Social Annotation: Promising Technologies and Practices in Writing

Justin Hodgson, Jeremiah Kalir, and Christopher D. Andrews

Abstract The act of annotation is intimately associated with reading, thinking, writing, and learning. From book marginalia to online commentary, this centuries-old practice has flourished in contemporary educational contexts thanks to recent advances in digital technologies. New computational affordances, social media platforms, and digital networks have changed how readers–as writers–participate in acts of annotation. Of particular interest is *social annotation* (SA), a type of learning technology that enables the addition of notes to digital and multimodal texts for the purposes of information sharing, peer interaction, knowledge construction, and collaborative meaning-making. This chapter reviews prominent SA technologies, functional specifications, key products, and insights from research, with particular attention to the use of SA in writing studies and composition. The chapter concludes by discussing implications for writing studies and suggests SA technologies can make a critical impact on student reading and writing practices.

1 Overview

Annotation is the addition of a note to a text. This deceptively simple writing practice is associated with a rich history of literature and literary studies (Barney, 1991; Jackson, 2001), is relevant to many humanities and social science disciplines (Siemens et al., 2017; Unsworth, 2000), and affords the practices of multimodal composition expressed by a range of material and digital technologies (Davis & Mueller, 2020; Jones, 2015). From rubricated medieval manuscripts to

J. Hodgson (✉) · C. D. Andrews
Indiana University Bloomington, Bloomington, IN, USA
e-mail: hodgson@indiana.edu

J. Kalir
University of Colorado Denver, Denver, CO, USA

book marginalia, underlined words to marked up blogs on the Web, annotation is a genre of communication (Kalir & Garcia, 2021) that synthesizes reading with writing (e.g., Wolfe, 2002a, 2002b), private response with public engagement (e.g., Marshall & Brush, 2004), and cognition with composition (e.g., Traester et al., 2021). In this chapter, we consider annotation as a writing practice that has often been, and continues to be, expressly *social* (e.g., Kalir, 2020; Sprouse, 2018), as indicated by readers who write and exchange their notes with one another, make meaning together, and use interactive media to construct knowledge about shared texts and contexts. More specifically, we borrow and build upon a definition from Novak and colleagues (2012) that defines *social annotation* (SA) as a type of learning technology enabling the addition of notes to digital and multimodal texts for the purposes of information sharing, peer interaction, knowledge construction, and collaborative meaning-making (e.g., Eryilmaz et al., 2013; Gao, 2013; Kalir et al., 2020; Zhu et al., 2020).

Given technological developments, pedagogical insights, and enthusiastic use of SA within both composition and literature courses (e.g., Allred et al., 2020; O'Dell, 2020; Sievers, 2021; Upson-Saia & Scott, 2013; Walker, 2019), it is pertinent to review how SA is relevant to writing studies. In this chapter, we first examine the core idea of SA technologies and practical specifications. We then identify key SA technologies, offering a brief examination of specific affordances and constraints. Finally, we offer insight into existing SA research in–and adjacent to–writing studies, and critically explore the implications of SA technologies for writing pedagogy and practice. Much contemporary research about SA emerges from educational studies, and specific domains like the learning sciences and literacy education. There are a few investigations about SA within writing studies which, appropriately, we review later in this chapter. Nonetheless, SA scholarship has primarily advanced SA as a learning technology–and not just a writing technology–and has provided formative insights on the purpose, pedagogy, and potential of SA technologies and practices.

In writing about SA technologies as relevant to writing studies, we recall Bryant's (2002) emphasis on the "fluidity" of written texts; namely, that processes of composition, revision, publication, reading, analysis, and discussion are fundamentally collaborative endeavors. Readers are writers, their writing is often social, and SA practices exemplify how textual collaboration can thrive across formal and informal learning environments. Moreover, SA technologies facilitate a range of meaningful feedback loops–from instructor to student, and among learners–that are critical to writing pedagogy (Sommers, 2006), invite students to serve in multiple roles (e.g., as tutor, expert, motivator, mentor, and collaborator), and that help develop dynamic learning communities in courses.

