

“When I saw my peers annotating”

Student perceptions of social annotation for learning in multiple courses

Student
perceptions of
social
annotation

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Abstract

Purpose – Social annotation (SA) is a genre of learning technology that enables the annotation of digital resources for information sharing, social interaction and knowledge production. This study aims to examine the perceived value of SA as contributing to learning in multiple undergraduate courses.

Design/methodology/approach – In total, 59 students in 3 upper-level undergraduate courses at a Canadian university participated in SA-enabled learning activities during the winter 2019 semester. A survey was administered to measure how SA contributed to students' perceptions of learning and sense of community.

Findings – A majority of students reported that SA supported their learning despite differences in course subject, how SA was incorporated and encouraged and how widely SA was used during course activities. While findings of the perceived value of SA as contributing to the course community were mixed, students reported that peer annotations aided comprehension of course content, confirmation of ideas and engagement with diverse perspectives.

Research limitations/implications – Studies about the relationships among SA, learning and student perception should continue to engage learners from multiple courses and from multiple disciplines, with indicators of perception measured using reliable instrumentation.

Practical implications – Researchers and faculty should carefully consider how the technical, instructional and social aspects of SA may be used to enable course-specific, personal and peer-supported learning.

Originality/value – This study found a greater variance in how undergraduate students perceived SA as contributing to the course community. Most students also perceived their own and peer annotations as productively contributing to learning. This study offers a more complete view of social factors that affect how SA is perceived by undergraduate students.

Keywords Higher education, Student perceptions, Anchored discussion, Hypothesis, Social annotation, Undergraduate learning

Paper type Research paper



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Introduction

Annotation, or the addition of a note to a text, is a practice intimately associated with reading, thinking, learning and scholarly discourse that predates, by hundreds of years, our digital era (Adler, 1940; Marshall and Brush, 2004; Skains, 2019; Unsworth, 2000). Today, annotation tools – and associated instructional arrangements and activity structures – help enable a range of learning practices such as reading comprehension, collaboration and peer review (Gao, 2013; Nokelainen *et al.*, 2005; Schacht, 2015; Zywicka and Gomez, 2008). While annotation, in some circumstances, may be an individual and idiosyncratic practice (Marshall, 1997), developments in open and collaborative annotation technologies (Kalir, 2019; Seatter, 2019; Staines, 2018) have advanced what scholars broadly refer to as social annotation (SA). According to Novak *et al.* (2012), SA is a genre of learning technology that enables the annotation of digital resources for information sharing, social interaction and knowledge production.

Unlike text annotation applications, which may only support commenting and highlighting features for individual readers, SA affords an “online social platform for information sharing” (Novak *et al.*, 2012, p. 40; Cohn, 2019). SA technology enables multiple readers to interact with a text and one another in a shared discursive context so as to promote “more contextualized and more focused discussion” (Gao *et al.*, 2013, p. 477). A number of learning practices typify collaborative activity among such “texts-as-contexts” (Kalir, 2019), including multimodal expression, the demonstration of expertise (McCartney *et al.*, 2018) and knowledge construction (Plevinski *et al.*, 2017). The socio-technical “formations” (Facer, 2011) made possible by SA have productively supported interdisciplinary teaching and learning among formal course contexts (Fendt and Paradis, 2016; Reid, 2019), aided meaning-making in open educational initiatives (Kalir, 2020), and have also encouraged new approaches to scholarly production and communication (Mirra, 2018; Siemens *et al.*, 2017).

As a form of online talk (Paulus and Wise, 2019), SA may be understood as a practice relevant to interdisciplinary intersections among the information sciences and learning sciences. In one respect, SA enables learners to interact with primary sources and other documents as information-rich environments given how technical and collaborative features (Kalir, 2018) can aid learners’ curation of resources, information seeking behaviors and collective sense-making (Glazewski and Hmelo-Silver, 2019). SA is also a semantic Web technology (Whaley, 2017) that, consequently, may afford learners the capability to make implicit knowledge – from both documents and from their interactions with others when referencing documents – more explicit and useful as a shared social resource (Di Iorio and Rossi, 2018). Furthermore, the technologies and practices associated with SA reflect a trend in the learning sciences to support and study group-level processes in computer-supported collaborative learning (Stahl, 2017) amidst the emergence of participatory and open learning environments (Chen, 2019; Kalir, 2018). From a conceptual stance, SA organizes group communication and cognition into a “new substance” (Dillenbourg, 2005) as shared notes augment collective expression, negotiation and meaning-making (Suthers, 2006). This theoretical positioning of SA as a collaborative and socially-situated activity (Enyedy and Stevens, 2006) is resonant with conceptual assertions made in our related work about group literacy practices (Kalir and Garcia, 2019) and shared meaning-making through collective epistemic expression (Kalir, 2020).

The growth of SA technologies and practices across learning environments has resulted in multiple complementary areas of inquiry. Most SA research attends explicitly to *learning practices and outcomes* such as reading comprehension of

discipline-specific literature or primary sources (Kararo and McCartney, 2019), collaborative and “layered” reading (Sprouse, 2018) and shared meaning-making (Chen, 2019). Other studies of SA have investigated *instructional approaches*, as with the SA model-learning system (Johnson *et al.*, 2010) or arrangements for “anchored” online learning environments (Gao *et al.*, 2013). Another broad category of SA research concerns *learners’ perceptions* of and attitudes about SA for learning (Gao, 2013; Kawase *et al.*, 2009; Mendenhall and Johnson, 2010). This latter area of inquiry echoes broader interest in student perceptions of educational technology (Henderson *et al.*, 2017; Lowerison *et al.*, 2006), as the ways in which learners view the use of technology may or may not be related to their learning (Ellis, 2016; Gerjets and Hesse, 2004). Moreover, our theoretical orientation toward SA enabling socially situated and group-level collaborative activity inform a decision to examine two constructs – students’ perceptions of learning (Richmond *et al.*, 1987) and perceptions about the sense of community (McMillan and Chavis, 1986) – that reflect longstanding inquiry about the ways in which social technologies and social relationships shape student engagement in their learning (Chu *et al.*, 2019; Halic *et al.*, 2010; Martin and Bolliger, 2018).

As learning sciences methods provide new insight about higher education instruction (Hora and Ferrare, 2013), this study is motivated by a need to better understand how students perceive the value of SA for their learning and sense of community in higher education. While student perceptions of SA tools and activities have been a focus of prior studies (Kanevsky *et al.*, 2017; Nokelainen *et al.*, 2005), we specifically attempt to address a number of common shortcomings prevalent in other investigations about perceptions of SA enabling learning, such as cursory instrumentation used to measure perception and attitude (Gao, 2013) and the use of data from single courses (Johnson *et al.*, 2010). We also recognize a need to investigate more than student perception of the technical features of SA tools as some studies that examine perceptions of educational technology can also reveal how students value and benefit from peer-supported digital educational experiences (Henderson *et al.*, 2017).

