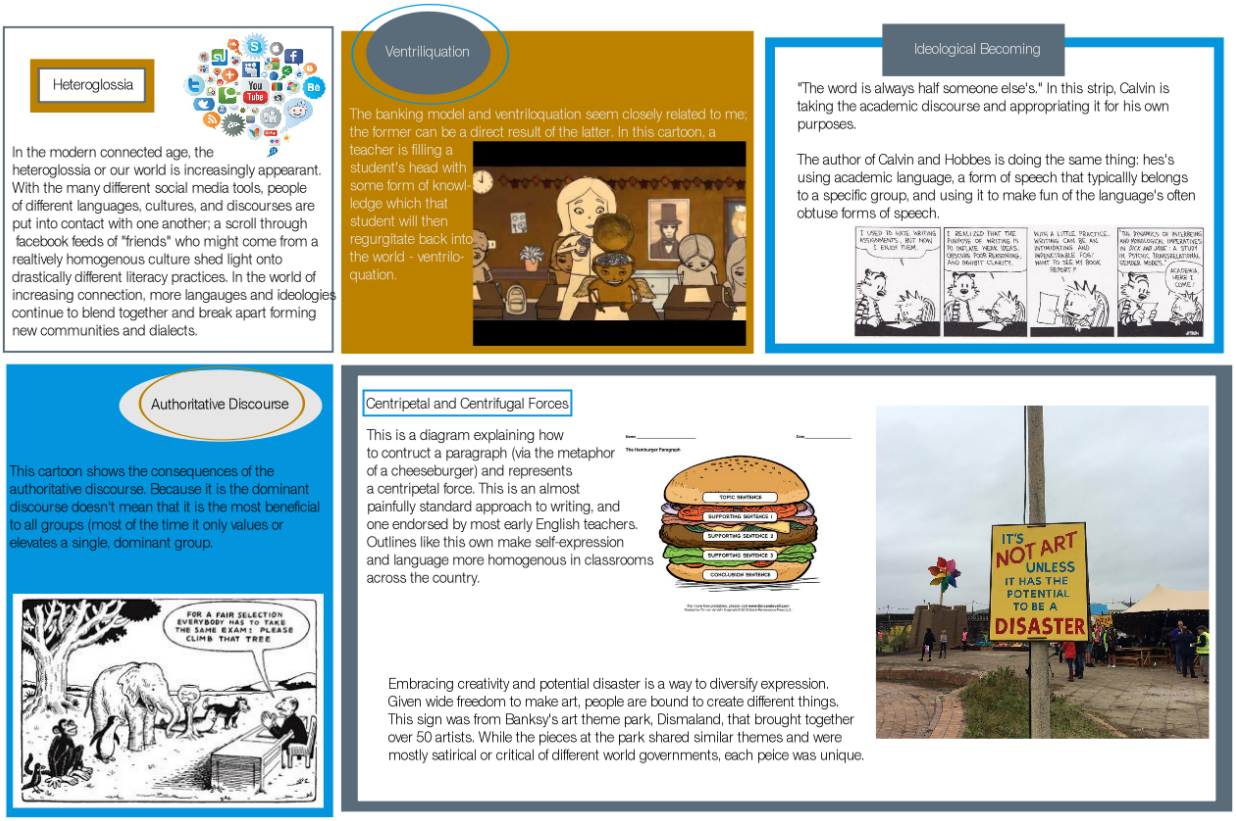


Figure 34: Solo Whiteboard "Bakhtin Remix" coded as Past Peer-Authored Assets > Concept-representation

The undergraduate education course asks students to engage with a number of complex texts from literacy and language scholars, perhaps none more dense and challenging than the work of Soviet literary theorist Mikhail Bakhtin. In his essay on "The Problem of Speech Genres" (1976), Bakhtin offers a number of challenging terms in articulating his concept of language. To help students grasp those terms, the "Bakhtin Remix" activity asks students to find assets shared by peers from across the previous 10 weeks of the course to represent each of the six terms. Through these representations, students both find examples that demonstrate some specific application or occurrence of the term, as well as revisit past concepts represented in those activities as a means of connecting them to the Bakhtinian terms. As one of the final activities of the weekly modules, students will have already read the Bakhtin text and discussed it with their instructor during a synchronous session. By asking students to apply the terms to real-world examples and artifacts, students are demonstrating higher-level understanding of the concepts, which can once again be used by the instructors as a mode of formative assessment.

In Figure 34, the student remixes six assets from five different weeks of the course to represent the six Bakhtinian terms. In the upper left quadrant of the Whiteboard, the relation between

asset and term is causal, where the image depicts a variety of social media tools from a module about "connectivism" (Siemens, 2005), which is positioned here as a cause of a global blending of discourses and cultures, the result of which are more "heteroglossic" texts. To the right, the student establishes another causal relation, taking an image shared by a peer to represent Paolo Freire's (1976) "banking model" of education, and explaining how students' mindless consuming of information leads to a kind of "ventriloquation," or texts speaking through students without critical awareness. With other remixed images, the relation is more directly representational. For example, the "hamburger" image that describes the five-paragraph essay form used by students in more traditional expository writing contexts is used to represent the concept of "centripetal forces" in literature, which Bakhtin describes as the pulling in or consolidating of literary forms. This is contrasted against the image of a sign reading "It's not art unless it has the potential for disaster" to represent centrifugal forces, or the spinning out and broadening of form through experimentation and disruption. In total, the student uses four key terms from past readings in both explaining and expanding upon the six Bakhtinian terms, situating each in relation to an asset shared by a peer from a past module.

Tracing an Asset Meme

Given the number of activities like the above where students are deliberately asked to look back across the course in remixing assets in Whiteboards, we might expect to find instances of a single asset remixed across many Whiteboards, similar to the way a meme propagates across the Internet, though at a much smaller scale within the course. Looking at asset reuse data from the SuiteC analytics as well as at individual assets and their reuse counts in the Asset Library, I discovered a number of cases where assets appeared across multiple Whiteboards over time. As one might anticipate, these assets tended to be shared early on in the course, with Week 1 assets the most likely to become a meme, as this provided more time and opportunity to be reused in future Whiteboards.

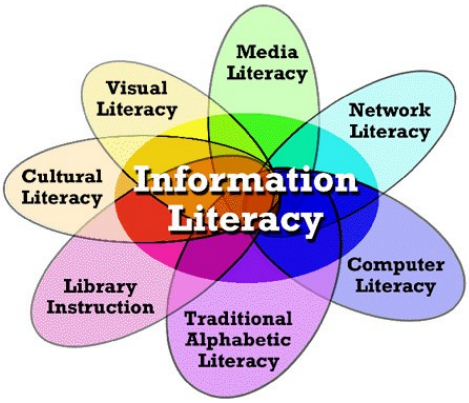


Figure 35: Information Literacy asset that became a meme

Figure 35 is an example of a graphic from the web that was shared by three different students during the first two weeks of the course as part of the #mylitworld activity, where students were asked to find an artifact from online to represent what it means to be literate in the world today. Centered by the term "information literacy," the rainbow-colored graphic shows seven overlapping ovals, each of different color for seven different types of literacy, such as "traditional alphabet literacy" and "computer literacy." Despite numerous searches, I was not able to locate the original source of the graphic, though it does appear across a number of academic blogs and presentation slides. Search terms for images in Google such as "What is literacy," "modern literacy," "types of literacy," "image of literacy," and "multiple literacies" all yielded results of the graphic, suggesting

that students would have been likely to encounter the graphic based on the nature of the activity prompt.

