Open-Access Student-Centered Learning

The Open Web as a Collaborative Space for Higher Education in Public

Lisa Tagliaferri(✉)

The Futures Initiative, The Graduate Center, CUNY, New York, NY 10016, USA
ltagliaferri@gradcenter.cuny.edu

Abstract. This study examines two open-access websites that host online public-facing courses at the university level. Online learning environments are replacing or enhancing many physical classrooms within higher education, but these learning environments are not necessarily free, open-access, or publicly available on the open web. Considering two organizations that host free and open websites available to use by any member of the public, this study demonstrates how open-access and public-facing pedagogy on the web is in-line with student-centered practices. Network analysis, website structure, content analysis, and surveys suggest that students can be equally and potentially more empowered as practitioners in their own education by sharing their knowledge-building with a wider audience on the open web. Open web communities can enable student-centered pedagogy practices to freely evolve outside of a hierarchical and institutional structure, and can work to further student-centered goals through producing knowledge for anyone to access and contribute to on the open web.

Keywords: Open access · Open web · Student-centered learning

1 Introduction

As online learning environments are replacing or being used in tandem with physical higher education classroom spaces, it is important to ensure that traditional modes of learning that recreate hierarchies and exclude different forms of knowledge production are not replicated without critical examination. With contemporary classrooms being innovated through student-centered learning practices, educators, software developers and undergraduate students have an opportunity to reshape online learning through open-access and open-source technologies, conducting their teaching and learning experiences online and in public.

The purpose of this study is to examine higher education student-centered pedagogy practices conducted on the open web through public open-access platforms. Student-driven learning changes the power dynamics of the classroom by casting students as knowledge-producers who are stakeholders in their educational outcomes.

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This study is driven by two guiding questions:

1. When undergraduate students are tasked with creating a public-facing and living document on the web for peers and experts alike to have access to their learning and production of knowledge, how are their approaches to learning challenged and how do their outcomes change?
2. Is online open-access learning consistent with student-centered learning methodologies and how can such a learning environment expand the goals of this pedagogical practice?

2 Background

Considering college and university courses that take place to some extent on two open-access sites, with a focus on undergraduate courses in particular, this study identified, examined and analyzed courses that were, at least in part, conducted online and in public. The open web provides a potential space for student-centered pedagogy to take place, with the ability to impact both students and instructors. This study worked with two sites in particular, but many of its methods can be replicated on other open-access sites, and its findings can have broad implications for other sites on the open web that intersect with pedagogy.

2.1 HASTAC

Built on the open-source Drupal content management system, hastac.org is the primary online collaborative space and official website of HASTAC (Humanities, Arts, Science, and Technology Alliance and Collaboratory; pronounced "Haystack"), a scholarly network that is committed to changing the way those in higher education teach and learn. As of June 2016, HASTAC has over 14,000 registered users, nearly 14,000 user-generated content posts, and receives about 50,000 pageviews a month. Founded in 2002 by Cathy N. Davidson and David Theo Goldberg [1], HASTAC is reputed to be the world's first and oldest academic social network, predating Facebook, Myspace, and nanoHUB [2]. An entirely open and free online community, HASTAC is a place for engagement across disciplines, driven by the ethos of collaboration by difference.

Initially providing an online participatory space for academic and research-focused collaboration across disciplines by primarily doctoral students and faculty, HASTAC has been community-led since its foundation. As an open network with many different users across fields, HASTAC has more recently moved towards an online community with many robust user-generated resources focused on pedagogy and learning. This has been an organic and user-driven shift over time, directed in large part by members of HASTAC Scholars cohorts.

The HASTAC Scholars initiative, founded in 2009, is a fellowship program for graduate and undergraduate students that are enrolled in and sponsored by colleges and universities. Each year, a new cohort of HASTAC Scholars is accepted into the program, and the students have come from 145 institutions to

date. While HASTAC Scholars primarily hail from North America, they have also been based in Europe, Australia, South Africa, India, and Japan.

HASTAC has also convened an annual conference since 2007, enabling HASTAC community members to meet each other in-person to share their work and collaborate with others. Hosted by affiliate organizations in different international locations, it is attended annually by 250–450 individuals — professors, independent scholars, graduate and undergraduate students, and others interested in using technology to innovate learning.