It is incumbent upon learning scientists to offer robust and reliable evidence about how undergraduate students perceive SA activities – not only SA tools – as well as what students find valuable about SA mediating their peer interactions and learning in social contexts. In response, and so as to take seriously the Novak *et al.* (2012) suggestion to conduct “in-depth” investigations of SA in a variety of learning environments and social arrangements, we advance a study that investigates two constructs relevant to students’ SA activity within and across courses of diverse disciplinary content at the same university. First, and most robustly, we investigate student perceptions of how SA contributes to learning. We do so by exploring students’ perception of the value of annotation including exposure to and interaction with peer annotations. Second, and given the social dimension of SA, we investigate students’ perception that SA contributes to a sense of community. Accordingly, this study is guided by the following research questions:

- RQ1.* How did students in multiple undergraduate courses perceive SA as contributing to learning? In particular: a) how did students perceive annotation as contributing to their learning; and b) how did students perceive peer annotation as contributing to their learning?

Literature review

The relationship between SA and learning has been studied across various contexts as relevant to K-12 education, higher education and professional learning (Ball, 2010; Kalir, 2020; Reid, 2019; Siemens *et al.*, 2017; Wolfe and Neuwirth, 2001). Studies of SA in K-12 education, for example, have examined how collaborative reading practices can improve learners' reading comprehension and attitudes (Chen *et al.*, 2014; Chen and Chen, 2014; Zywica and Gomez, 2008), as well as reading performance abilities such as deep reading, high-level analysis, summarizing and evaluation (Yang *et al.*, 2013). Among researchers and educators in professional learning contexts, SA has been found to support communities of practice and promote the coordination of relevant learning activities such as peer review, meaning-making and the development of disciplinary expertise (Kalir, 2019; McCartney *et al.*, 2018; Seatter, 2019). Given this study's focus on student perceptions of SA for both learning and sense of community in higher education, our literature review considers: first, SA trends and research opportunities in higher education teaching and learning; and second, insights from a small body of literature specifically concerned with student perceptions of SA.

Social annotation in higher education

Research indicates that undergraduate and graduate students' reading comprehension, peer review, motivation and attitudes toward technology use are all positively influenced by the inclusion of SA in course learning activities. Such is the conclusion of Novak *et al.* (2012), who offer, to date, the only dedicated literature review concerned with the educational use of SA tools in higher education. Their review of 16 experimental studies conducted across seven different disciplines found that SA tools lead to gains in student learning, and that "SA-based learning activities contribute to improved critical thinking, meta-cognitive skills, and reading comprehension" (p. 47). For example, Mendenhall and Johnson (2010) studied SA for peer review and critique and found that such annotation practices can enhance students' critical thinking (Liu, 2006). Nonetheless, Novak *et al.* (2012) identified numerous limitations in current SA research, suggesting future studies engage larger sample sizes across varied educational settings, examine students' annotation-related learning behaviors and progressions (Sun and Gao, 2017) and examine how SA occurs alongside other collaborative learning activities (Chen, 2019).

Amidst the "ubiquitous" growth of asynchronous online learning in higher education (Virtanen *et al.*, 2018), recent research has examined the ways in which SA creates "anchored" learning environments (Gao *et al.*, 2013) whereby students' discursive and collaborative activity is situated directly atop or alongside a digital text. SA-enabled anchored discussion has been studied in the context of computer-supported collaborative learning (Jeong and Hmelo-Silver, 2016; Kalir, 2018), and can create more authentic discursive opportunities that promote student collaboration about salient aspects of course readings. For example, students' SA can aid familiarity with complex discipline-specific vocabulary (Kararo and McCartney, 2019) and can effectively encourage students to learn with and from one another (Gao, 2013; Sprouse, 2018; Van Der Pol *et al.*, 2006). Moreover, anchored discussions have been found to encourage knowledge construction activities such as interpretation, questioning and consensus-building, while decreasing students' cognitive efforts to coordinate between a primary source and their discussion of the text

(Plevinski *et al.*, 2017; for additional insight about student cognition and coordination during annotation, see Yao and Gill, 2009). Notably, the use of SA in an anchored learning environment for individual reading activity (i.e. text highlighting) has not been found to positively improve students' course performance (Winchell *et al.*, 2018), further suggesting that the social qualities of SA matter as students engage with course content and their peers.

Perceptions of social annotation

Few studies have explicitly examined student perceptions about the use and value of SA in higher education. Novak *et al.* (2012, p. 48) summarized emerging trends in this domain, noting: "it appeared that students liked using social annotation technology and felt that this type of technology facilitated and supported learning." Mendenhall and Johnson (2010) found that undergraduate students perceived SA to be useful, especially as a way to receive feedback and organize information. However, these findings of student perceptions of SA were based upon interviews with only six participants from the same course. Also, included in the Novak *et al.* (2012) review was a study by Nokelainen *et al.* (2005), which examined perceptions of SA from learners in two courses – in-service educators in a statistics course and graduate students in a technology course. A post-course survey completed by 21 students across both courses asked whether learners disagreed, agreed or strongly agreed with seven statements, such as: "the comments made by other learners promoted my learning." The researchers concluded that SA brought "added value" to the learning process, with students reporting that SA favorably changed study habits and that peer commentary "promoted" learning practices (similar findings have also been reported among K-12 students; see Lin and Tsai, 2011). Not included in the Novak *et al.* (2012) review were confirmatory findings by Su *et al.* (2010, p. 764), who compared student perceptions of SA to more conventional discussion forums. Results from a survey of 45 undergraduate students studying computer science found favorable attitudes about the perceived usefulness, ease of use and learning satisfaction of a SA tool; specifically, "most of the students thought that group learning scenarios with annotation systems did increase their interest, happiness and achievements in collaborative learning." Alternatively, Suhre *et al.* (2019, p. 960) also studied university students' perceptions of SA ease of use and found – despite no reported sample size from students in eight courses, and little detail about how the survey was designed – that student perceptions were negatively influenced by "reading from a computer screen and expressed concern [sic] about the obligatory number of annotations."

Several other studies have provided insight into how students in higher education courses perceive SA as either contributing to their learning or as pertinent to their social interactions. Chen and Chen (2015) are among the few researchers who have examined student perceptions of SA across multiple university courses, albeit from a single discipline. Survey responses from 21 graduate students in three business management courses suggested generally positive attitudes about the social qualities of SA. In addition to finding that SA increased learners' reading motivation, they reported that SA can create a communal learning environment and provide emotional and peer support among groups of students. Three other studies also present encouraging findings of how students have perceived SA as relevant to either learning or a sense of community, albeit based on less robust data and methods. Kanevsky *et al.* (2017) reported that graduate students found SA useful when interacting with peers, clarifying ideas and making connections while reading, but did so based upon only six survey responses, and without making clear how the survey instrument was constructed, whether it was a reliable measure or how the responses were analyzed to make claims about student perceptions. Similarly, Gao (2013) included a "brief survey" about perceptions of learning with SA that included only one Likert question and

three open-ended questions. In total, 33 pre-service teachers in three sections of one undergraduate course reported a “moderately positive” attitude about their use of SA. [Chen \(2019\)](#) investigated graduate students’ perceptions of the “usefulness” of SA and found, despite a small sample size of only 8 students, that the Hypothesis tool was perceived to support community building and collaborative sense-making.