The three students who shared the graphic into the Asset Library all shared a different version of the graphic. One student linked directly to an educational blog that contained the image so the source could be traced, and while the other two downloaded and uploaded the graphic to the Asset Library, thus breaking the link to the source. I was able to determine all three came from different sources because the Asset Library preserves the pixel dimensions of an image, and each asset was of a different size when viewed in the Asset Library. Although students can all see each other's assets once posted in the Asset Library, it is likely that these students were not aware that some else had shared the same graphic before them, either because they posted before looking through the Asset Library or because they did not scroll back far enough in time to notice the same graphic had been posted days earlier. Interestingly, while the student Amy[18] was the first to post the "Information Literacy" graphic, she later reuses Mora's "Information Literacy" asset in her Whiteboards. This may be in part related to SuiteC functionality and the way assets are added to a Whiteboard, where a student can either search by keyword or scroll backward in time through assets, and then select the desired assets to be added to the Whiteboard canvas. In Amy's case, she may have been scrolling backward and come upon Mora's before her own, and therefore chose to add it out of convenience.

The curricular emphasis in the first week and throughout the course in moving students from a print-centric definition of literacy towards a more expansive, socioculturally-oriented understanding clearly resonates in this graphic. In their asset descriptions, all three students share a similar rationale for choosing the image, describing how it captures the multiple ways of being literate in the world today. One of the students, Mora, describes, "Coming into this class my definition of literacy was fairly literal and limited to the written word. During our first discussion, however, my mind was opened to several different types of literacy." One of her peers comments on the asset, "As you stated, my definition for literacy was limited to reading and writing as well. This photo visually exhibits the complexity of literacy." Although none of the descriptions or comments on the original asset go into detail about the kinds of literacies listed in the graphic, or the reason why "information literacy" specifically is centered as a point of convergence, it is clear that students are more focused on demonstrating their understanding of of literacy as multiple and varied, so combined with the prevalence of the graphic in related search terms, it is not surprising that it would appear multiple times as an asset for the #mylitworld activity.

[18] All student names are pseudonyms to protect the identity of participants

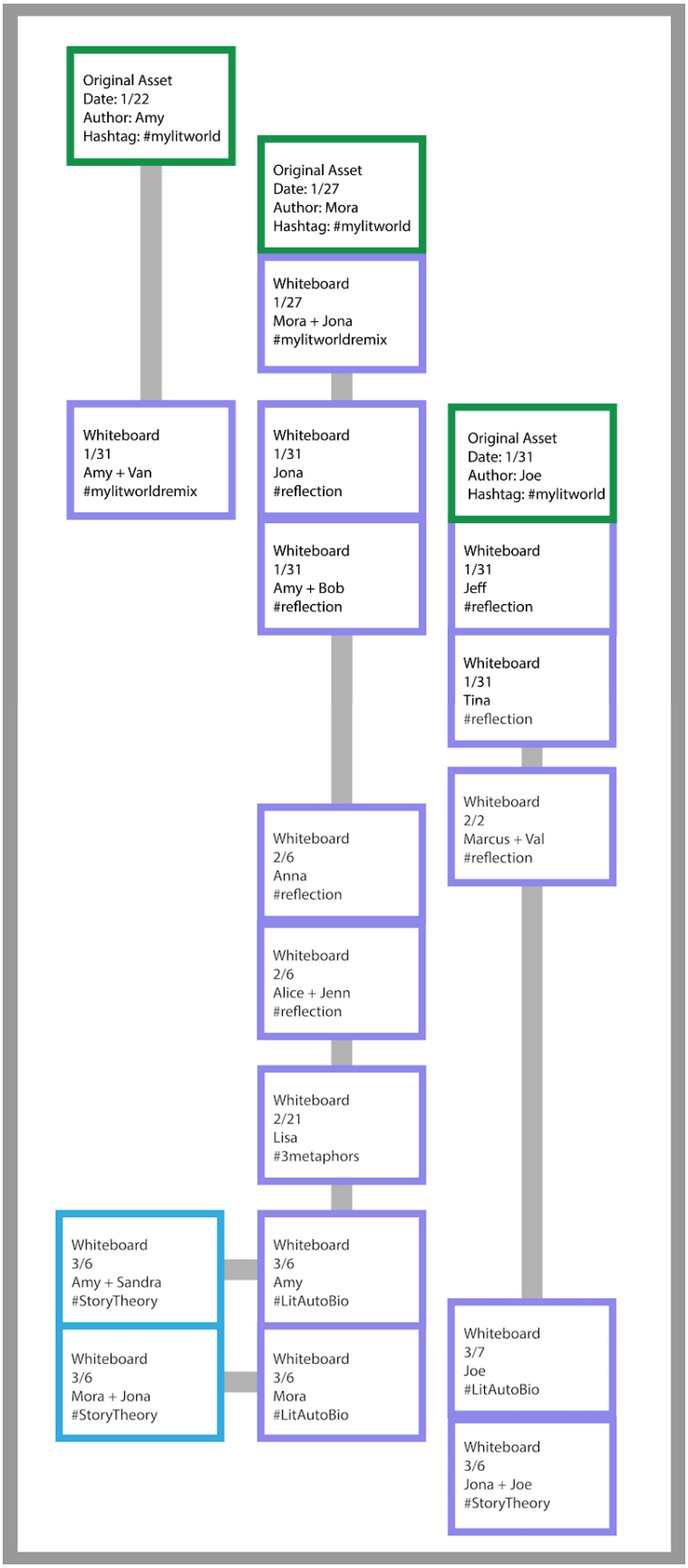


Figure 36: Temporal Visualization of Asset Remix Event

Figure 36 is a temporal visualization of the remix event, with each tile representing an Asset or Whiteboard containing the "Information Literacy" graphic, where the green outline tiles correspond to the three "original" assets, the purple outline tiles correspond to Whiteboards that reused the original assets, and the blue outline tiles correspond to Whiteboards that reused a Whiteboard containing the original assets. Each tile contains the date the Whiteboard was exported to the Asset Library, the author(s), and the hashtag associated with that asset/Whiteboard. The vertical lines indicate that Amy's asset was reused one time, Mora's asset was reused eight times, and Joe's asset was reused five times, while the two horizontal lines indicate two Whiteboards were reused in two other Whiteboards. The timeline begins on January 22nd with the first instance of the "Information Literacy" graphic appearing in the Asset Library shared by Amy, and concludes on March 7th with a Whiteboard by Joe, for a total of 19 appearances in the course Asset Library, not counting duplicate Whiteboards, as students sometimes published the same Whiteboard multiple times during the process of editing. In addition to the three students who first shared the graphic, 11 more students authored or co-authored a Whiteboard using the graphic.