2   Core Idea of the Technology

SA is a type of learning technology predicated on two ideas about annotation as a writing practice. First, readers are writers who, for centuries, have added both informal and scholarly notes to their texts: manuscript glosses and scholia, book marginalia, and other forms of written commentary (Jackson, 2001; Nichols, 1991; Stauffer, 2021). Second, readers in our contemporary era have, not surprisingly, brought their everyday and academic writing practices to the Web so as to mark up electronic texts, online resources, and other features of digital environments (Cohn, 2021; Kalir & Garcia, 2021; Piper, 2012). From blog posts to wikipedia entries to social media updates, there are many ways that readers write online and often do so in direct response to other texts, topics, and social contexts. Indeed, the first Web browser, Mosaic, included annotation functionality that was intended to support social reading and writing practices (Carpenter, 2013). But our scope is necessarily more narrow. Whereas, for example, wikis are social technologies that encourage groups to read shared documents, there are categorical and pedagogical differences between the composition of new texts and commentary added to existing texts. We approach SA as a learning technology that directly "anchors" (Gao et al., 2013) written notes to digital primary sources, thereby creating a more proximal and contextual environment for reader response, peer interaction, and shared meaning-making (e.g., Chan & Pow, 2020; Mendenhall & Johnson, 2010). As we review below, there are a range of SA technologies (e.g., Murphy, 2021), as well as extensive use of SA in both scholarly publishing (e.g., Staines, 2019) and transparent qualitative inquiry (e.g., Kapiszewski & Karcher, 2021), with implementations that span elementary, primary, and secondary education. In this chapter we are concerned with the use of SA in formal, higher education contexts and, specifically, writing and composition courses.

3   Functional Specifications

From a technical standpoint, SA technologies operate as browser extensions or applications, with those applications also serving the purposes of formal coursework within Learning Management Systems (LMS; e.g., Canvas, Blackboard). Broadly, SA technologies work with Web-based texts that allow users to select key elements (primarily text) and add multimodal comments. SA tools are dynamic as they allow for shared access to the same text-based artifact, adding layers of interactivity to reading practices. In addition to adding notes to a text, readers can also reply to comments, create threaded discussions, and anchor individual comments and discussion threads within the text. This adds layers of interactivity to reading practices and shifts reading from a solitary activity into one that is social, "Support[ing] social reading, group sensemaking, knowledge construction and community building" (Zhu et al., 2020, p. 262).

Zhu and colleagues (2020) provide the most comprehensive summary, to date, of the social, technical, and pedagogical affordances of SA technologies. With concern for the use of SA in both K-12 and higher education contexts, the authors reviewed 39 relevant studies and identified five types of activities that are supported by SA. These include processing domain-specific knowledge, supporting argumentation and knowledge construction (e.g., Morales, Kalir, Fleerackers, & Alperin, 2022), practicing literacy skills, assessment and (peer) feedback, and connecting learning across online spaces. Perhaps more critically, however, is that SA technologies enable rich parallels between the act of reading and the values championed in the teaching of writing, as with process-oriented pedagogy, peer-to-peer focused engagement, and other practices rooted in the *social epistemic* frame. SA technologies render the act of reading visible among a group, thereby enabling socially situated "first draft thinking" practices for learners to read and write together (Kalir, 2020).

While functional specifications and pedagogical affordances characterize many SA technologies, not all are created equal. Indeed, some social reading technologies can be used to surveil student reading (Cohn & Kalir, 2022) or inadvertently exacerbate inequitable power relations (Bartley, 2022). In the next section, we explore prominent SA technologies with a focus on those used in writing studies. Admittedly, different SA technologies have different functional affordances. For example, *Hypothesis* allows readers to add hyperlinks and embed visual media in annotations, and to determine whether annotations are public or private. Others, like *Perusall*, include AI-powered functions, like automated grading. There are also other annotation applications (like Adobe Acrobat Pro or PowerNotes) that are SA adjacent; they feature social functionality despite other primary tool uses. In these cases, SA-adjacent annotation technologies may include a range of additional features (e.g., editing annotated artifacts, downloading notes with annotated texts), but often with less dynamic social functionality that does not readily integrate within a LMS.

4 Main Products

In a recent review, Murphy (2021) noted that SA, also commonly referred to as collaborative annotation, has increased in popularity in the past few years. The advent of cloud-based technologies, improvements in network structures, and greater degrees (and ease) of access–as well as increased options within the technologies–have aided in SA technologies being adopted across a range of instructional contexts (Ghadirian et al., 2018; Murphy, 2021; Seatter, 2019). Moreover, there is a wide array of SA (and SA-adjacent) technologies, stemming from a distributed history of production, from university-supported designs, to non-profit tools, to commercial applications. These technologies collectively feature a range of technical and social affordances, with educators deploying various and complementary teaching strategies. It is prudent, then, to categorically organize SA technologies to help identify core elements and associated practices. Accordingly, we employ Murphy's (2021) tripartite structure of SA technologies–Open Web Collaborative Annotation tools; Document-based; and

Publishing Platforms–complemented by our original commentary and reference to relevant examples.