Overall, literature about SA in higher education features inconsistent and incomplete descriptions about the methods and instruments used in some studies to investigate students’ perceptions of SA tools and their learning. Furthermore, variation among studies that focus on either a single course or multiple courses (perhaps, in the same discipline) has made it difficult to establish a reliable measure of student perception of SA. Accordingly, there is an unmet need for methodically sound cross-course studies about how students in higher education perceive SA as contributing to both their learning and to a sense of community.

Methods

This article presents a case study about how undergraduate students perceived SA as contributing to their learning and sense of community. We used an exploratory and single-case study design ([Baxter and Jack, 2008](#)) given a novel and broader research effort at a Canadian university to implement SA activities among multiple courses and across various disciplines during the winter 2019 semester. According to [Yin \(2018\)](#), a case study is neither synonymous with nor a subset of other post-test research designs. Rather, a case study is an appropriate methodology when inquiring about distinct phenomenon in the real-world, when researchers can access and credibly report about activity in context, and when suitable methods can empirically “illuminate” (p. 26) research questions. Specifically, our team adopted an “embedded” approach to case study given that we focused upon SA use and student perceptions of SA in multiple courses as distinguishable units bound within a single university, as well as our use of both quantitative and qualitative analytic methods to examine common processes within units ([Scholz and Tietje, 2002](#)).

Activity associated with this case study commenced in 2018, when faculty from multiple disciplines were recruited to participate in this research through an institution-wide campaign involving workshops, consultations, e-mail outreach and other strategies. Ultimately, a total of seven faculty members agreed to integrate SA into their winter 2019 courses at both the undergraduate and graduate levels. The faculty participating in this research received technical support and guidance from our team throughout the semester. The SA tool Hypothesis was identified as the ideal technology for this research. Hypothesis is a free and open-source technology that exemplifies advances in open Web annotation ([Kalir, 2019](#)), and is featured among an emerging body of literature detailing the use of SA in higher education. Hypothesis has been shown to encourage “open conversations” among university students ([Chen, 2019](#); [DeRosa and Robinson, 2017](#); [Robbins, 2017](#); [Sprouse, 2018](#)) and has also been identified as a highly flexible, usable and sociable tool ([Seatter, 2019](#)). This case study adds to the literature about Hypothesis’ use in higher education, while more broadly expanding upon previous SA research by detailing how students perceive SA as contributing to their learning and sense of community in various course contexts.

Participants and course context

Data from seven courses were collected as part of the overall research effort. Our final sample for this case study, however, consisted of three courses, namely, publishing studies (PUB); gerontology (GERO); and gender, sexuality and women’s studies (GSWS). These courses were selected from the larger study for the following four main reasons:

- (1) all three courses were upper-level undergraduate courses;
- (2) a majority of the students in these courses engaged with SA frequently during their coursework;
- (3) the courses represented three different disciplines; and
- (4) the participating faculty worked closely with our research team to integrate SA into their courses, teaching practices and student learning activities.

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These criteria excluded four courses in which SA was a less integral aspect of course activity (i.e. students authored few annotations), courses taught at the graduate level and a course taught by one of the authors. In total, 56 of 59 students enrolled in the participating courses (95 per cent) annotated at least once during the semester (Table I).

All 26 students in PUB used Hypothesis to collectively author 1,118 annotations during the semester. The faculty member teaching PUB organized each class session into two phases; a traditional lecture was followed by student discussion. Prior to each class session, students were instructed to make a minimum of two annotations per reading, with the instructional goal of eliciting questions and opinions for in-class discussion (Figure 1). To encourage SA, the faculty member often referred to Hypothesis in class, provided guidance and support at the start of the course, and also shared feedback about students' annotation activity three times during the semester. Annotations represented 15 per cent of students' total grade in PUB. Notably, the faculty member had over two years of experience using Hypothesis and SA in their courses.

GERO enrolled eight students who authored 759 annotations. Typically, the faculty member had students work in groups for the first half of the class, then offered a traditional lecture. The faculty member promoted the use of Hypothesis by talking about SA during class sessions and by sending online messages reminding students to annotate. Annotations were worth 15 per cent of students' final grade. At the end of the term, the faculty member used a custom rubric to grade students' SA based upon the consistency and number of annotations, depth of commentary, resources linked to annotations, the extent to which or way in which SA engaged peers and the originality of annotations.

Finally, GSWS enrolled 25 students and featured a combined lecture and seminar format. The faculty member described this particular group of students as an "outlier" as, in their opinion, students did not participate as extensively when compared to previous courses. The faculty member introduced Hypothesis with the intention of promoting collaborative learning. At the beginning of the semester, the faculty member had students perform practice annotations, in hopes that they would support each other while learning to use the tool. In total, 22 of the 25 students used hypothesis to author 267 annotations. The faculty member did not assess the content of student annotations. Instead, students' participation represented 20 per cent of the final grade, which included both in-class contributions and the use of Hypothesis.

Table I.

Summary of courses,
participating
students, annotation
activity and survey
responses

Course	# of students	Annotators	Total annotations	Survey responses
PUB	26	26	1,118	12
GERO	8	8	759	7
GSWS	25	22	267	14

can't ask their prize for a residency, residence fees, because those prizes actually represent them — can occasionally get money and attention.

And in response to the same vague question I asked L'Abbé — what do you think of the publishing industry in Canada — Guri said,

On the one hand, compared to many other countries, and for the size of our population, we have an enormous number of presses and literary magazines. It could feel like wealth — it ought to feel like wealth — except for the fact that the crowd of people running these operations — especially the ones in charge of the money and the decision of who to publish — is so homogenous. **People of colour, Indigenous folks, as well as white women and queers and genderqueers of all racial identities — the list goes on — are all still sorely underrepresented and underfunded as publishers.**

This underrepresentation at the top creates a powerful and distorting chain reaction, so that when we walk into those book launch parties and readings that are an inevitable part of literary life, we get the Mostly White Room (which a number of people have written about), the room where women are mostly in supporting and listening roles (read: publicists and potential affair-partners for famous, I mean Canada-famous men), where queers are mostly invisible, where there is no wheelchair access, and where celebrated writers of colour are literally asked to leave on the assumption that they are party crashers. I'm not making this stuff up. It's in no way a true reflection of our collective potential as an artistic, human public or of the powerful voices that exist here.

It's that underrepresentation in positions of power that must change — that is changing. **It's not enough to publish a few authors of colour who can tell immigration tales, or a few Indigenous authors who then bear the burden of educating an ignorant public. Structural change requires the hard work of unlearning privilege, being reflective about unearned power, and giving it up to others.**

The shortlisted authors that I was able to speak to about this award, chapbooks, and their ideas about the Canadian publishing industry all felt similarly — cautiously — optimistic about a seeming shift, in different ways:

Sakikar: "I love how this genre [chapbooks], historically, seems to be about the periphery ... Chapbook making, because it's labour intensive and for a smallish market, seems somehow vaguely subversive, and like a kind of resistance, or outside of, the 'mainstream,' where margins flourish, and in each region I visit, there always seems to be dozens, if not hundreds of chapbooks, popping up like mushrooms."