2.2 The Futures Initiative CBOX

The open-source Futures Initiative Commons In A Box (CBOX) site (futuresinitiative.org) was built in 2015 specifically for the use case of providing an open online component to courses taught at the City University of New York (CUNY). CBOX is free software intended to help organizations create multi-site networks and is based on the WordPress content management system and the BuddyPress plugin [3]. As CBOX was developed at CUNY, it was a straightforward choice for the customized Futures Initiative CBOX site, which was adopted specifically to be utilized in CUNY courses sponsored by the Futures Initiative. The largest urban public university in the United States, CUNY is comprised of 24 campuses and is the institutional home of over half a million students [4].

There are over 550 registered users on the Futures Initiative CBOX site, and the monthly pageviews vary from 7,000 sessions to 38,000 sessions each month depending on whether CUNY classes are in session.

Founded in 2014 and based in the Graduate Center campus of CUNY, the Futures Initiative is working to advance equity and innovation in higher education [5], and is committed to public education as a public good. Viewing the website as an aspect of its mission, much of the teaching and learning that takes place in courses that are affiliated with the Futures Initiative is available online for public consumption, with the intention of providing a model for other institutions of higher education. Additionally, the Futures Initiative holds a workshop series, "The University Worth Fighting For," that is livestreamed and live-tweeted and archived on its website [6], and coordinates a Peer Mentoring program across the CUNY campuses.

2.3 Similarities and Differences

HASTAC and the Futures Initiative are two non-profit organizations that share several central goals and key principles in common:

- They are committed to innovating teaching and learning and often employ technology as an aspect of their broader approach.
- They seek to advance equity through bringing more diverse voices to the fore, focusing on countering structural inequality not through goodwill but through "design[ing] structures that themselves are equal" [7].
- They both work to build communities through leveraging the open web.

– They serve the public through making free resources available online.
– They do not sell their network or user data in any way [8].

Though the two organizations have a number of similar objectives and overlapping foundational values, they also have important differences.

HASTAC is a mature international organization of over 14,000 site users/members that was founded in 2002, 12 years before the Futures Initiative began. It receives funding through various bodies, including through universities and grants, and though it maintains partnerships and affiliations, HASTAC is an independent organization and online community. Unlike the Futures Initiative, HASTAC was not created as a space for conducting online components of classrooms, but as a community for interdisciplinary researchers, which it identified as "humanists, artists, scientists, and engineers" on its site in 2005 [9]. Through bringing together these community members, the site sought to facilitate innovative technological projects at the service of interdisciplinary research and teaching in the humanities. While HASTAC was initially invested in what came to be known as the digital humanities, its current site uses the tagline "Changing the way we teach and learn" [10], showing a shift towards an emphasis on pedagogy while not precluding research and other scholarly activities.

The Futures Initiative is embedded within CUNY, and while there are over 550 users on its site, it does not have an organizational membership in the way that HASTAC does, nor does it host international conferences. A much younger initiative, is has been focused on higher education since its inception in 2014. Though the Futures Initiative CBOX site is open to anyone who would like to join, it was intended as a space for online learning and collaboration across the CUNY network of campuses. The Futures Initiative is therefore much more focused in its scope, primarily serving CUNY, New York City, and public education writ large.

3 Methodology

Focusing on undergraduate courses taught in part on two open-access sites, this study identified, examined and analyzed courses that were to some extent conducted online and in public. HASTAC, as an international academic social network, has over time organically included more user-driven online learning components. The Futures Initiative CBOX site was adopted specifically for use in the urban undergraduate classrooms of New York City.

The quantitative approach of this study consisted of website structure analysis via taxonomy and user-generated content, and pulling data from SQL relational databases to see user content creation and user movement across pages within sites. The resulting data were then analyzed through network visualization and statistical analysis to render pathways clearer and to show movement through the respective sites by individual users. Studying this data pointed to ways that working out classroom goals on the open web affected learning. This collected data was examined to realize conclusions about user interaction with

the respective site, and how much the users' interaction with the site benefitted their learning outcomes.