The "Information Literacy" graphic appears across six different course hashtags, each of which provide a specific frame for how the asset will be reused. Students worked on the #mylitworld, #mylitworldremix, and #reflection during the first week of the course, and for the nine Whiteboards that reuse the "Information Literacy" assets, students consistently express that the asset, for them, represents a new-found understanding that literacy encompasses a diverse range of practices and tools. In the #reflection Whiteboards, as students begin synthesizing ideas from across the week, the "Information Literacy" graphic becomes more deeply connected to other assets and ideas. For example, in the 1/31 #reflection Whiteboard by Jona, she includes the "Information Literacy" graphic as one of several assets that "summarized what I learned this week." Her paragraph text begins first by describing her class conversation about literacy practices, then references her peer Mora and the "Information Literacy" graphic as a representation of some of these different literacy practices, then connects the graphic to the definition of literacy offered by James Gee from a required week 1 reading. Next, she connects these multiple literacy practices to her upcoming field work, where she describes how she anticipates seeing these various literacy practices in action among students. She then makes a subsequent connection to a Dr. Seuss asset shared by another peer, which she interprets as "the idea that the more knowledge and exposure you have, the more doors and opportunities will become available to you," in essence connecting the idea of becoming literate in different kinds of literacy practices to professional opportunity and social advancement. In the adjacent paragraph, she then uses assets that represent more traditional school-based literacies to contrast the previous paragraph and assets. She claims, "Students often aren't able to express and receive credit for their talents and knowledge that branch outside the basic curriculum." She closes her text by going back to the importance of becoming literate in "social, cultural, and financial" literacies to "thrive and communicate" in the world. In this Whiteboard, the "Information Literacy" graphic plays a central position in meaning-making, as the student makes connections to her class discussion, field work at a local school, academic reading, and notions of schooling and success while demonstrating that she grasps the socio-culturally-oriented definition of literacy.

Moving forward in time to later hashtags, the "Information Literacy" graphic continues to be reused in more expansive ways. For the #3metaphors activity, students were prompted to look back across assets from the course to represent each of the three metaphors of literacy, a concept offered by Sylvia Scribner (1984), another course reading. In the 2/21 Whiteboard by Lisa, she uses the graphic to represent Scribner's notion of literacy as adaptation, which the student describes as the need to apply different kinds of literate abilities "depending on the situation." Later in the course, several students include the "Information Literacy" asset in their #LitAutoBio Whiteboards, where they are prompted to organize ideas for their literacy autobiography papers, a long-form paper that

melds together the student's own story of "becoming literate" with theoretical concepts from the course. On 3/6, Mora reuses her original "Information Literacy" asset, this time to communicate her interest in "interdisciplinary" areas of study and her decision to become a cognitive science major because it allowed her to develop expertise in many different areas. In her last sentence, she provides a more detailed reading of the "Information Literacy" asset, this time explaining the central position of "Information Literacy" in the graphic. She writes:

> Information is not just media, or culture, or traditional alphabetic literacy. Information is comprised of so many disciplines and ideas, and to be literate in information is to be literate in all the relevant areas. This idea led me to pick my major of cognitive science.

For Mora, information in the graphic is positioned broadly as the diverse materials through which people make sense of the world. For another student, Joe, the graphic is positioned in his #LitAutoBio Whiteboard more specifically in relation to his interest in technology, inspired by watching a Star Wars film in his youth and extending into his studies in the College of Engineering. At this point in time, the asset first shared to represent a preliminary idea about literacy has become connected with specific course concepts, contrasted with more traditional notions of literacy, and to the students' personal histories and interests.

Remix Classroom Tensions: Copying vs Transforming

The meme analysis reveals the diverse ways students remixed an asset shared by peers, both in design as well as in meaning. However, applying remix practices and these kind of collaborative, multimodal composing activities in a university course can appear at odds with more traditional forms of learning and academic practice. Based on feedback from students, the Whiteboard activities were without doubt the most polarizing aspect of the course, with open-ended survey responses ranging from, "The assignments were amazing!" to "The online portion really does nothing for my education and sometimes gets to a point that really just annoys me." For students with more negative perceptions of the activities, their criticisms can be organized into three categories. First, students expressed frustrations with the usability and limitations of the Whiteboard tool, which no doubt lacked some of the features and familiarity of more established design tools like Microsoft PowerPoint and Google Slides. Second, collaborating with peers posed challenges for some students, as they struggled to find others available to work on Whiteboards with them. Interestingly, according to one of the course surveys (45 total responses) 13% reported having no experience in previous courses collaborating with peers on assignments, thus it could not be assumed that all students were familiar or comfortable with working with peers in such a way. And third, as the quote above conveys, for some students, designing and remixing a multimodal text simply did not have a perceived educational value to them compared to activities with which they had greater familiarity. While 47.7% of students reported they preferred project-based assessments with different forms of media, 22.7% said they still preferred multiple choice exams.

For all students but especially those with a preference for more traditional forms of assessment like a multiple-choice exam with clear right or wrong answers and familiar procedures for completion, establishing both expectations and ethics around collaboration, composing, and remix can play a crucial role in helping students recognize the pedagogical value in these activities. Particularly with the way remix is positioned in the course, the distinction between merely copying the work of a peer and transforming that work to form new meanings may not always be so obvious to students. While the assets stay intact as they are reused across different Whiteboards and the SuiteC software cites each instance of reuse, the ideas and design of a Whiteboard are what make one Whiteboard unique from another. Looking at each Whiteboard as its own assemblage, the relations between parts, both spatial (designed) and semiotic (meaning), help determine the character of their uniqueness, as new "virtual" properties of the asset come into being under different configurations.

Part of the instructor's role in the course is therefore to support students to effectively produce artifacts meaningful to both their own learning and to the learning of their classmates.

During one semester of the undergraduate course, an instructor began to suspect that a student was simply copying the Whiteboards of a peer rather than transforming assets to create new meanings. Her speculation was incited by both the design of the student's Whiteboards as well as the similarity in text and assets he used. The instructor then confirmed her suspicions by looking at the student's interaction history, where she observed that the student was indeed looking at the Whiteboards of the student who he appeared to be copying. When the instructor queried the student about the copying, the student responded by explaining that he viewed his classmates' Whiteboards for inspiration for his own composing, and that he assumed such practice was encouraged. Of course, seeking inspiration from peers was indeed encouraged in the class; however, the instructor maintained that the student needed to further develop his own ideas. The ambiguity in this case around originality and transformation can be attributed to the qualitative nature of transformation here, and confirms the need to go beyond a record of citations toward an ethics around remix in the academic environment. In this case, the instructor did not take a punitive approach with the student, but instead made suggestions to the student to help him improve his meaning-making practices.

Another instance of a student remixing the Whiteboard designs of a peer that can serve as a model for how such practices are intended to unfold in the course occurred in the #3Metaphors activity mentioned above.

Figure 37: Ethics of Remix- Whiteboard on top appeared in the Asset Library first, followed by the Whiteboard on the below

Visually, there are clear similarities between the two Whiteboards, notably the three intersecting circles. At the center of the circles, both Whiteboards also contain the word literacy, though the top Whiteboard uses the text editor where the bottom Whiteboard uses another asset containing the text 'literacy." However, the similarities between them end there, as the colors used to design the circles and text are different, as are the assets and the framing of those assets in relation to Scribner's three metaphors for literacy: Adaptation, Power, and Grace. Further, the student who remixed the Whiteboard design notes in her asset description, "I credit Jenna for giving me the idea of making interconnected circles in order to express how related Scribner's metaphors are." In this example, the notion of an ethically responsible and academically effective remix through peer-sharing appears fully realized, as the student was able to find a design that helped her develop a more complex understanding of the concept while giving credit to a peer for supplying this inspiration.