Fizzer: "Just having a female judge read my book who totally got what I was trying to do, it was extremely meaningful ... I think that, historically, men have made women small. But women have always made tremendous

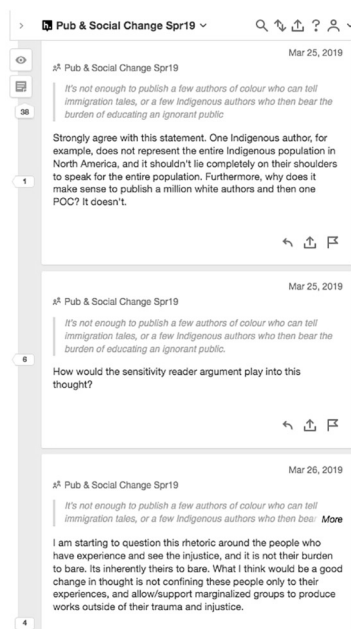


Figure 1.
Sample annotations
from PUB with
student names
removed

A summary of how Hypothesis was integrated into PUB, GERO and GSWS is included in [Table II](#) to highlight additional similarities and differences across course contexts.

Data collection and analysis

At the end of the winter 2019 term, students from all three courses were invited to complete an online survey about their experiences using Hypothesis. Participation in the survey was voluntary. Across the three chosen courses, a total of 33 of the 59 students enrolled in the courses (56 per cent) responded to the survey ([Table I](#)). Surveys are an appropriate method for analyzing embedded units within a single-case study ([Yin, 2018](#)) and, as previously reviewed, is a common method among studies that examine student perceptions of SA ([Chen, 2019](#); [Gao, 2013](#); [Suhre et al., 2019](#)).

Our survey design was adapted from the [Halic et al. \(2010\)](#) instrument, which measured undergraduate student perceptions about the effectiveness of blogging in coursework. Specifically, this instrument was chosen because it is focused on how the use of a social learning technology informed student perceptions of their learning and their sense of community. The instrument was developed with insights from a review of the relevant literature and validated using factor analysis, and has been adapted for use in numerous studies exploring online and social learning ([Duarte, 2015](#); [Kuo et al., 2017](#)). As with the [Halic et al. \(2010\)](#) survey, our instrument featured a five-point Likert scale (strongly agree, agree, neutral, disagree and strongly disagree) for students to rate their agreement about 12 items across two dimensions, namely, perceived learning and sense of community. The first dimension, perceived learning, included items such as "I believe that incorporating annotations in course discussions can enhance my learning experience in general" and "overall annotating using the Hypothesis tool helped me learn." The second dimension, sense of community, included items such as "annotating helped me feel connected to other

Course	Course structure	Student engagement	Faculty		Goal of using SA	Assessment of SA	Technical issues with SA
			experience with SA	Enthusiasm for SA			
PUB	Lecture/ student participation	High	Two years	High	Encourage close reading	15% of total grade; graded for quality and quantity	None
GERO	Lecture/ active groupwork	High	None	High	Incentivize readings and encourage close reading	15% of total grade; graded for consistency, quantity, depth of commentary, the inclusion of outside resources, engagement with other students and originality	Required technical support during the first two months of the semester
GSWS	Lecture/ seminar	Lower than usual	None	High	Encourage collaborative learning	20% of total grade; graded for quantity only	Required technical support during the first two months of the semester

Table II.
Summary of course
contexts featured in
the case study

students in this course” and “due to annotations, I felt that I was an important part of our classroom community.” A Cronbach’s alpha test confirmed the internal reliability of survey sections ($\alpha = 0.91$ and $\alpha = 0.88$), indicating that the adaptation of the instrument from one learning technology to another (blogging to SA) remained a reliable measure of student perception of both their learning and sense of community.

An additional four original open-ended questions were added to the [Halic et al. \(2010\)](#) survey to provide students with an opportunity to qualitatively share perceptions in their own words (the survey instrument, including the four new open-ended questions, is included as [Appendix](#)). Among these four original open-ended questions, responses to two are included in this case study: “what value did you find in annotating readings for your courses?” and “think of an instance where seeing a peer’s annotation or interacting with them via annotations was particularly valuable. What made it valuable?” The selection of these two questions was based upon alignment with both parts of our first research question regarding perceptions of how annotation and peer annotation contributed to learning.

The quantitative data analysis presented in this case study focused on student responses to the six Likert scale items that were deemed most relevant to the research questions: three items focused on students’ perceptions of SA for learning and three on their views of SA for fostering a sense of community. In addition to this quantitative analysis, responses to open-ended questions were inductively analyzed using open-coding and constant comparison ([Strauss and Corbin, 1990](#)), whereby codes assigned meaning to students’ qualitative responses ([Miles and Huberman, 1994](#)). To ensure a high degree of reliability during the coding process, two of the authors first independently coded a sample of student responses and compared the results. Once the codes were agreed upon, one of the authors coded the remaining qualitative responses independently using an iterative process between student responses and the proposed codes. NVivo was used to perform this analysis.

Results

Our case study investigated undergraduate students’ perceptions of SA across three courses and features two complementary sets of findings. First, in response to *RQ1*, we report the survey responses to questions regarding student perceptions of SA for learning. Then, in response to *RQ2*, we report our findings of how students perceived SA as contributing to a sense of community. Finally, in response to both research questions, we present a qualitative analysis of responses to two open-ended questions that inquired as to what students found most valuable about their annotation and peer annotation. These latter questions offer a more nuanced understanding, in students’ own words, of how SA was perceived to be valuable to their learning and sense of community.

Perceived value of social annotation for learning

Survey results indicate that students in PUB, GERO and GSWS generally perceived SA to be useful for learning in their respective courses. Across courses, most students either agreed or strongly agreed with three statements regarding the use of SA to share knowledge and experience, SA as enhancing course discussions and learning, and SA as aiding individual learning ([Figure 2](#)). This positive perception of SA was strongest in GSWS, where 86 per cent of students agreed or strongly agreed with the statement “annotating helped me to share my knowledge and experience with my peers;” and in GERO, where 78 per cent of students agreed or strongly agreed with the statement “overall annotating using the Hypothesis tool helped me learn.” Students in PUB, however, expressed the most neutral and negative views of SA, particularly when 33 per cent of the respondents disagreed or

