Reinfrastructuring Classroom Discourse with ThoughtSwap

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Abstract: ThoughtSwap (TS) technology can be used to change the infrastructure of conversation by changing the information available to instructors and students in the classroom. It can provide a subtle invitation towards conscientious discourse. Unlike other attempts to mediate interaction, this approach emphasizes focused, punctuated moments of attention to one's own and other people's ideas. It creates different starting places for whole class or small group discussions. 49% – 100% of students participated in the initial entry of ideas over the course of the semester in 25 classes with nine instructors. Instructors adapted and adopted TS to garner different kinds of information and use that information to seed more conscientious forms of classroom discourse.

Introduction

Classroom discourse can prepare students to become informed citizens able to question, defend and criticize beliefs, listen and respond to others, know about social issues and hold rational arguments (Cazden et al., 2003; Hess, 2009). Past studies have shown success using open discussions to establish "a community of inquiry" in the classroom (Akyol et al., 2009). However, despite some success, this vision remains largely aspirational. In STEM disciplines, getting students involved in thinking beyond domain-specific content is especially difficult (Li et al., 2019; Leung, 2020). When asked about learning expectations before a Computer Science Ethics class, one student anonymously wrote,

> "This class is quite useless in my opinion. I understand morals and ethics of computer science related applications are important, but provided you have a good mentor and have time to develop these ideas there is no need to take this class…<anonymized institution> should offer an alternative for students who have already…have fully developed ideas."

This frank and strongly felt articulation alerted the instructor that issues in teaching the class needed to be addressed. It called the entire class into question, but the larger point is that the thought could prevent the student from understanding the possibilities inherent in the course and the topic. Exposing private differences creates pedagogical opportunities, if they are addressed. Freire argues that education can be freedom, "the means by which men and women deal critically and creatively with reality and discover how to participate in the transformation of their world" (Freire, 2000, p.34). Universities can encourage students to contribute responsibly in the socially complex world (Kromydas, 2017). Freire's educational ideal is close to what we attempt to support in this project through allowing *conscientious discourse*, engagement that expresses participants' ideas and attachments clearly and truthfully but that simultaneously focuses on listening and responding. This framing concerns developing the individual's logical pathways *and* the perception of discourse as part of a community.

ThoughtSwap (TS) is a technology that can promote conscientious discourse by *reinfrastrucuring,* that is, changing the underlying information of the initial moments of synchronous classroom discourse. It uses *contained anonymity;* students create anonymous writings, called thoughts, that are shared only with other members of the synchronous class during the class meeting's duration to encourage more student participation and give the instructor a better grasp of the different positions that students in the classroom hold. It also provides fodder to elaborate and extended student discussions, especially through *swapping*, an action by which each student receives and is made responsible for representing someone else's anonymous thought. The point of TS lies not in the technology itself, or the particular thoughts contributed by students initially, but in the ways that these thoughts seed and change small groups and whole class discourse.

Establishing that such complex changes have happened is challenging. This paper moves in that direction: (1) by presenting TS as a tool that can reinfrastructure classroom information (2) by providing preliminary evidence of usability in a range of university-level classes.

An earlier version of TS (Dickey-Kurdziolek et al., 2010) was used with a small group of 8th grade science

students. Many of the students considered their contributions unique only to find, upon examination, that they were actually saying the same things. The results also showed that by changing the informational infrastructure of the classroom, we created new challenges for instructors. The injunction to be "guide on the side" (King, 1993) is widespread, but by no means unproblematic (Bock et al., 2021; Dennen et al., 2007).

Both "Are instructors able and willing to use TS?" and "Does TS reinfrastructure the classroom?" are components of the deeper question of whether, how and when TS supports conscientious discourse.

Related Tools

The TS design proposition differs from other discourse-related tools that tend to promote majority views, create collaborative online structures, or seek to capture enduring contributions. Assorted applications for pedagogy centralize the ideas of mandated participation and/or, like Mentimeter, emphasize the majority's view (Dyer, 2021). Classes often require students to participate in discussion forums and threads by posting opinions and responses to other people's opinions. Many of these permit a superficial form of participation without encouraging depth (Dennen et al., 2007).

Some Computer Mediated Communication (CMC) tools encourage the collaborative creation of online structures, such as maps (Lotan-Kochan et al., 2006) or arguments (Nussbaum et al., 2002). Features of Learning Management Systems have also been repurposed for collaborative knowledge construction in online discussion forums (Scardamalia et al., 2003). Kialo (Beck et al., 2018) structures written responses into literal pros and cons which show sides of a topic rather than actual varying perspectives on a topic.

The overarching pedagogical philosophy of these CMC tools in classrooms is similar in that they look at learning as a dialogic, social and cultural process (Scardamalia et al., 2003) while attempting to enable learning through interaction with peers. So too do Consider.it (Kriplean et al., 2012) and Reflect.it (Kriplean et al., 2012). While not for classroom pedagogy, both systems share our value on focused moments for considering others' opinions. But these tools concentrate on capturing ideas and saving them rather than utilizing ephemera to create realtime accountability and interaction.

The ThoughtSwap Tool

TS (see Figure 1) is a classroom tool that allows sharing of a prompt by the facilitator (instructor), so that the participants (students) can respond in writing with contained anonymity.