Open Web Collaborative Annotation tools allow readers to publicly and privately annotate the Web. These technologies usually layer a minimal interface on top of Web content and require browser plugins to access annotation layers. These SA technologies *bring annotation to an object to be annotated*. The most common tools in this category are *Diigo* and *Hypothesis*. Research about *Diigo* found that undergraduate students prefered this SA technology to conventional discussion forums (in an LMS), as SA practices guided learners' attention to specific textual features and created more focused peer interaction (Sun & Gao, 2017). *Hypothesis* is of particular interest as both the technology and non-profit organization have actively shepherded efforts toward creating the open annotation standard and interoperability between annotation tools (Whaley, 2017). What makes *Hypothesis* of additional interest, as Kalir (2019) has demonstrated, is that it supports readers' multimodal expression, turns texts into discursive contexts, provides users with an accessible information infrastructure, and can help learners visualize cognition and social interaction (see also Morales et al., 2022). *Hypothesis* easily integrates with other open educational initiatives and integrates well with Canvas, Blackboard, and Moodle, among other LMS.

Document-based SA technologies allow annotators to upload files, such as PDFs, into the technology whereby documents are converted for annotation. In contrast to those in the former category, document-based SA technologies *require users to bring the object-to-be-annotated to the technology*. Common tools in this category include: *Perusall*, which is primarily used in higher education contexts (e.g., Miller et al., 2018; Walker, 2019); *NowComment*, which supports K-12 literacy education (e.g., Fayne, Bijesse, Allison, & Rothstein, 2022); and *HyLighter*, which operates in both educational and commercial settings. *HyLighter* uses data analytics to help annotators make sense of annotations in context, as well as across contexts, allowing notes to be brought together from multiple sources. *Perusall*, much like *Hypothesis*, integrates with major LMS, such as Canvas and Blackboard. This integration (as with Open Web *Hypothesis* above) can help reduce instructor and student onboarding, make documents more easily accessible, and aid the coordination of SA activities.

Publishing Platforms, particularly scholarly publishing platforms, are a third category of SA technology that allows readers to participate in peer review activities associated with books (e.g., Fitzpatrick, 2011) and journal articles (e.g., Staines, 2018). Publishing platforms that offer SA functionality are similar to document-based SA technologies, but the annotation features are built into the online platform: *requiring that both the annotator and the object-to-be-annotated go to the platform*. Common tools in this category include MITs *PubPub* platform used to support open peer review of *Data Feminism* (D'Ignazio & Klein, 2020) and *Open Knowledge Institutions* (Montgomery et al., 2021).

Complementing Murphy's categories, there are several other reviews of SA technologies and research. For example, Ghadirian, Salehi, and Mohd Ayub (2018) track the rise in research publications that focus on SA technologies, offer a critical distinction between text annotation tools like *Microsoft Word* and *Adobe Acrobat* versus

SA technologies, and offer a thorough overview of *HyLighter*, *Margelina*, and *Diigo*. Seatter (2019) reviewed *Annotation Studio*, *Hypothesis*, *NowComment*, *Prism*, and *Google Docs*, evaluating each in terms of flexibility, usability, and sociality to assess usefulness and applicability to pedagogical activities. Of additional note, Seatter called for an increased focus on universal design and accessibility with open SA technologies, seeing more inclusive features as helping make Open Web SA technologies "more objectively open technologies" (p. 10).

5   Research

Having identified a range of SA scholarship across disciplines, this section focuses on research in writing studies. There is a rich history of scholars in composition calling attention to the importance of reading (e.g., Haas & Flower, 1988; Horning, 1987; Joliffe, 2003, 2007; Wolfe, 2002b, 2008) and there has been renewed interest in recent years (Carillo, 2015; Horning & Kraemer, 2013; Joliffe, 2017; Salvorti & Donahue, 2016; Sullivan et al, 2017;). But the specific turn to SA practices and technologies is relatively new, with only a handful of works fundamentally rooted in SA considerations and/or their implications for student writing in composition and English courses. Although we do not present a formal literature review, we identified the following studies as being representative of recent efforts to incorporate SA in writing studies. These collective works offer insight into:

- the "multiple reading lenses" students employ in first-year composition (Sprouse, 2018),
- the impact of SA on student writing and course outcomes (Walker, 2019),
- how SA technologies and practices alter students' perceptions of reading and writing (O'Dell, 2020),
- how SA technologies create opportunities for readerly-writing practices and allow for *textual amplification through readerly additions* (Davis & Mueller, 2020)
- how SA technologies foster active collaboration among students and leave visual traces of critical reading practices (Traester et al., 2021), and
- how SA technologies can help students situate writing in relation to knowledge building practices (Sievers, 2021).