A Tapestry of Media for Connecting and Knowledge-Building

In terms of forwarding a pedagogy of remix, the obvious shortcoming of this study is in its methodology, which does not concretely demonstrate to the skeptic that students who completed the remix activities would learn more or earn higher grades than students completed more traditional activities or assessments, like a quiz. And if the objectives of the course focused narrowly on students demonstrating mastery of a specific set of definitions and concepts from course readings, I am not sure a peer-to-peer, remix pedagogy would indeed outperform direct instruction and quizzing. However, the objectives of the undergraduate literacy course are not limited to only the memorization and regurgitation of course instructional content, and in fact, course readings on critical pedagogy (Freire, 1970) actually call-out direct-instruction models, or what Freire calls "banking models" of education, as tools for cultural suppression and hegemony.

Beyond the more political and ideological arguments against direct instruction and traditional assessments like quizzing, I also contend that the collaborative remix activities develop competencies beyond just mastery of the content-related objectives. For students, moving through a complex tapestry of media in the Asset Library, and choosing artifacts shared by others to represent concepts as well as to expand one's own ideas and perspectives, demands higher-order thinking and critical sense-making that much more closely align to the kinds of literacy and knowledge practices engaged in networked information environments. Further, the careful coordination of image, text, and shape in

designing a Whiteboard supports students in developing multimodal literacies, which has application to now-ubiquitous modes of online communication and knowledge-production, such as blog writing and other digital composing practices. The collaborative nature of this remix work also helps foster skills and dispositions related to teamwork and peer-to-peer learning, often identified as "soft skills" crucial to career preparedness, where working on interdisciplinary, diverse teams, both in-person and virtually, have become commonplace in emerging industries such as technology (Hirsch, 2017). Working with others and having opportunities to weave one's personal identity and experiences into the course also help foster a sense of community and connectedness to others, which have been demonstrated in the online learning research to improve student satisfaction and decrease course drop-out (Bawa, 2016).

For instructors, Whiteboards serve as an articulation of student thinking, student identities, and their ongoing understanding of course concepts. Unlike a multiple-choice quiz, which provides a narrow, constrained view of student understanding, limited to only a performance-based outcome on a specific series of questions with a right or wrong response, the activity of designing Whiteboards express a more nuanced and complex thought process- a kind of brainstorm that helps an instructor see a path toward understanding. As students move towards the major assessments of the course- longform narrative and expository writing- the language and spatial representations of ideas used in Whiteboards help not only scaffold students from idea generation through idea maturation, they also provide instructors important insights for interventions to help ensure students grasp the concepts. For example, instructors describe reviewing student Whiteboards before their synchronous discussion sessions with students to help inform talking points and dialogue. As members of the course community, instructors also learn about the cultural identities and interests of their students through the personal connections made between assets and course concepts, helping build a rapport with students in the absence of more synchronous, in-person opportunities for connection.

Combining an ecosystem of tools like SuiteC that have been designed to foster remix in an academic context with a curricular approach that harnesses those technical capabilities in positioning remix activities as a central learning practice in a course experience offers some intriguing pedagogical opportunities for online learning. In a course like the one under investigation here, where there is a clear focus on engaging digital literacy practices, cultural perspectives, and critical dispositions, the fit between the course learning objectives and the remix activities appears obvious. In other domains and disciplines, the fit may be less obvious, as the curricula demands greater attention on the development of specific skills that may be more appropriately assessed through more quantitative means. However, given both the need to support students in developing skills to critically navigate information-dense online environments and to design multimodal artifacts, as well the demonstrated value in bringing students' cultural identities into the classroom as a means of fostering a sense of connection to others and relevance to the learning objectives, I believe there is both an opportunity and a need to begin to weave in some creative, remix activities into all curricula to support student success. As commercial tools such as PowerPoint, Google Slides, and Adobe composing programs have begun to link directly to shared media repositories, the kinds of remix practices engaged through the SuiteC tools are becoming more and more commonplace in other more established tools. The ubiquitous presence of remix tools and media for remixing, therefore, is an invitation for instructors and course designers to begin strategically integrating collaborative remix activities into the student learning experience.

Conclusion

Relationship between Collaboration and Evidence of Learning

While I have drawn comparisons between students' social activities and their final grades throughout this dissertation, I have also tried to emphasize those emergent opportunities for learning that occur only through dynamic social interaction. Given the findings from the regression analysis in the Engagement Index Chapter as well through supporting observations, such as the network graphs that compare an 'A' student and a 'B' student, there appears some evidence that at the very least, there was a positive relationship between Asset Library activity and final grade. Without a control group or looking at students' individual rates of improvement, I am cautious in how I frame the results of the regressions. It is noteworthy, however, that in a pilot course with a different curriculum and with more emphasis on the Engagement Index leaderboard, students with more Engagement Index points did not perform better on the final exam.

Therefore, observing some signals of a meaningful relationship here between final grade and activity is encouraging. Qualitatively, the artifacts analyzed serve as examples of the multiple ways students engaged, shared, and remixed course resources as part of their learning process. When we look back at the on-ground version of the education course, the value of those artifacts- the assets students shared in the Asset Library and the Whiteboards they produced- as evidence of learning become more apparent. Where the in-person lecture hall tried to structure opportunities for interaction, student thinking and idea development were mostly contained and concealed in the jottings of their individual notebooks. Moving those activities to an online context focused on social sharing and making opened up those thinking processes and idea development to the community, allowing others to directly contribute to their development. These contributions may come from peers in spontaneous and emergent ways, such as with the example of the Chicano Labor Movement flag and the comments that formed around that artifact. But also for instructors, who can use those assets to inform their synchronous sessions with students, introduce scaffolds to support learning, and connect with student's personal perspectives.

Visualizing Social Interactions

Looking across the entire SuiteC system and broader course system, I identify five ways that students interacted with peers in the course:

- Synchronous session (in-person/video)
- Discussion Forum thread
- Asset engagement (view, like, comment, reuse in Whiteboard)
- Whiteboard asynchronous co-composing
- Whiteboard synchronous co-composing and messaging

The design of SuiteC as an ecosystem for sharing and remixing intends for interactions to move seamlessly across these domains, and for each to build off the other. In the Asset Library Chapter, for example, I limit my analysis only to those interactions, which on their own, lack a certain quality of depth and sustained dialogue. However, if we consider those interactions in relation to the collaborative composing in the Whiteboards, we can then observe the significant ways that those two types of interactions support each other- the Asset Library as a place to be exposed to ideas and perspectives, and the Whiteboards as place to pull those diverse ideas together in forming new kinds of understandings.

Part of the ongoing development of SuiteC has been focused on how best to communicate the unfolding of these different modes of interaction and collaboration back to students as a way to

encourage the strengthening of existing ties as well as the formation of new ties. The Impact Studio now serves as such a means of visualizing much of the social activity unfolding in SuiteC. The network visualizations included in the Asset Library chapter taken from the Impact Studio, for example, allow students to view the degree of reciprocity with their ties in hopes this feedback may prompt students to respond to interactions initiated by others. With the introduction of the Impact Studio, an asset "Activity Timeline" was added to the full-view mode to allow users to see who else has visited and engaged with that assets.