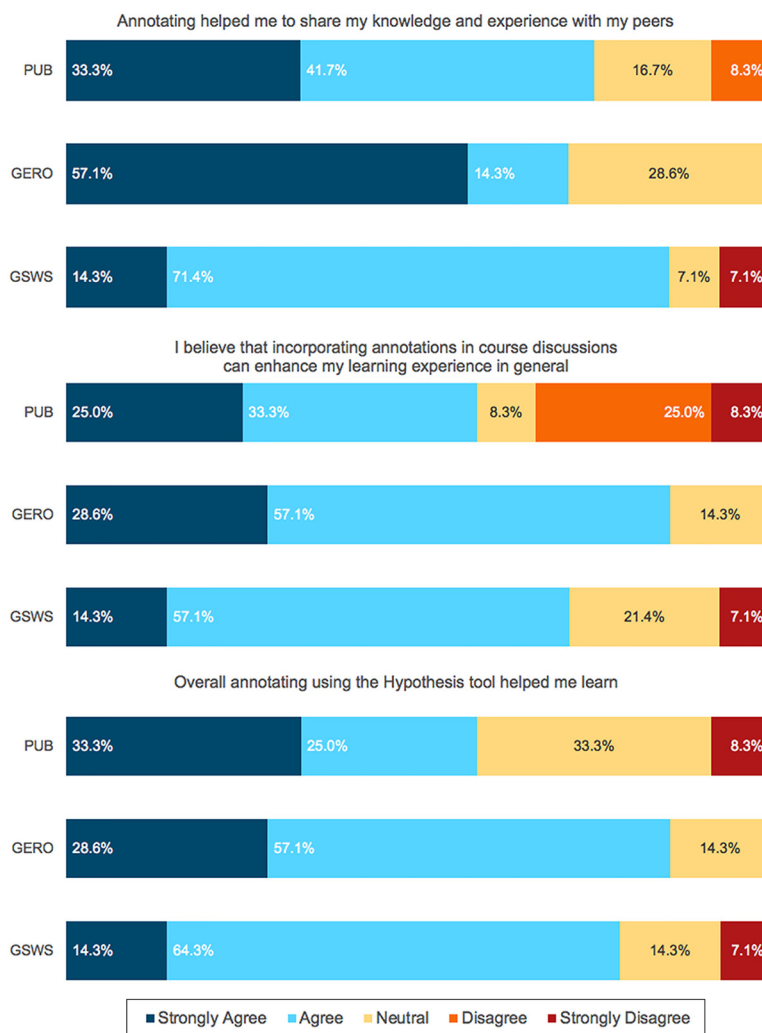


Figure 2.
Student Likert scale
responses about
perceptions of SA for
learning

strongly disagreed with the statement “I believe that incorporating annotations in course discussions can enhance my learning experience in general.”

These survey results about the perceived value of SA for learning are further underscored when comparing the distribution of responses across the three courses. GSWS and GERO students answered survey prompts similarly to one another, whereas PUB students responded to the survey with a greater diversity of opinion about the value of SA for their learning.

Perceived value of social annotation for sense of community

Survey responses about the perceived value of SA for contributing to a sense of community were mixed. A majority of students in all three courses agreed or strongly

agreed that SA helped them feel connected to their peers (Figure 3). However, student responses about the importance of SA to their classroom community, as well as whether SA improved the quality of peer interaction, were, overall, less enthusiastic. Notably, 42.9 per cent of GERO and 35.7 per cent of GSWS students responded neutrally to the statement “in comparison to my other classes, the quality of my interaction with other students improved due to annotations;” and 25 per cent of PUB students disagreed with the statement “due to annotations, I felt that I was an important part of our classroom community.”

When comparing, across courses, students’ responses to three survey questions about the value of SA for encouraging a sense of community, responses evidenced noteworthy variance in student views about the social benefits of annotation. Students exhibited greater

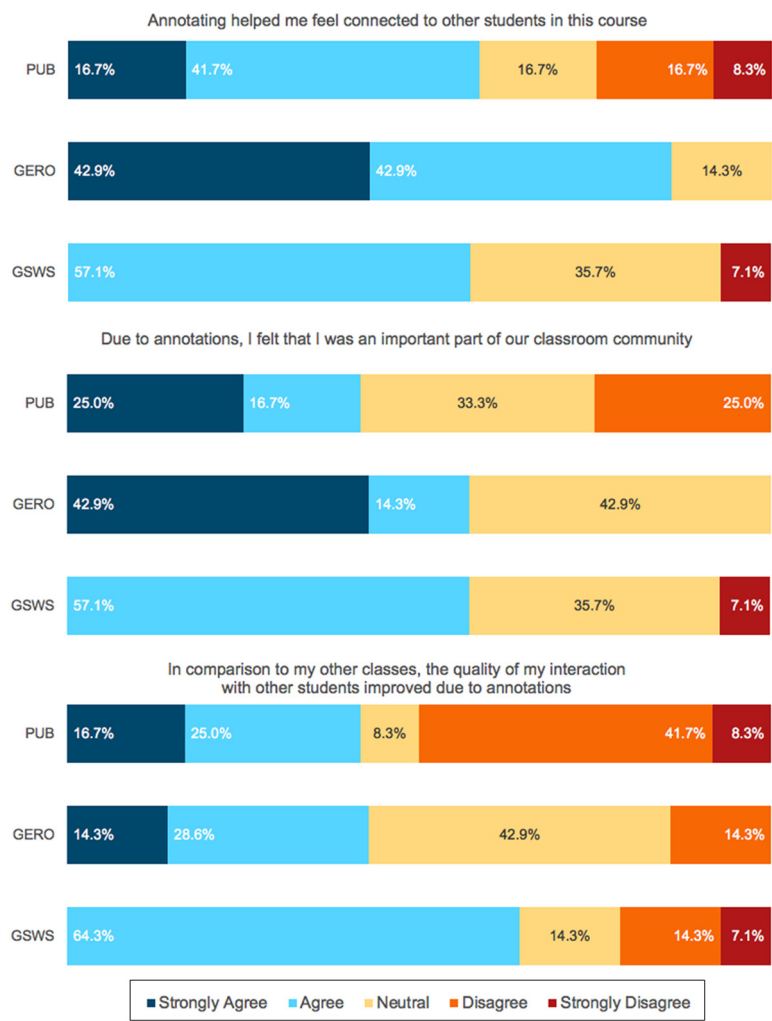


Figure 3.
Student responses
regarding the
perceived value of SA
for the sense of
community

variance in their perceptions about the social benefits of annotation when compared to perceptions about the value of SA for learning. Among the three courses, responses from students in PUB were more varied than those in either GSWS or GERO, though differences among the courses were smaller than with other survey questions.

Student descriptions of the perceived value of social annotation

To better understand what aspects of SA students perceived to be of value, we asked students to describe in their own words what value they derived from annotation and from reading peer annotation. In the first instance, we asked: “what value did you find in annotating readings for your courses?” The inductive and iterative coding process for 33 responses to this question resulted in 3 themes, namely, *understanding*, *engaging and interacting*. Only 2 students suggested that they did not find value in the use of SA for course activities (e.g. “I did not find it valuable,” PUB.001). These themes are described in detail, below, and are summarized in [Table III](#).