The qualitative approach of this study consisted of granular content analysis that was context-driven, and blog post reflections, and student surveys. Based on students' experiences in various configurations of traditional or student-centered classrooms and those with or without an online component, this study examines how pedagogical approaches had an impact on students' learning outcomes, and whether what they had hoped to achieve in each respective class was realized.

4 Website Structure

Each organization serves a different community, and is built on a different content management system. Drucker and Svensson have proposed that "middleware" — tools that have a back-end for data and an interface for users, including web-based content management systems — "should not just appear or be taken for granted, but needs to be the result of intellectual, iterative and materially grounded processes incorporating appropriate expertise and infrastructure" [11]. The two middleware choices of each site offer different functionality and methods to collaborate, teach, and learn on the open web and in public, and should continue to be critically analyzed and evaluated by developers and members of their respective communities.

4.1 hastac.org

Built on Drupal 7, and having cycled through several iterations since its launch, hastac.org offers its users a robust content management system.

Content Types. HASTAC enables all registered site members to make use of several different content types (Fig. 1): Blog post, Wiki, Opportunity or Event, Group, Organization.

Blog posts, each authored and edited by a single site user, are by far the most used content type on hastac.org. Blog posts offer the opportunity for users to share research, reflections, initial inquiries, calls for collaboration, resources such as digital research tools or approaches to pedagogy, and more.

Wikis are started by one site user, but are open to any registered user for edits. Though Wikis offer a space for collaboration, they do not intrinsically identify authorship to those viewing the site, which may not be the preferred method for the citation-focused academic user base to blog in public.

Opportunities or Events are a content type that enables users to add a calendar-based item to hastac.org. Opportunities can range from calls for papers to job postings. Posted Events may call attention to a lecture, performance, conference, etc., that will take place online or anywhere in the world (there is a map integration available for this content type). The Opportunity or Event postings have a separate RSS feed from the HASTAC site at large, as it is commonly used [12].

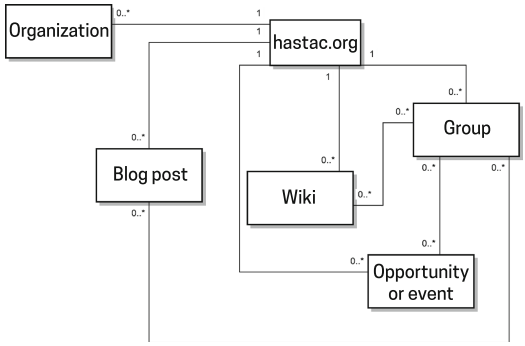


Fig. 1. Content structure of hastac.org as available to general users.

The Group content type can be originated by any registered user of HASTAC, and can be made public or private. Groups allow the collection of other posts under a larger heading, with the following content types: Blog post, Wiki, Opportunity or Event. Groups often bring like-minded users together; members of the Digital Collections Group (https://www.hastac.org/groups/digital-collections), for example, collaborated to consider the in flux space of the digital archive. Group members posted their thoughts, provided examples, and shared events related to online archives.

The Organization content type allows interested parties — often universities, digital humanities initiatives, and academic-focused non-profits — to create a static page that pulls simple information about their program and their affiliated users together into HASTAC. Unlike the Group content type, the Organization content type cannot have child content types affiliated with it.

Topics. Additionally, each of these content types, except for the Organization content type, requires users to choose a Main Topic to categorize the post: Teaching & Learning Practices; Humanities, Arts & Media; Technologies, Networks & Sciences; Social & Political Issues; Educational & Cultural Institutions; Publishing & Archives.

Each of these required Main Topics has between 8 and 11 Subtopics that can also be chosen to further narrow down the topic of the post, making content easier to find and automatically pulled together. As an example, a list of the Subtopics for the "Humanities, Arts & Media" Main Topic are as follows: Geography & Mapping; Film; History; Literature & Language; Music & Sound; Digital Humanities; Video & Animation; Visual Arts & Design.