A Vision for Inclusion

If we are going to privilege the social as the fabric from which learning emerges, we need to ensure that everyone has equitable and inclusive access to the cloth. Throughout this dissertation, I have pointed to the 'impacts' of assets, and the emergence of course memes or those that generate large comment threads. We have also seen some preliminary success in being able to use neural networks to predict how much interaction an asset will receive, based on contextual information such as the time of posting[19]. In social media contexts, insights about "popularity" and "influence" and "trending" are used to drive more traffic to those places, or people, or media. But in a learning context where the emphasis is not to sell advertisements but to increase student access to novel ideas and diverse perspectives, my focus here on popularity metrics or impact serves a much different purpose than in social media contexts. Moving forward, if we are able to identify trends in the popularity of visibility of peer-generated popularity, it may be possible to imagine ways to support students whose work may not be receiving feedback from the community.

A system that automates interventions that attempt to support inclusivity offers interesting possibilities. For example, in recommending modes of interaction, such as guiding a student towards the work of a peer who is not receiving much feedback from others, may help ensure students feel connected to the learning community. A responsive system that can suggest potential pathways for interaction based on previous activities could also help address some of the challenges in the design of a socially-turned curriculum, where instead of prescribing one specific action for everyone, the software itself could make personalized suggestions or set target goals for students that push them to take one new, diverse activities. For example, if a previous week, a student received a lot of comments, but did not follow-up or reply to those comments, the system would recommend they focus their activity on commenting. This would help build more dialogue around assets and strengthen existing ties. Or, if a student's social network appears to have a few close ties, the system may set a target of interacting with several people outside her immediate network to discover new people and potentially new perspectives.

Of course, with any automated solutions, we also need to carefully consider the ethics around this kind of intervening in the social dynamics between students. It will be important, therefore, that the instructor continue to play a role in moderating how those recommendations are being taken up by students, and whether they are truly enhancing the quality of peer-to-peer interactions. Ultimately, the success of such a system would be measured by how well it performs in helping bring the learning community closer together and to support interactions that generate new, unanticipated opportunities for learning that augment the course materials and outcomes. In this dissertation, I have pointed to several examples of what these opportunities look like, as well as how social sharing and remix contribute to the ongoing formation of connections between content and between people, shaping how that community, as an assemblage of people, tools, and content, is perceived and experienced by the participants.

[19] This work is currently be conducted under the leadership of Professor Zach Pardos with Renzhe Yu and Alessandra Silveira

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Introduction Chapter

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Appendices

Appendix A: SuiteC Data Events

'Launch Asset Library',
'Launch Whiteboards',
'Launch Engagement Index',
'List assets',
‘View asset’
’Open asset from whiteboard'
'Edit asset'
'Create asset'
'Create file asset'
'Create link asset'
'Like asset'
'Unlike asset'
'Search assets'
'Deep link asset'
'Deep link Asset Library search'
'Create asset comment'
'Edit asset comment'
'Delete asset comment'
'List whiteboards'
'Create whiteboard'
'Open whiteboard'
'Select whiteboard elements'
'Add whiteboard element'
'Update whiteboard element'
'Delete whiteboard element'
'Change whiteboard layer order'
'Zoom whiteboard'
'Whiteboard copy'
'Whiteboard paste'
'Deep link whiteboard'
'Export whiteboard as image
'Export whiteboard as asset'
'Edit whiteboard settings'
'Create whiteboard chat message'
'Get whiteboard chat messages'
'Get engagement index'
'Sort engagement index'
'Search engagement index'
'Update engagement index share'
'Get points configuration'
'Install bookmarklet'
'Install bookmarklet instructions'

Appendix B: Student Survey

Fall 2015

Form description

Student ID

Short answer text

My Major

Short answer text

My year at Cal

- Freshman
- Sophmore
- Junior
- Senior
- Other

(Across all my classes) I generally find collaboration with my peers in class to be:

- Engaging and beneficial to my learning
- Not Engaging but beneficial to my learning
- Engaging but not beneficial to my learning
- Neither engaging nor beneficial to my learning
- Hard to say; I rarely collaborate with peers in class

(Across all my classes) I find the online component of the course to be:

- Engaging and beneficial to my learning
- Not Engaging but beneficial to my learning
- Engaging but not beneficial to my learning
- Hard to say; I only access readings online
- Hard to say; I rarely do any work online

(In this course) I have found the online activities to be (check all that apply):

- [ ] Engaging and Beneficial to my learning
- [ ] Not Engaging but beneficial to my learning
- [ ] Engaging but not beneficial to my learning
- [ ] Neither engaging nor beneficial to my learning
- [ ] I haven't completed anything online yet

(In this course) I found using the Asset Library and Whiteboard to be:

- ○ Very user friendly
- ○ Confusing at first, but then easy
- ○ Always confusing
- ○ Asset Library was easy but Whiteboards were hard
- ○ Asset Library was hard but Whiteboards were easy

Please elaborate on any of your responses here.

Long answer text

(Across all my classes) I feel I learn best from: [rank in order with 1 the most and 8 the least]:

	1	2	3	4	5	6	7	8
Profes...	○	○	○	○	○	○	○	○
Short A...	○	○	○	○	○	○	○	○
Cramm...	○	○	○	○	○	○	○	○
Video ...	○	○	○	○	○	○	○	○
In-Pers...	○	○	○	○	○	○	○	○
Class ...	○	○	○	○	○	○	○	○
Online ...	○	○	○	○	○	○	○	○
Readin...	○	○	○	○	○	○	○	○

(Across all my classes) when it comes to assessments, I:

- ○ Prefer multiple choice exams such as midterms and finals
- ○ Prefer writing long-form essays or papers
- ○ Prefer projects that include different forms of media
- ○ Have no preference, just focused on the grade

(In this class), I most often search the Asset Library by (select all that apply):

- ☐ Clicking on hashtags
- ☐ Searching by Uploader
- ☐ Scrolling through it
- ☐ Searching by Keyword
- ☐ Other

(In this class), I felt the weekly activities (mark any that apply):

- ☐ Allowed me to demonstrate my understandings of key course ideas
- ☐ Allowed me to relate key course ideas to real-world contexts
- ☐ Allowed my to work creatively
- ☐ Were not clearly related to key course ideas
- ☐ Were confusing and difficult to follow directions

Describe your favorite assignment so far:

Long answer text

Compared to my other classes, I feel collaboration in this class:

- ☐ Is more engaging
- ☐ Is more beneficial to my learning
- ☐ Is less engaging
- ☐ Is less beneficial to my learning
- ☐ Hard to say; I don't collaborate with peers in other classes

(In this class) I felt navigating the weekly modules and assignments was:

- ○ Easy to follow the flow of assignments from class to class
- ○ Hard at first to follow, but improved
- ○ Always hard to follow
- ○ Easy to follow but unnecessarily complicated

Please elaborate on any of your responses below

Long answer text

Appendix C: Interview Protocol

Interview Protocol Participants

Background:

1. Did you complete the survey? If not, please complete this survey: https://docs.google.com/forms/d/1LPEfTDNEQ_8fbRey7kh4B3WGXdkziSfxeH9Q7KV42fc/viewform
2. Sign consent form if he hasn't already (e-signature)
3. Ask about if they have taken online courses? If yes, please explain your experiences.