Comprehending course content. One-third of students who completed the survey (11 of 33) perceived SA as helping them to better comprehend their course content. For example, one student reported that SA “helped me remember the readings more because I needed to be more engaged with them” [PUB.016]. Another student shared that SA made it easier to “pick out key findings and ideas” [GSWS.003]. Students’ commentary about better comprehension of course content also mentioned specific technical features of the tool, such as the utility of being able to “highlight the important points” [GSWS.009] and the ease with

Themes	Definition	Example
<i>Perceived value for the learning of SA</i>		
Comprehending course content	Refers to how SA helped students to better comprehend the content of the course readings	Allowed me to better understand the readings and keep track of my thoughts [GSWS.025]
Engaging with course content	Refers to the way in which SA changed how students interacted with the content of the courses	It helped make sure I did the readings and actually engaged with them [PUB.014]
Sharing ideas and peer interaction	Refers to the way that SA allowed students to see and share ideas in relation to the course readings	Being able to see other people’s ideas and thoughts [PUB.005]
No value	Refers to the perception that SA was not valuable for learning	I did not find it valuable [PUB.001]
<i>Perceived value of reading peer annotations</i>		
Comprehending and clarifying course content	Reflects how students’ annotations helped each other to better comprehend the content of the course readings	There were a few readings that were hard to digest, and seeing other students’ annotations made the reading easier to understand [PUB.004]
Confirming ideas	Refers to students’ interaction with their peers’ annotations validated their own views	It was valuable to me when I saw my peers annotating/commenting similar ideas or when they were explaining similar experiences [GERO.022]
Engaging with diverse perspectives	Refers to students’ interaction with different perspectives	Because their perspective was very unique, and it shifted my perception [PUB.007]
No value	Refers to students that did not found their peers annotations valuable for their learning	It was not valuable [GSWS.024]

Table III.
Summary of themes, definitions and examples of responses to open-ended questions

which students could go “back to main points” [GSW.S008]. One student noted that SA helped them to contextualize and understand the larger scope of course readings: “it was helpful in ingraining the important parts of the text in connection to the larger themes of the course and in sharing knowledge amongst the class” [GSWS.027].

Engaging with course content. Similarly, another third of students’ (12) perceptions of SA included changes to their engagement with course content. One student explained that SA:

made me actually really read the articles and/or book chapters as I couldn’t just skim through them; I actually had to read them and engage with them by annotating which allowed me to digest information [PUB.006].

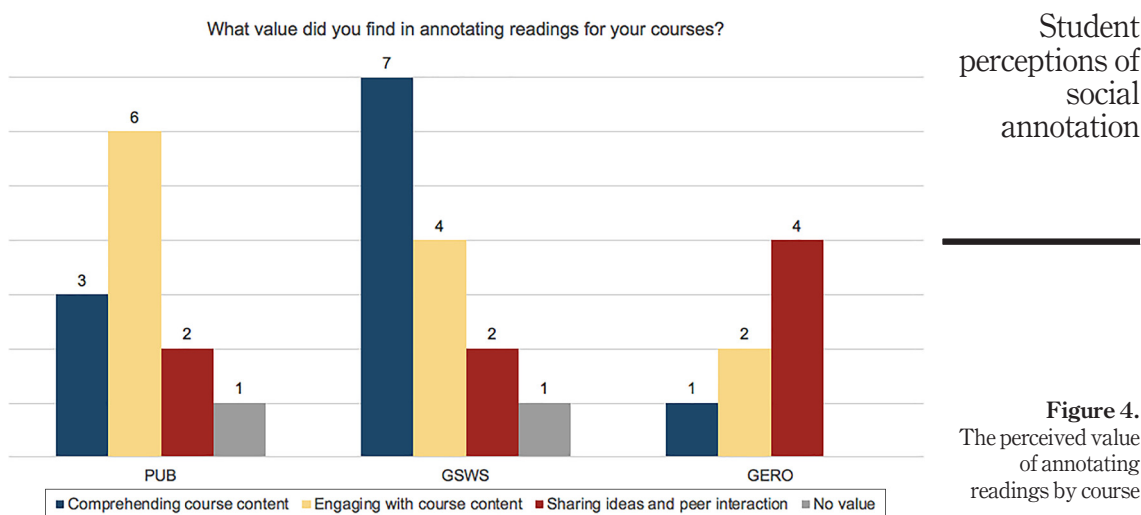
A student reported that “I did more of the readings for this class than I typically would [sic]” [PUB.015], and that SA helped them stay on schedule, as annotating was an “incentive to get the readings done before lecture” [GSWS.023]. Students also reported that this new way of interacting with the course readings made them “think critically and engage with the literature in front of me as opposed to passively consuming the material” [PUB.017].

Sharing ideas and peer interaction. A quarter of students (8) perceived SA as enabling them to easily share ideas about course readings with one another, as well as subsequently interact with one another by discussing those ideas. Furthermore, students found SA to be valuable because it allowed them to “see everyone’s collective thoughts in one place. We often get side tracked with our own thoughts even though everyone thinks differently” [GERO.033]. Students mentioned that SA allowed them to share their own ideas, reporting: “I find it easier to express my thoughts in writing than in group discussions. Hence, it served as a platform for me to freely express myself” [GERO.030]. A student also remarked that “I was able to relate the readings to some real life experiences, share my thoughts with peers, and start important discussions between us [sic]” [PUB.013]. By participating in this social and interactive reading process, students noted that they were “learning from others’ experience” [GSWS.026].

When comparing these results across the three courses (Figure 4), it is notable that students in each course differentially valued the integration of annotation into their courses. Specifically, GSW students’ responses suggest a greater appreciation of how annotation allowed them to better comprehend the course content, while GERO students appear to have placed greater value on the possibility of sharing ideas and interacting with peers. Finally, PUB students appeared to value how SA enabled them to engage deeply with the course content.

Following the same inductive and iterative coding process, we coded the 33 student responses to the survey question that asked about the value derived from reading peer annotations. This question asked: “think of an instance where seeing a peer’s annotation or interacting with them via annotations was particularly valuable. What made it valuable?” Responses to this question were also grouped into three themes, namely, *understanding*, *confirming* and *diversifying*. In response to this question, three students indicated that they found no value in reading peer annotations (e.g. “it was not valuable” [GSWS.024]). These themes are described in detail, below, and are summarized in Table III.

Comprehending and clarifying course content. A quarter of students (8) reported that reading peer annotations helped them to better comprehend the content of their course readings. For example, students reported that peer annotations helped them to “clarify a point” [GSWS.023] or correct a “misunderstanding in the readings” [GERO.029]. Students viewed peer annotations as particularly useful when encountering unfamiliar terms; several students noted the value of having peers “provide definitions or links on terms which were



not common” [GERO.032]. A student said: “seeing everyone’s different views on certain parts of the text helped me understand them more” [GSWS.011].

Confirming ideas. A smaller number of students (4) also perceived that peer annotations validated their own views. Students noted that SA confirmed ideas and, specifically, that annotation “made my [sic] value my ideas more knowing others were thinking the same” [GSWS.003]. For example, one student from PUB detailed the value of SA enabling the confirmation of ideas:

I brought up a quote from the book 1984 which I found very relevant to a part of the reading I was focusing on. Another student commented that she also thought about this book when reading the quote. I was happy to hear that I was not alone and had more confidence in sharing my opinions [PUB.013].

Moreover, a student described how they valued moments “when I saw my peers annotating/ commenting similar ideas or when they were explaining similar experiences” [GERO.022].

Engaging with diverse perspectives. Most commonly, SA enabled students to interact with different perspectives presented by peers, which, in turn, helped students to “expand on their ideas” [PUB.018]. Over half of the students (18) reported that this interaction with new and sometimes divergent ideas was important because “different people come from different backgrounds/cultures and that intern [sic] bring different ideas on our class where both prof and other students can benefit from” [GERO.031]. Students valued that SA helped them understand “different cultural perspectives” [GERO.019], “have constructive debates about the various views” [GERO.030] and “have a respectful and thoughtful way to discuss each other’s opinions and see other perspectives” [GSWS.028].