While "History", "Film", and "Literature & Language" are obvious Subtopics for the "Humanities, Arts & Media" Main Topic, Subtopics like "Digital Humanities" and "Geography & Mapping" have a more interdisciplinary breadth, and users who select the Main Topic and Subtopic "Humanities, Arts & Media → Digital Humanities", may also want to choose the "Technologies, Networks & Sciences" Main Topic, but are not able to do so.

Topics have also changed through each iteration of hastac.org. The most recent Drupal 7 instance of the site was launched in the summer of 2015, and Main Topics shifted from the previous Drupal 6 instance. For example, the topics "Academia", "Collaboration", and "Pedagogy & Teaching" were converted to the Main Topic "Teaching & Learning Practices", with "Collaboration" and "Pedagogy" made into Subtopics of "Teaching & Learning Practices". Through this change, topics were automatically modified once the site was converted, such that a Blog post marked with the "Academia" topic in 2014 is now marked with the "Teaching & Learning Practices" Main Topic. Though in the past users were able to forego tagging their content with Main Topics, on the current site only administrators can make content without categorizing it.

The recasting of topics is indicative of HASTAC's commitment to the changing needs of its user base, and enables its content to be readily searchable without requiring (though allowing) user-generated tags.

4.2 futuresinitiative.org

As Commons In A Box is built on WordPress and the BuddyPress plugin, it offers limited content types of a Blog (a fully-functional WordPress site that becomes the child site of the futuresinitiative.org main parent site) or a Group (which includes a forum) (Fig. 2). Groups and Blogs can be associated with each other (at a 1:1 ratio), but need not be. For the purposes of taxonomy, "Child Site" will be substituted for "Blog" within this study, though the documentation and graphical user interface of CBOX uses both "Blog" and "Site" to refer to the multiple WordPress sites within its multisite framework [13].

Spring 2015. The first iteration of the Futures Initiative CBOX site was built for an interdisciplinary network of courses, and was called "Mapping the Futures of Higher Education" after the course, rather than "Futures Initiative" after the organization. The parent site of the CBOX installation was a graduate-level course taught at the Graduate Center, which enrolled a dozen students from

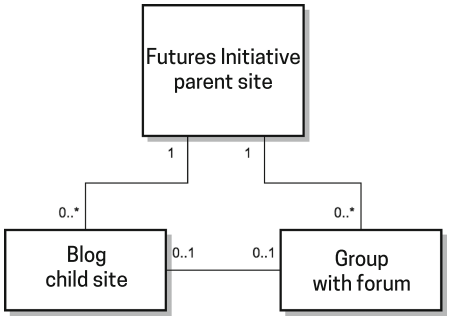


Fig. 2. Content structure of futuresinitiative.org available to all users.

masters and doctoral programs. Each of these graduate students either taught one or more undergraduate courses throughout the CUNY system or played an administrative pedagogy-focused role at a CUNY campus. For each course or organization that the graduate students taught or oversaw, one Child Site, one Group, or a combination of one Child Site and one Group was created.

While many graduate students chose to employ both a Child Site and a Group, these were not necessarily discrete spaces. For example, the students of the Anatomy and Physiology course taught at Lehman College used both the Child Site and the Group as a forum to communicate with each other. Some instructors used the Group to be a private space to channel class-only conversations, with the Child Site functioning as a public-facing project-oriented space. Within the CBOX multisite network, both Groups and Child Sites can have layers of public visibility and privacy, allowing for each graduate student instructor to strike the best balance for their individual courses or organizations.

Many undergraduate students also created Child Sites. Some undergraduate students chose to use their Child Sites as a blog, and others chose to create one to satisfy a project requirement within their courses. One example of a CBOX-based project is the "Knowledge is Priceless, Education is Not (http://futures.gc.cuny.edu/education/)" Child Site created by students of the Introduction to Narrative course taught at Queens College. This project provides background, statistics, personal experiences, and an invitation to hear from others.

Fall 2015–Spring 2016. Following the launch of the Futures Initiative in Fall 2014, and the launch of the Futures Initiative CBOX site in Spring 2015, the Futures Initiative sponsored 5 graduate-level courses at the Graduate Center in the Fall 2015–Spring 2016 academic year. Two courses were taught in the Fall term, and 3 courses were taught in the Spring. Though these courses still presented opportunities for being affiliated with undergraduate CUNY campuses, the vast majority of the graduate students enrolled in the Graduate Center courses were not teaching at the undergraduate level, or chose not to use the Futures Initiative CBOX as a component of their teaching.