Have you taken online courses before? If yes, describe experience.
If no, what kinds of digital tools have you used in previous courses?
What about collaboration?
What's your major, and how do you feel you learn best?

Describe a typical week of work for you in this class?
What mode do you use?
How do you search around in the library?
What are you typically doing when searching in the library?
Does your instructor bring your Assets into discussion?
How much time are spending looking at Peers work?
Does this help advance your ideas/learning?

Do you receive comments/likes/views on your Assets?
Do you check the engagement index

Walk-through Usage:

1. Can you log into the system and walk me through how you typically begin a weekly module.
2. Why do you access that view mode? Do you typically switch view modes, or only use one? (if they map mode) Is the aesthetics and and visual experience of the map mode meaningful to your learning?
3. Do you always use the same device? Do you ever access through a mobile device?
4. As you move through a weekly module, do you try to complete everything in one sitting? Do you always work in order or go out of order?
5. What kinds of activities in the course benefit your learning the most? Are there particular kinds of videos or instructional content on the site that you engage most with or feel benefit your learning most?
6. When watching videos, do you multitask or do you just stay focused on the video?

Collaboration

1. How much time do you spend looking at things your peers add? How helpful would you say looking at their things is?
2. What would make searching/discovering peer's assets more interesting or more useful to you?
3. How do you typically find a whiteboard partner? Has collaborating on whiteboards with peers been helpful to you learning?

4. How do you collaborate with this person? Synchronously (at the same time), asynchronously (at different times). Do you use the chat feature while collaborating?
5. How would you improve collaboration?
6. What other kinds of collaboration occur in the course?
7. What about re-using people's assets from the library? Do you see this as a form of collaboration?

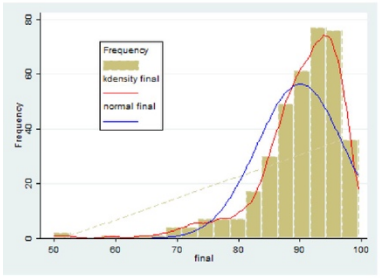
How does your work using the course software connect with your section discussions- either in person or in video hangouts?

Literacy Autobiography

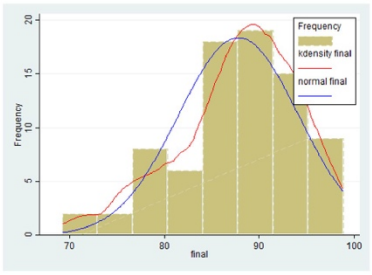
1. How, if at all, did your work in the Asset Library and on Whiteboards helped you in writing your literacy autobiography?
2. Describe a little how you went about writing your paper (did you write an outline, did you search tags, did you use a whiteboard).
3. Did things your peers added to the Library help you at all in writing your literacy autobiography?

Appendix D: Histograms of Activity

Course I

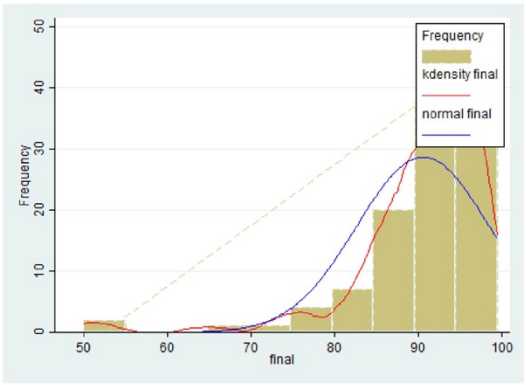


Course II

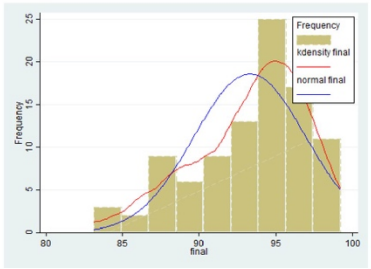


Final Grades

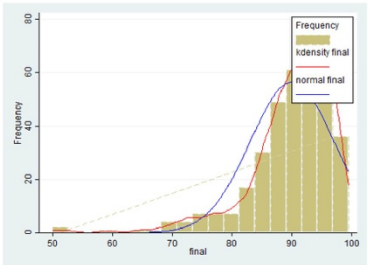
All Courses



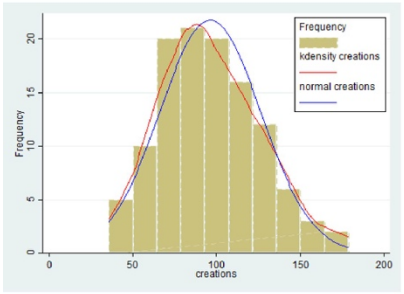
Course III



Course IV



Course I



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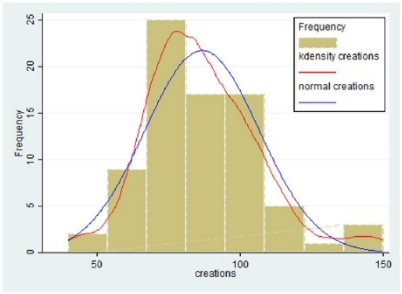
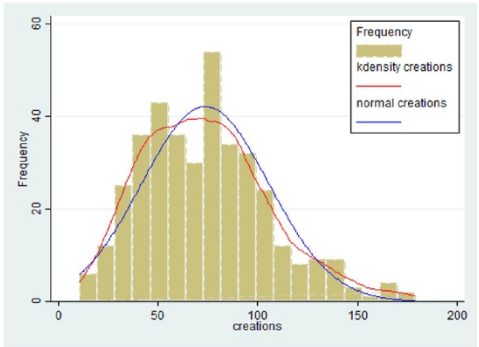
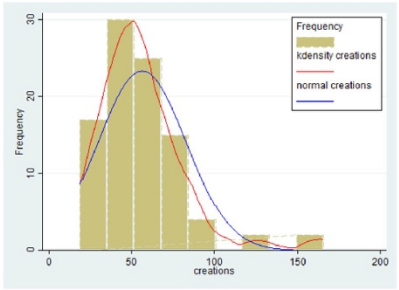


Creations Category

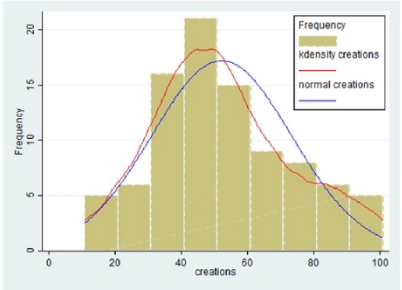
All Courses



Course III



Course IV



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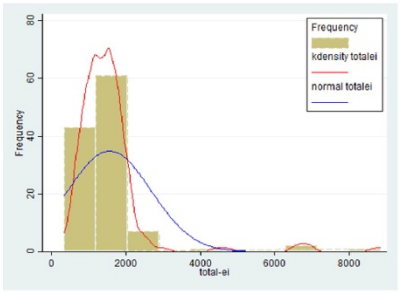