Sprouse (2018) identified reading as critical for students in composition but noted that the practices students employ while reading remain invisible. Consequently, she integrated *Hypothesis* into a first-year composition course and examined "multiple reading lenses" that students employed to guide textual engagement. Analyzing more than 1200 annotations generated by 18 students, Sprouse identified four reading purposes in student annotation: *reading for ideas*, or understanding and use of ideas in a text; *rhetorical reading*, or analyzing rhetorical choices and genre conventions; *critical reading*, or cultural values in sociopolitical contexts; and *aesthetic reading*, or personal connection to the text. She found that students often enacted multiple and "overlapping" reading purposes in attending to complex reading, particularly in

accounting for "writerly choices and their effects on readers" (p. 48). Sprouse's case documented how SA practices helped her, as the instructor, better assess the ways in which students took up reading practices. Implications from her study suggest that the visibility of student reading practices via SA allowed for better instruction and responsive feedback, made students aware of their reading lenses, and strategically oriented them to the ways in which they made sense of and used content from course texts.

While Sprouse (2018) investigated student reading practices, Walker (2019) studied the impact of SA technologies on student writing and course outcomes. Over two academic years, Walker included *Perusall* in four sections of sophomore-level English. Her study included 125 undergraduate students; 75 were in two course sections that included SA activities, and 54 were in the control sections. Walker collected data from *Perusall* (through the LMS) and from student surveys. The study goal was to determine the degree to which artificial intelligence (AI) elements in *Perusall* operated as pedagogical learning agents and helped students engage with course readings. Her view was that the more students engaged in course readings, the better they would be at leveraging those readings in their writing. While there are some concerns with this study (e.g., no substantive critique of "AI-robo" tools with heavy reliance on algorithms; little statistical difference in course outcomes given AI-based grading), the main gesture of Walker's findings suggests a positive correlation between students' use of *Perusall* and their final course grades. Walker's findings also echo related studies of SA technologies used in other disciplinary contexts (e.g., Gao, 2013; Kalir et al., 2020; Nokelainen et al., 2005) that demonstrate students' positive statements about SA activities and technology in narrative reflections about their learning.

O'Dell (2020) sought to better understand how SA technologies "alter student perceptions of reading and writing" (p. 2), and, moreover, how this technology impacted creative and collaborative writing practices in composition courses. From 2016–2019, O'Dell deployed *Genius* in five First-Year Writing Seminars, choosing the tool because it was accessible, operated with an attractive, aligned interface (i.e., Wolfe, 2008), encouraged collaboration, and mirrored social media practices familiar to students. O'Dell replaced traditional reading responses with low-stake *Genius* activities and encouraged students to "write down what they noticed and what interested them [in a reading], to bring in sources, to discuss their thoughts with others, and to ultimately use these insights to help create an argument for their essays" (p. 16). SA practices helped students to engage in close reading and gather textual evidence and information they could consolidate and integrate into "long-form writing" (ibid). Her analysis of survey data found that students perceived *Genius* favorably; the tool made "it easier [for students] to organize and communicate their ideas" (p. 2). O'Dell also discusses considerations for bringing digital technologies into the composition classroom and provides a nuanced frame for thinking about the inclusion of annotation technologies in writing courses.

Davis and Mueller's (2020) essay considers the history of the page and the multi-modality of texts as central to students' composition practices. They argue that shifts in materiality–and the means of textual production over the past 500 years–gradually

shifted reading from a "readerly-writing" experience into more passive consumption. However, they observe that digital technologies have "reinvigorated our attention to the page" (p. 112), alongside related practices of interaction as with annotation. They discuss how SA technologies have created opportunities for readerly-writing practices and how acts of *textual amplification through readerly additions* invite a reorientation of reading and writing pedagogies. But the act and space of textual amplification itself has been amplified by SA technologies, which make "social modes of readerly interaction" (p. 117) available and at speeds and scales never-before encountered by the printed page. Indeed, SA tools like *Hypothesis* are rooted in this idea of textual amplification by creating space (and a text-based interface), for multiple users to extend the ideas of others' writing, embed competing perspectives, and enable a complexity of understanding.