Although there was some variation among courses in terms of how students perceived the value of peer interactions (Figure 5), survey responses followed a similar pattern: engaging with diverse perspectives was the most common reason students valued peer annotations, followed by comprehending and clarifying course content, and then confirming ideas.

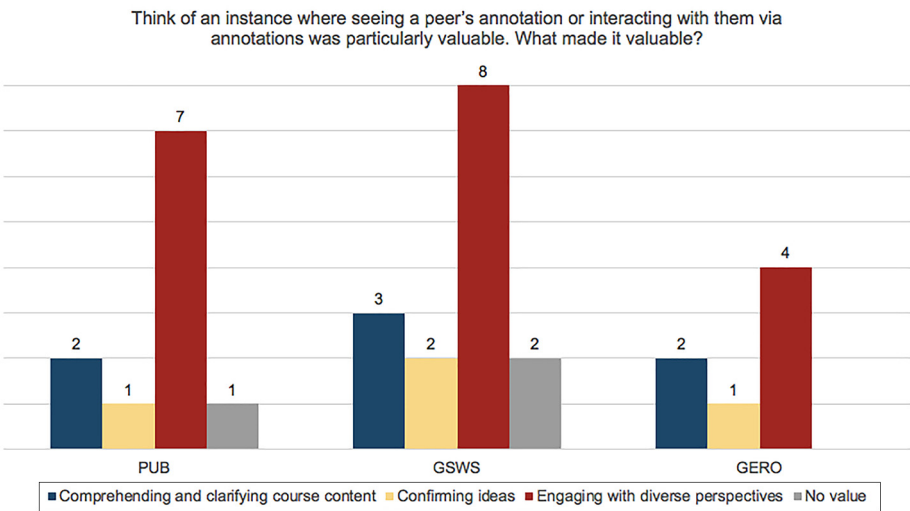


Figure 5.
The perceived value
of reading peer
annotations by course

Discussion

This study demonstrates that undergraduate students who used the collaborative annotation tool Hypothesis during coursework overwhelmingly perceived SA to be a valuable contribution to their learning. The case further shows, though with greater variance, that students perceived annotations as contributing to a greater sense of community. Moreover, our study highlighted that students derived value from both writing their own annotations and also from being exposed to and reading peer annotations. Our analysis of multiple courses as embedded units within a single-case study – and, in particular, survey methods that revealed students’ perceptions and self-described perspectives – builds upon prior SA research such as studies about the perceived value of SA ([Kanevsky et al., 2017](#); [Mendenhall and Johnson, 2010](#)) and the SA tool Hypothesis ([Chen, 2019](#)), to offer novel insight about the various reasons why students found SA to be valuable.

In one respect, our case affirms prior research indicating undergraduate students perceive SA to be a valuable aspect of their own learning and a useful contribution to coursework ([Chen and Chen, 2015](#); [Nokelainen et al., 2005](#); [Su et al., 2010](#)). A majority of students in PUB, GERO and GSWS agreed or strongly agreed that SA helped them share knowledge, enhanced discussions and supported how they themselves learned. Survey results indicated that, across course contexts, a majority of students reported positive perceptions of SA in relation to their learning. Specifically, students enrolled in larger courses with around 25 students, such as PUB and GSWS, and in smaller courses, like GERO, with only eight students, found value in their experiences with SA as it pertained to personal learning activities (like comprehending course content). Moreover, favorable views of SA were shared by students whether they authored a larger number of annotations throughout the semester, as with PUB (an average of 43 annotations per student) or a smaller number of annotations, as with GSWS (an average of 11 annotations per student). This finding suggests, first, that even limited use of SA was perceived by students as worthwhile and, second, that participating in SA activities – irrespective of the volume of annotation – was considered valuable for learning. Perhaps, unsurprisingly, given that annotation is known to aid undergraduate students’ comprehension and learning

(Marshall, 1997; Novak *et al.*, 2012), students reported that participating in annotation activities – which were also social activities (Cohn, 2019) – helped them to better understand their course content (especially in GSWS) and improved personal engagement with course material (especially in PUB).

However, our case study also reveals more complex insight regarding the value that undergraduate students associated with the social aspects of annotation. As noted, students demonstrated greater variance, and more neutral opinion, when asked to respond to Likert questions about whether SA valuably contributed to their classroom community. Over one-third of students in GERO and GSWS reported indifference as to whether the quality of their peer interaction was improved by SA. Moreover, one-quarter of PUB students disagreed about SA usefully contributing to their course community. Our findings, in this respect, differ from those reported by Chen and Chen (2015), suggesting SA may indeed create a communal learning environment but that student participation via SA in a shared discursive space may not necessarily foster a sense of community.

The complexity and potential contradiction regarding students' perceptions about the social qualities of SA were revealed in greater detail when students were provided with an opportunity to share their own words and perspectives. When asked an open-ended question about the value of "annotating readings for your courses," a quarter of student responses mentioned the benefit of SA enabling them to share their ideas with peers and interact with one another. This stance toward the social value of students both writing and sharing their annotations with peers was most prevalent in GERO. Furthermore, students' open-ended survey responses were consistent in revealing that students in all three courses valued their ability to access and read peer annotations. More specifically, while only a minority of students described the social value of peer annotation for confirming their own ideas or clarifying course content (a finding consistent with Kanevsky *et al.*, 2017), the majority of students in all three courses stated that there was value in SA enabling exposure to diverse perspectives (Gao, 2013). Thus, our analysis further establishes empirical insight about the types of social value afforded by SA (Mendenhall and Johnson, 2010), and does so through the use of a reliable survey instrument administered to a sample of students across multiple courses.

An unexpected and noteworthy finding from this case study is the distinction undergraduate students made between their stated value of peer annotation and the rated variance associated with SA and sense of community. That is, a majority of students described how SA can mediate academically productive peer relationships – such as SA enabling exposure to diverse perspectives – while, at the same time, some of these same students also perceived SA as not necessarily valuable for creating a greater sense of course community. While SA helped students, across courses, feel more "connected" to their peers, survey responses to Likert items were mixed regarding questions about feeling as though one was an important part of a classroom community (especially in PUB) and whether the quality of peer interaction improved because of SA. Yet, when students were provided with an open-ended prompt to recall a specific instance of peer annotation and to explain why it was valuable for their learning, students in all three courses reported that peer annotations helped them to comprehend and clarify course content, confirm ideas and engage with diverse perspectives (as summarized in Figure 5). SA enabled, in the words of some students, "constructive debates about the various views" [GERO.030] of course content, while also providing a "thoughtful way to discuss each other's opinions and see other perspectives" [GSWS.028]. As a means of encouraging constructive and participatory peer interaction among learners, this study does provide promising evidence that SA may be

perceived by undergraduate students as more than a “strategic” tool that assists their individual ability to merely “do” academic tasks (Henderson *et al.*, 2017).