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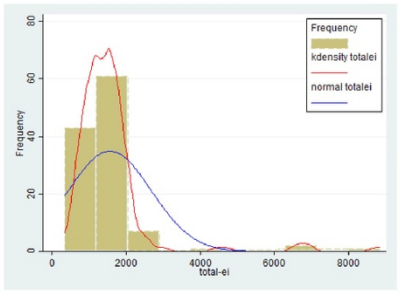
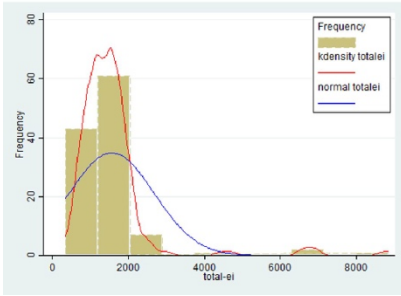
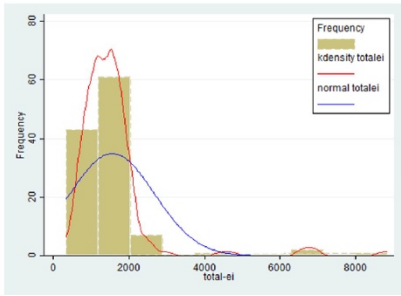


Course III

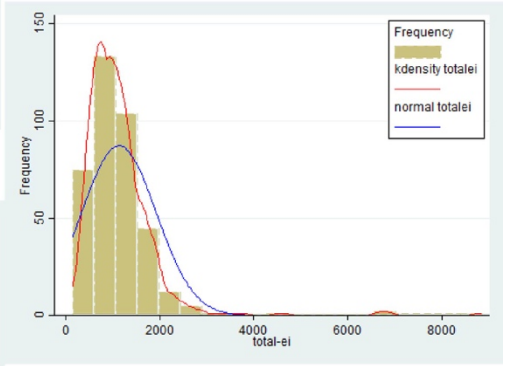


Course IV

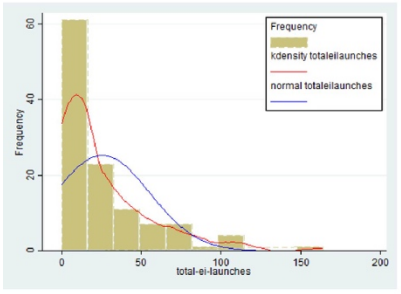


Total Engagement Index points

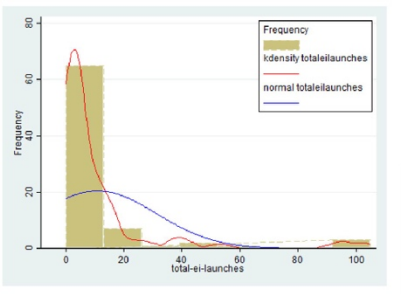
All Courses



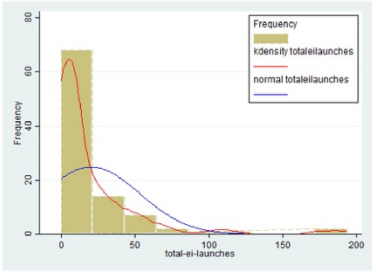
Course I



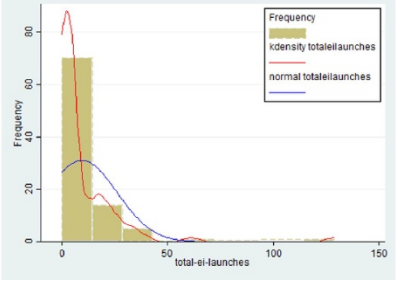
Course II



Course III

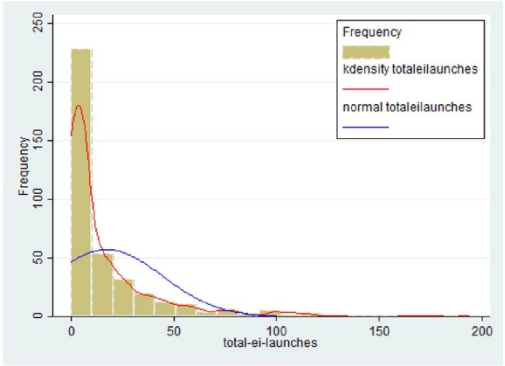


Course IV

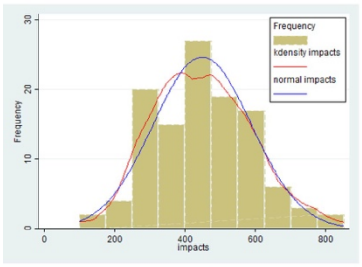


Total Engagement Index launches

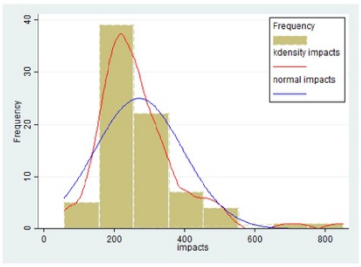
All Courses



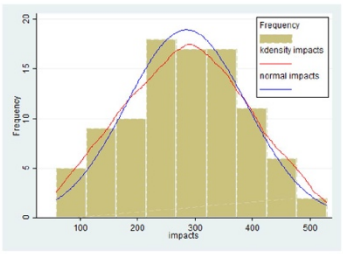
Course I



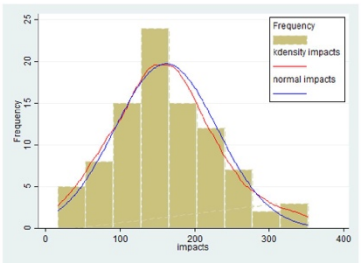
Course II



Course III

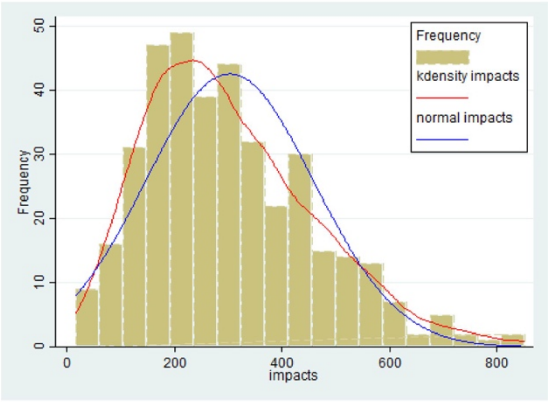


Course IV

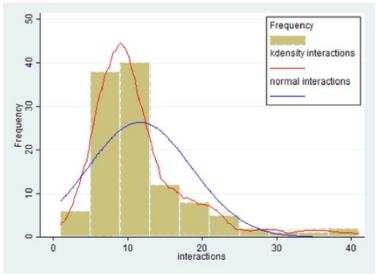


Total Impacts

All Courses



Course I



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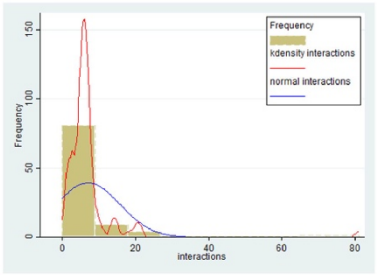

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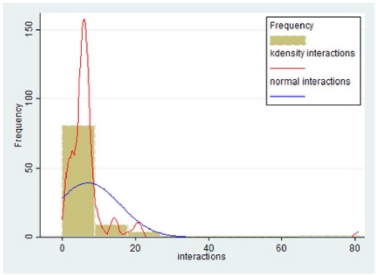