Traester, Kervina, and Brathwaite's (2021) study explored tool- and pedagogy-based interventions as a response to "the challenges associated with critical reading in the digital age" (p. 330). Each author integrated *Hypothesis* into their composition courses at three different institutional settings across the United States. The study rejected the idea that digital mediums of reading "preclude critical reasoning" (p. 329). Moreover, the authors found that SA technologies can aid in students building complex reading competencies and that annotation invites movement between higher- and lower-order cognitive engagements. Further, SA technologies facilitate understanding, situate differing viewpoints in-text, and enable situated responses, enhancing cognitive engagement and helping to make meaningful connections with texts/peers. Lastly, SA technologies can bridge *close reading* and *distant reading* practices, blur the line between public and private domains, and lead to personal reflection and to valuing reading as a way to (in)form a belief system.

Traester and colleagues (2021) further argued that the social dimension of *Hypothesis* can "foster active and voluntary collaboration" among students, and that students were inclined to "take on some of the more challenging tasks associated with expert reading" (p. 346). Additionally, SA activities allowed students to leave "visible traces" of their engagement within the text, "foreground[ing] the text in their conversations," and thereby creating a space "for more empathetic forms" of interaction (p. 347).

Sievers' (2021) study of a general education literature course focused on the relationship of SA practices to student writing. Sievers' case focuses on analyzed data from a single undergraduate course in 2016. She found that SA technology *Hypothesis*, "[w]hen used early in a student's career" can help better habituate students to "knowledge building through writing" and to "the collaborative, social, discursive nature of interpretation" (p. 432). As course instructor, she observed how *Hypothesis* moved up the work of interpretation and critical engagement (to "first encounters" with a given text), allowed students to model critical reading processes for one another, helped normalize the act of making inquiries and working through challenges (and doing so in open [i.e., public] ways), and situated knowledge making as "a community effort" (p. 447). Further, Sievers suggests students' SA activities influenced subsequent essay writing: "Triangulating their papers with their annotations and blog posts revealed […] close connections among these activities: their papers

used textual quotations more and in more precise ways, drawing closely on observations and ideas first articulated in their annotations and short writing assignments" (p. 447). Additional research should substantiate Sievers' claim and determine how SA activities influenced student writing; nonetheless, the overarching findings of her study have important implications for SA technologies and practices in writing courses.

6 Implications of this Technology for Writing Theory and Practice

With the advent of better, faster, more accessible digital tools, applications, and infrastructures, we have seen digital technologies have a major impact on how we teach composition. Moreover, with an increasing attention on digital literacy and digital creativity in higher education, there has also been a shift in what we teach in composition, in our learning outcomes, and in the architecture of our writing programs (Porter, 2009). This augmentation, reflective of an increasingly digital culture, places greater emphasis on digital ways of knowing, doing, and making (Hodgson, 2019) and invites the development of new pedagogies rooted not only in digital forms and functions, but also with a continued (and growing) interest in collaborative and interactive methods of learning (Kim & Bagaka, 2005). Or, as Gao (2013) put it, we are undergoing a shift in focus in higher education: moving from "learner-content interaction to learner-learner interaction" (p. 76). The challenge then is not if writing teachers will embrace digital technologies in the classroom, but rather how we come to understand the impact particular technologies have on the range of practices, purposes, and pedagogies we employ.

To this end, there is a wide assortment of possibilities for how SA technologies may change writing with respect to well-established characteristics and key considerations facing writing studies and practices.

First, SA technologies are particularly well-suited for low-stakes assignments that provide situated writing opportunities in texts as discursive contexts. Conventional reading responses, such as posts to a discussion forum, can be replaced with SA activities that allow students to move away from summative responses to analyze specific details, phrases, genre-specific conventions, and authorial choices. Additionally, SA technologies do not do away with discussion forums, but rather provide tools for anchoring threaded discussions in the text itself. This creates an opportunity to invite more complexity in student reading and thinking, as situating writing in-text offers a means for deeper reading engagements (O'Dell, 2020). When peers and instructors work through student annotations, they can prompt additional exploration by responding to an annotation, asking a question, pushing back against a particular perspective, and constructing new insight together (e.g., Morales et al., 2022).

SA technologies, then, provide an avenue through which to invite more complexity in student reading and thinking by (1) allowing writing teachers to situate rhetorical

inquiries in-text for students and (2) letting students respond to those inquiries in writing and, in some cases, through networked and layered media, all anchored in textual context.