One interpretation as to why undergraduate students perceived the social qualities of SA as usefully associated with peer interaction – and less a valuable contribution to course community – may be explained, in part, by considering SA as a form of peer-supported and technology-enhanced active learning (Williams and Chinn, 2009). Active learning strategies, such as small-group discussions and other student-centered learning activities, are often used as a substitute for, or as complementary to, traditional lectures, as was the case for the SA activities in PUB, GERO and GSWS. Though some research suggests students perceive active learning as a generally positive influence (Lumpkin *et al.*, 2015), students have reported feeling as though they have learned less from participating in active learning activities despite experiments proving that they have actually learned more than from lectures (Deslauriers *et al.*, 2019). This negative correlation may be explained by students perceiving the greater cognitive and social effort expended during active learning as signifying a poorer learning experience when, in fact, it does not. Perhaps, a similar dynamic explains why some students in this case study exhibited divergent perceptions about SA positively contributing to certain social aspects of learning such as the classroom community and higher-quality peer interactions. It is notable that our study’s results help distinguish how students perceive the value of SA at different social scales – that is, differentiating among personal, peer and community-level learning – given that both information and learning sciences research has established the various cognitive and academic benefits associated with small-group and peer-supported learning practices (Glazewski and Hmelo-Silver, 2019; Stahl, 2017).

Just as the results of this case study help to parse the ways in which undergraduate students perceived divergent social qualities and benefits of SA, so too should our findings be understood in reference to different social settings. The decision to include multiple courses from three disciplines provided us the opportunity to highlight how the particularities of higher education course designs and contexts (Hora and Ferrare, 2013) may affect both students’ use and perceptions of SA. In approaching each course as a distinct and embedded unit within our broader case, we must also recall that one of three faculty featured in this study (PUB) had previously used Hypothesis in course activities, that students’ SA contributions were incorporated into the assessment procedures of every course, and that our research team provided dedicated technical support to all participating faculty throughout the study. Moreover, the faculty who participated in this research were cognizant of SA affordances germane to many fields of study, such as close reading (Sprouse, 2018) and collaborative sense-making (Kalir, 2019), which likely helped create learning environments favorable to students’ use of SA. While we can only speculate about the extent to which these contextual factors constructively informed how SA was integrated into coursework – and, perhaps, also informed student perceptions of SA – we do suspect distinct course elements played an important role. As such, we urge researchers and faculty to carefully consider how the technical, instructional and social aspects of SA may be organized in concert to enable both discipline-specific and group-level learning practices appropriate to a given course context.

Complementing the importance of our findings, this study also points toward a number of methodological and instructional implications pertinent for higher education researchers, learning scientists and faculty interested in SA, asynchronous and anchored discussion and student perceptions of social learning technologies and arrangements. First, we recommend that researchers studying the relationships among SA, learning and student perception continue to engage learners from multiple courses and from multiple disciplines and that

indicators of perception be measured using reliable instrumentation. A strength of this case was our decision to adopt a student perception survey (Halic *et al.*, 2010) from one collaborative learning technology to another, and to augment the instrument with open-ended questions that provided an opportunity for students to describe perceptions of SA in their own words. In the same spirit, we hope that future researchers adopt our survey instrument to investigate how students perceive the value of SA in additional disciplines and education levels, within alternative learning environments (i.e. online learning), and among larger sample sizes. Second, and from an instructional perspective, faculty should carefully consider how students are introduced to SA, what types of discursive entry points and ongoing supports are provided for meaningful asynchronous discourse (Van Der Pol *et al.*, 2006), and whether other digital tools and collaborative practices may complement SA to either deepen student learning (Chen, 2019) or strengthen classroom community. Third, and finally, we encourage both researchers and educators to further discern the contextual and pedagogical qualities that may explain some of the variance found in this study, particularly as concerns students differentially perceiving SA as valuable among peer relations in comparison to their broader course community. Future inquiry should identify with nuance what factors helped to determine why certain undergraduate students in some courses perceived SA to be a valuable aspect of both their personal and peer-supported learning.

Limitations and further research

The seven faculty members recruited for our broader research project integrated SA into their courses with varying degrees of instructional success and overall student engagement. By intentionally selecting only three courses, this case study allowed us to study perceptions of students from a similar population (i.e. upper-level undergraduate), across multiple disciplines and among students who actively used SA. However, in doing so, this case study was unable to provide insight into the perceptions of students who had little or no experience with SA, address the reasons these students did not actively engage in SA practices or compare students from the same discipline in different courses. Similarly, by restricting our analysis to eight survey items out of a larger instrument, our study omitted valuable findings to focus on two research questions pertaining to students' perception of their learning and sense of community. Other survey responses about items such as "I was stimulated to do additional reading or research on topics discussed in annotations" and "annotation has made me think about the course content and concepts outside of this class" are, therefore, left for future studies. Further, should our survey instrument be adapted by others, we encourage future research efforts to elicit student perceptions about how SA specifically contributes to community building as a proxy for better understanding the relationship between SA and sense of community as this detail is missing from our inquiry and related studies (Chen, 2019). Finally, our exclusive focus on student perceptions of SA without simultaneously examining how SA may have mediated either individual academic tasks (Winchell *et al.*, 2018) or social learning practices (Sun and Gao, 2017) may be considered a limitation. Few studies have robustly examined student perceptions of SA alongside a complementary analysis of students' annotation content (an exception is Mendenhall and Johnson, 2010). Our team's forthcoming inquiry, drawn from the same sample and focused on SA and students' knowledge construction practices (Plevinski *et al.*, 2017), will serve as a useful complement to this case about the perceived value of SA.

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Social Annotation: Student Perceptions Survey

1. To what extent do you agree with each of the following statements? Answer them as they relate to this course

	SA	A	N	D	SD
I liked sharing my knowledge and experience with my peer					
Class discussions (online or in class) helped me to achieve course objectives					
I liked engaging in course discussions (online or in class)					
I liked reading assigned texts					
Beyond this class, I often annotated course readings (on paper or with some tool)					

2. How did you decide what parts of the text to leave annotations on?
 3. If you did annotate, what motivated you to do so?
 4. If you did not annotate, why not? What would have made you do so?
 5. To what extent do you agree with each of the following statements? Answer them as they relate to this course

	SA	A	N	D	SD
Annotating helped me to share my knowledge and experience with my peers.					
I believe that incorporating annotations in course discussions can enhance my learning experience in general.					
Other students' comments via annotations were important.					
Annotating helped me understand other points of view.					
Annotating made me think about the course content and concepts outside of this class					
My point of view was acknowledged by my peers in this course.					
Overall annotating using the Hypothes.is tool helped me learn.					

6. What value did you find in annotating readings for your courses?
 7. How would you like to see annotations being used in future courses?
 8. To what extent do you agree with each of the following statements? Answer them as they relate to this course

	SA	A	N	D	SD
I annotated more than required by my instructor.					
Annotating helped me feel connected to other students in this course.					
Due to annotations, I felt that I was an important part of our classroom community.					
I was stimulated to do additional reading or research on topics discussed in annotations.					
In comparison to my other classes, the amount of my interaction with other students increased due to annotations.					
In comparison to my other classes, the quality of my interaction with other students improved due to annotations.					

9. Overall, how would you describe your participation (both in-class and online) in the course in comparison with other students?
 10. Think of an instance where seeing a peer's annotation or interacting with them via annotations was particularly valuable. What made it valuable?