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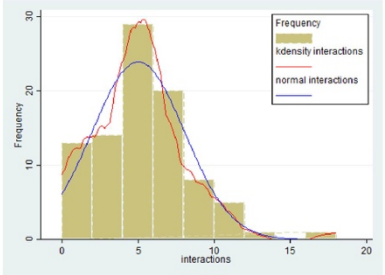
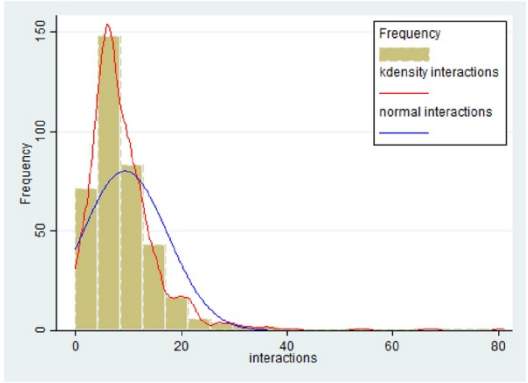


Total Interactions

All Courses



Appendix E: Asset Comment Coding Table

	Comment	Code (Author, Meaning, Self, Concept)		
2	Hi Name and Name, I really like your explanation of literacy and the journey of it as more than learning to read and write. My own literacy story is focused around becoming literate in another form besides reading and writing.	A: Personal Address	A: Complement	S: Reference to work
3	Hi Name and Name, Your whiteboard successfully captures the the use of creativity in literacy and how it is not simply limited to reading and writing. The dominant discourses in our society tend to create distances between individuals from all backgrounds and economic standings, therefore, hindering creativity in various fields. Art, which is usually considered creative, comes in many forms such as ballet and hip hop, and it facilitates connections between individuals alike.	A: Personal Address	A: Complement	C: key terms
4	I love how your whiteboard shows a lot of different discourses, and it demonstrates very well that the idea of literacy is no longer about reading and writing. Art is certainly one of the ways of developing our skills of being literate, and I believe literacy changes overtime. So the way we see literacy now might not be the same that we will see in the future.	A: Compliment	M: Interpreting images	C: key terms
5	This whiteboard does a great job explaining that reading and writing is just the tip of the literacy iceberg. There is so much more to literacy, like art, dancing, et cetera. It also delves into the role discourse plays in all of this. I like that Susmi makes the point that our narrow description of literacy as reading and writing is connected to the values of the dominant discourse.	A: Compliment	A: Personal	C: Key Terms
6	I think you guys did a great job explaining each other's discourses. I like that you both addressed the idea that dominant discourses vary and that each discourse has its own meaning of being "literate". The discourse of art is so broad, yet each art discourse has a special quality of being unique and creative with its own rules, community, and form of expression.	A: Compliment	C: Key terms	M: interpreting images
7	Hi Name and Name, First of all, great job putting this together because you guys really explained each other's whiteboards very well. I noticed how each of you described how literacy is expressed in so many ways rather than just reading and writing. Also, the way you guys connected both whiteboard with one another really captured the main points of the literacy images you guys posted. Thank you for sharing !	A: Personal Address	A: Complement	A: Gratitude
8	I certainly agree with you two that literacy not only means the ability of reading and writing as what I thought before this course. You guys make a good connection between your stories with the concept of discourse. Since in different circumstances, dominant discourses can be different and the meaning of being literate can be changed as well.	A: compliment	C: Key terms	
9	Going through this whiteboard helped me out the most in how to understand the concept of different forms of literacy. Although you two have excelled in discourses related to a form of art and expression, there were still distinct differences in which you found ways to connect with others around you or grabbed a hold of different experiences to assist in your development of your literacy. At the same time, you both had the ability to find similarities in how your story had described a part of your life. This was a great example and collaboration!	A: Compliment	M: Interpretation	C: key terms
9	Going through this whiteboard helped me out the most in how to understand the concept of different forms of literacy. Although you two have excelled in discourses related to a form of art and expression, there were still distinct differences in which you found ways to connect with others around you or grabbed a hold of different experiences to assist in your development of your literacy. At the same time, you both had the ability to find similarities in how your story had described a part of your life. This was a great example and collaboration!	A: Compliment	M: Interpretation	C: key terms
10	This whiteboard helped me assess some of the things that we recently have covered throughout the course on how literacy is fluid and can be applied to many realms. Additionally, I find it interesting how they touch upon challenging the narrative of dominant discourses, which I feel is really important and in many ways, beneficial when thinking about the importance of learning and how abstract it is in today's education.	A: Compliment	C: Key terms	S: Worldview
11	This specific whiteboard helped me visualize dominant discourse very well. Dominant discourse is usually set by society and people that are highly powerful. This makes people that don't follow dominant discourse feel as if they do not belong. I really do truly believe that dance is a creative way of connecting with people because you show emotions that are difficult to vocalize. It is a great way of expressing problems in society such as dominant discourse. Great whiteboard collab!	A: Compliment	C: Key Terms	S: Worldview
12	Hi Name and name, I really enjoyed your whiteboard! I like how you both connect your stories back to discourses and how the dominant discourse can really shape a person and how they learn. I also like how your literacy stories are not about reading and writing, which really emphasizes how literacy has a much broader definition.	A: Personal Address	A: complement	C:Key terms
13	Great whiteboards and explanations! The explanation about the art discourse helped me understand more abstract definitions of a discourse. I agree that art is a more creative means of literacy, since people can interpret it in different ways. It is usually not the dominant discourse because of this reason, which you also touched on!	A: Compliment	C: Key Terms	
14	Both your whiteboards seem to emphasize forms of literacy outside the standard notions of learning to read and write. I believe this is a core concept of the class; we are attempting to increase our ZOPD, but often to do so requires finding secondary discourses that expand our ZOPD. I think Name discovered that acquiring the discourse of those kids expanded her potential, just as Name expanded her potential of worldly understanding through artist expression.	C: Key Terms **(ZOPD)**	A: Pesonaal Address	M: interpreting images
15	Literacy is more than reading and writing. I find it so beautiful to be literate in art and music.	S: Worldview		
16	I loved how your whiteboard seemed to really emphasize the importance of different types of discourses, not just the standards. Art, especially dancing, is a way of communicating emotions and ideas with all types of people, universally, and is a discourse that is not traditionally thought of. I, myself, have been playing music from a very young age and I know that forms of art are forms of languages that can connect others outside the discourse as well. We can also relate this to the reading and videos regarding Hip Hop and graffiti in the African American community.	A: Compliment	S: Experience	C: key terms
17	Your whiteboard demonstrates the many different discourses that exist in the art realm. The discourse used in painting are different than the discourse used in dancing. However, both are in a sense social in that the final artistic product is commonly shared. The audience, in return, gets a glimpse into the artists artistic expression. From my own experiences, I think it is interesting to note that different types of dancing have different and overlapping discourses.	M: Interpeting	S: Experience	C: Key terms
18	This helped me understand how their are different realms of "art". Yes the community of "art" has particular aspects that make it a particular discourse, but there are different aspects or realms of art that may not be understood. Such as Dance is different from Drawing. But, both incorporate the interaction with others and the sharing of different ideas.	A: Compliment	M: interpretating	C: Key terms