Second, SA technologies have the capacity to enable high-quality feedback and support. Instructors can provide meaningful feedback about course readings by engaging with students' annotations and by situating inquiries and commentary directly in the text for students. Doing so can prompt further consideration, refocus analysis that may be off target, confirm lines of thought, and offer additional insight and expertise. Moreover, while SA technologies are primarily rooted in the kinds of reading practices students enact in writing classrooms, they can also be used among learners to facilitate peer review of their writing, allowing reviewers to anchor their feedback directly in the text as well.

Finally, SA technologies expand the physical margins of a text by adding a digital layer through which student annotations can be placed in the text and into conversation with others' annotations. As discussed, annotations may be multi-modal and hyperlinked to other media or resources, crafting a multimedia tapestry for meaning making practices. SA technologies create new spaces for multimodal writing and composition, for content engagement, and for peer-to-peer collaboration. When thoughtfully implemented in coursework, SA technologies can effectively help readers to focus on writing quality as a part of their annotation process. Further, the planned pairing of SA technologies and writing practices can help students better understand texts, aid clarity and coherence in subsequent writing activities, and can expose students to a range of writing styles and strategies. SA technologies can make a critical impact on student writing and reading practices and have the potential to improve the quality and complexity of student learning.

7 List of Tools

Annotation Studio	A suite of collaborative web-based annotation tools under development at MIT	https://www.annotationstudio.org/
Diigo	An abbreviation for "Digest of Internet Information, Groups and Other stuff," is an online platform that is intended to "streamline the information workflow" through the organization, annotation, and sharing of online resources	https://www.diigo.com/

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Genius	A music encyclopedia where users annotate song lyrics	https://genius.com/
HyLighter	A web-based annotation tool that allows for marking up digital texts and sharing comments and notes with other users	https://www.hylighter.com/
Hypothesis	Open-source software that affords "a conversation layer over the entire web that works everywhere, without needing implementation by any underlying site."	https://web.hypothes.is/
Marginalia	An open source web annotation system used to enrich online discussion. It works with various web browsers and allows users to highlight text and write margin notes. The program is a successor created by Geof Glass to Andrew Feenburg and Cindy Xin's TextWeaver	http://webmarginalia.net/
NowComment	A free platform primarily used in K-12 educational contexts that provides a platform "for group discussion, annotation, and curation of texts, images, and videos."	https://nowcomment.com/
Open Review Toolkit	Open source software that facilitates open review by allowing users to convert book manuscripts into a website	https://www.openreviewtoolkit.org/
Perusall	A social-reading platform that integrates with LMS and allows students and teachers to digitally annotate texts	https://perusall.com/

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PowerNotes	A digital notetaking platform that allows for annotation of digital texts, source management practices, and note-downloading capabilities	https://powernotes.com/
Prism	A tool for crowdsourcing interpretation by allowing shared mark-up and with each being categorized: creating a visualization of engagement with the text	http://prism.scholarslab.org/
PubPub	An open-source publishing platform for knowledge communities	https://www.pubpub.org/

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Justin Hodgson is Associate Professor of Digital Rhetoric in English at IU Bloomington and founding editor of the Journal for Undergraduate Multimedia Projects (jumpplus.net). His research explores the intersections of rhetoric and writing studies, digital learning and digital pedagogy, play and game theory, and art and aesthetics, and his monograph, Post-Digital Rhetoric and the New Aesthetic (Ohio State University Press) examines how shifts in the human-technology assemblage invite different approaches to the study and teaching of writing. His scholarship has appeared in Kairos, Composition Studies, and Enculturation, among other journals.

Jeremiah Kalir is an Associate Professor of Learning Design and Technology at the University of Colorado Denver School of Education and Human Development. His research—which spans literacy education, the learning sciences, and teacher education—examines how annotation facilitates social, collaborative, and justice-directed learning. Kalir's monograph, Annotation (MIT Press), introduces annotation as a genre that is significant to scholarship and everyday life. His scholarship has appeared in the Journal of Literacy Research, Information and Learning Sciences, Research in the Teaching of English, Distance Education, and English Journal, among other journals.

Chris Andrews is a PhD Candidate in the Learning Sciences program at Indiana University—Bloomington. His dissertation research focuses on how college instructors use the collaborative annotation software, Hypothesis, within their online courses and the processes and contexts that influenced their decision-making regarding annotation use. Prior to his doctoral studies, he taught high school media and technology classes (i.e., video production, TV broadcasting, digital media, and photography) for seven years in Utah.