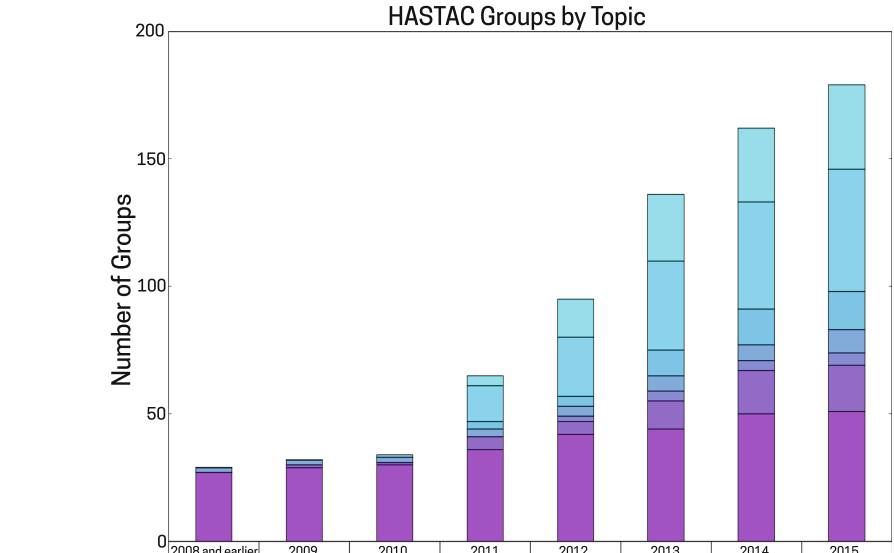
On a per-campus basis, CUNY already offers a number of digital tools for online teaching, including Blackboard and Digication ePortfolios. CUNY also offers other WordPress-based online platforms: QWriting (http://qwriting.qc.cuny.edu/) at Queens College and Blogs@Baruch (http://blogs.baruch.cuny.edu/) at Baruch College; and multi-site WordPress networks OpenLab (https://openlab.citytech.cuny.edu/) at New York City College of Technology and CUNY Academic Commons (http://commons.gc.cuny.edu/) based at the Graduate Center, which Commons In A Box is based on. This level of saturation may deter graduate student instructors from using the Futures Initiative CBOX in their classrooms unless they are required to do so. Following the Spring 2015 terms in June 2015, the site had 410 users, and since then, the number of users has increased to 557.

5 Results and Analysis

Considering that the creation of online learning spaces within HASTAC was community-driven while the learning environment of the Futures Initiative CBOX site was imposed by higher education student-centered learning practitioners, comparing the two open-access spaces has proven to be informative.

5.1 HASTAC Groups

As hastac.org was not built directly with teaching in mind, users have decided to utilize the Group content type in order to bring undergraduate students together into a learning space on the open web. The increased interest in teaching and learning on HASTAC can be shown in Fig. 3.



	2008 and earlier	2009	2010	2011	2012	2013	2014	2015
Humanities, Arts, & Media	0	0	1	4	15	26	29	33
Teaching & Learning Practices	0	0	0	14	23	35	42	48
Technology, Networks & Sciences	0	0	0	3	4	10	14	15
Educational & Cultural Institutions	2	2	2	3	4	6	6	9
Publishing & Archives	0	0	0	0	2	4	4	5
Social & Political Issues	0	1	1	5	5	11	17	18
Uncategorized	27	29	30	36	42	44	50	51

Fig. 3. HASTAC Group main topics over time [14].

The numbers of Fig. 3 show significant growth in the Teaching & Learning Practices Main Topic in particular, with no Group identified with that Main Topic until 2011, when 14 new Groups were created as Teaching & Learning Groups. In 2012, that number increased to 23 Teaching & Learning Groups total, then 35 in 2013, 42 in 2014, and 48 in 2015.

This generalized interest of the HASTAC user base is qualitatively analyzed through a more granular approach. Nine user-created public and private Groups have been identified as online spaces to facilitate learning at the graduate or undergraduate level:

- **Ocelot Scholars, Schoolcraft College (Michigan), created 12/2011, 36 members.** Undergraduate students and professors use this Group to engage with the broader mission of considering alternative methods of knowledge production.
- **ACM Newberry Seminar: Research in the Humanities, Monmouth College (Illinois), created 06/2014, 23 members.** A private Group for undergraduates participating in "Across the Curriculum" at the college, and the only private Group that has been identified as an online course component.
- **Scholarly Voices, created 01/2015, 133 members.** This is a more open version of the Ocelot Scholars Group, inviting undergraduates at any institution to participate. Though this is not a course per se, several courses point undergraduate students to this Group to contribute content.
- **Queens College – Introduction to Narrative, Queens College (CUNY) (New York), created 01/2015, 12 members.** This is the only direct corollary that exists between an undergraduate course with a Futures Initiative CBOX component and a HASTAC component.
- **Politics and Practices of Digital Media, Brown University (Rhode Island), created 02/2015, 17 members.** An undergraduate course in the Department of Modern Culture and Media.
- **Computer Science Ethics, St. Thomas Aquinas College (New York), created 02/2015, 17 members.** This is an online component of an undergraduate course taught in Spring 2015 that asked students to post reflections and projects (including software development projects).
- **Understanding Film and Media Cultures in a Digital World, created 09/2015, 17 members.** This collaborative Group focused on teaching and learning, and was a space for graduate student-instructors (all HASTAC Scholars) based at Queen's University Belfast and Vanderbilt University in Nashville, Tennessee.
- **SJU Adult Learning Theory, Saint Joseph's University (Pennsylvania), created 02/2016, 10 members.** Unlike the examples above, this Group is administered by a student rather than by an instructor of the course, a graduate-level class in the Organizational Development and Leadership Program.
- **SJU Coaching & Consulting Spring 2016, Saint Joseph's University (Pennsylvania), created 03/2016, 9 members.** A student also administers this Group, which is a component of an undergraduate-level class.

From the list above, several emerging patterns can be identified: (1) Groups for undergraduate students limited to one semester and one institution, (2) Groups for undergraduate students that are open in terms of institutional affiliation and semester, (3) Groups for graduate-level courses, (4) Groups that are administered by students for use in their own classrooms.

The Queens College – Introduction to Narrative Group provides an interesting counterpoint to the Futures Initiative CBOX as that course participated across both sites. The HASTAC Group version of the Queens College course has 12 members in the Group, but only 3 blog posts. These blog posts differed from posts done on the Futures Initiative CBOX site and were not cross-posts, but the CBOX site had 42 members and 46 published posts in comparison. This indicates that having multiple spaces to blog may be redundant, and students may not want to make public posts in multiple online venues.

The description of the SJU Adult Learning Theory Group sums up some of the reasons why courses may look to open-access communities on the open web: "We are utilizing this online tool to publish our work and provoke conversation about the topics we are studying from a larger learning community" [15]. With this intention, the Group did achieve its goals through making use of the HASTAC platform, which allowed them to publish their work, spark conversations, and share with a larger community. Though their 10 posts received between 16 and 30 "thumbs ups" each, these same posts only received between 0 and 6 comments each. Moving forward, HASTAC developers and administrators may consider doing more to foster conversation if teachers and students conducting components of their classes on HASTAC are interested in receiving more feedback and partaking in broader conversations.

The variety of use cases for the Group content type suggests how powerful platforms on the open web can be in contexts that may have been outside of the intention of developers.

5.2 Futures Initiative Child Sites

The Futures Initiative CBOX, having been built for the Futures Initiative networked courses across the CUNY campus, already had the intended use case of facilitating online learning and student-centered collaboration. The site provided an online space to bring students together and to empower them through participating in a public-facing forum.

Previous research has shown that the Futures Initiative CBOX, as an open-access site on the open web, has facilitated students' wandering through various Child Sites, similar to a sandbox game like Minecraft [16]. That is, a student enrolled in Art History at Brooklyn College may join and engage with the course Child Site for the Chemistry course taught at Borough of Manhattan Community College.

In their study following the networked Futures Initiative Spring 2015 course, "Summary Report: A Mixed-Methods Study on the Course 'Mapping the Futures of Higher Education' at CUNY," Flanagan and Greenblatt conducted surveys and interviews with undergraduate students enrolled in courses affiliated with the Futures Initiative. They found that Child Sites were "an important aspect of the undergraduates['] experiences since it created a stronger sense of a community" [17], citing that students at CUNY campuses were primarily commuter students that did not live in dorms together. They also found that the undergraduates registered on the Futures Initiative CBOX site used it primarily for

"communication, collaboration, and learning with peers" [17]. Community building, collaboration, and communication are all aspects of student-centered learning that were enhanced through the use of the Futures Initiative CBOX site.

The network visualization (Fig. 4) maps the CUNY campus representation on the Futures Initiative CBOX site as well as the users that are affiliated with one of more of the campuses (as students, instructors, administrators, or as a combination of two roles). A comparison between this and a visualization from 2015 [16] shows a slow down in terms of user enrollment following the first iteration of the site for the "Mapping the Futures of Higher Education" Spring 2015 course, but as of 2016 the site is more fully reaching throughout the CUNY system and engaging with more graduate student instructors and administrators with multi-campus affiliations through the number of user nodes that are connected to more than one campus node.

Fig. 4. Network visualization of Futures Initiative CBOX site's users and affiliated CUNY campuses, June 2016 [18,19].

Figure 4 has user nodes in light blue and campuses in dark blue nodes with 18 CUNY campuses represented of the 24 total in the system, up from 16 campuses in 2015. Though 6 campuses do not have users that are connected to more than one campus, Baruch College moved from a hub with two users in 2015 to a more centralized hub with many more users in the June 2016 network analysis.

The network analysis and visualization of the Futures Initiative CBOX sites points to a community that is still growing and becoming more connected to its localized network of CUNY colleges. Over time, this network should increasingly become decentralized, which is in-line with student-centered non-hierarchical pedagogy. With many graduate students who are affecting change in multiple directions, these networks also show a student-driven approach to learning that does not radiate from professors, but from graduate students and undergraduate students.

6 Outcomes

This ongoing study and analysis has suggested that open-access web-based components are consistent with student-centered learning and that values associated with this practice lead to positive learning outcomes for undergraduate students alongside positive teaching outcomes for instructors. Open access is directly in line with the mission of student-centered pedagogy and public education in that making knowledge freely available to everyone is a major tenant. Making classroom-based knowledge production available on the web further the goals of student-centered pedagogy in that a broader audience has access to that discourse, and can contribute if desired.

HASTAC moving organically towards an online space for undergraduate student-centered learning is indicative of a need for this kind of learning environment that is on the web and open to the public.

An analysis of the Futures Initiative CBOX site shows that undergraduate students are actively participating in their own course sites as well as exploring course sites that they are not affiliated with, suggesting engaged learning and a greater interest in their individual learning outcomes. Network visualizations show interaction throughout the Futures Initiative CBOX site, as well as a substantial amount of student-created content, which is a core value of student-centered learning methodologies.

Initial survey responses indicate that students are interested in taking more classes that include student-centered learning and digital components [17]. Students are challenged on the web when they have too many requirements across diverse online sites, but as shown from the robustness of their content creation across HASTAC and the Futures Initiative CBOX site, they do not find public engagement to be challenging. As indicated by student-administered HASTAC Groups, students are ready to drive their own online-based learning. A fuller study on outcomes of digital literacy and online presence over time of undergraduate students enrolled in such courses could be of value in the future.

7 Conclusions

This study demonstrates how open-access and public-facing pedagogy on the web is in-line with student-centered practices and that students can be equally and potentially more empowered as practitioners in their own education by sharing their knowledge-building with a wider audience. This study highlights pedagogy on the public open web, but as both HASTAC and the Futures Initiative CBOX site have private group or private child site functionality respectively, it is important for educators, software developers, and undergraduate students to consider how important privacy is to the communities they are working with. Student-centered pedagogy that is open-access and online can evolve in both open-source and open web communities, and can be of particular importance to students in the undergraduate classroom.

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