Instructors can use large screens to show students one or more student responses. They can also *swap* thoughts, so every student receives a thought submitted by another student in the class. Everyone in the class receives a redistributed thought even if they did not contribute any themselves and so are enabled to participate in subsequent conversation. While all of the thoughts in TS are anonymous, every thought belongs to someone in the class, thus we characterize the anonymity as *contained*.

TS's potential to reinfrastructure the classroom is based in a constellation of four differences from prior tools and systems. First, the process creates shared, "punctuated" times for focus on one's own and then on others' thoughts. Second, most prior systems treat thoughts as objects to be captured and preserved. In contrast TS values written contributions as invitations for reflection and change. Real-time interactive conversation supplants initial thoughts. Third, *contained anonymity* identifies a novel space in which individuals are nameless but not entirely unknown. Contained anonymity balances (1) the protections of anonymity and its associated invitation to be honest (2) the social responsibility that goes along with membership in a collective, engaged in the same task at the same time. Furthermore, because the instructor acts as a facilitator, discussion of inappropriate behavior may become part of the social space of the class. Fourth, swapping gives the instructor leverage to ask students to transcend the self by representing what someone else has said, especially important if the view is a minority one.

User Study and Initial Findings

Four female and five male instructors from a large research university Vu and two small liberal arts institutions, Gc and Fp, used TS from Fall 2018 to Spring 2021 in 25 classes. Two of the instructors were also part of the research team (with no access to identifying data). 770 students from the participating classes used valid code names in the consent form for explicit formal consent, thus were included in the study.

Figure 1
Sequence of actions in ThoughtSwap include instructors share a prompt (a), Students draft initial thoughts (b), Instructors receive submitted thoughts (c), Redistribute - each student receive a thought submitted by a peer (d)

(a)

(b)

(c)

(d)
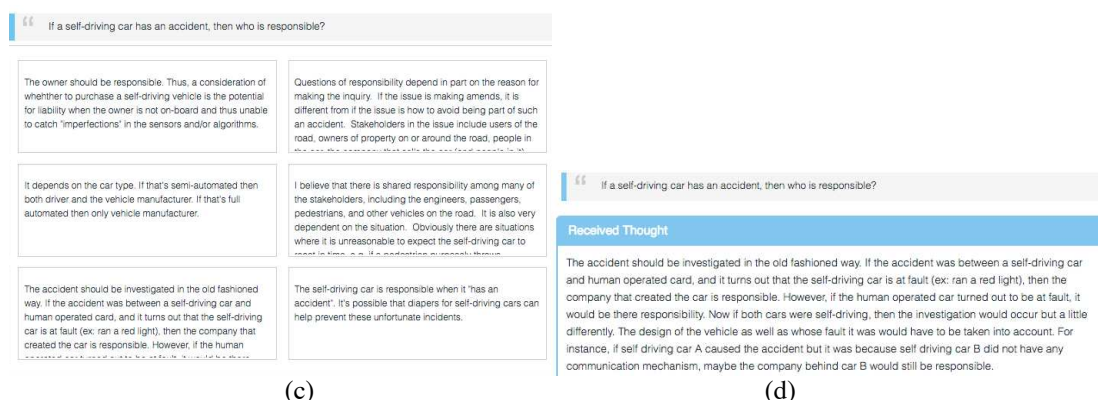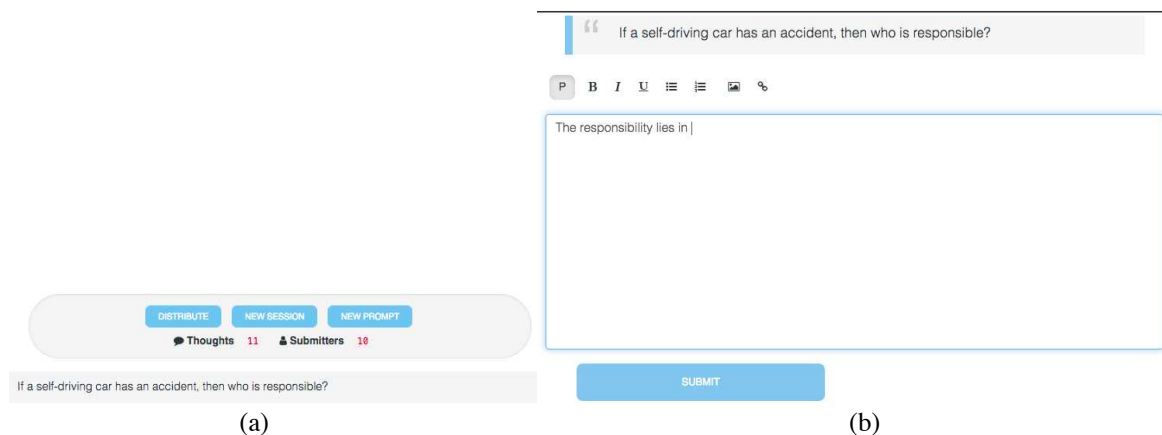
Gender and ethnicity, which have often been seen as related to classroom participation, were unevenly distributed. For example, 78.6% of students in the 9 offerings of the mandatory class for Computer Science students where most of the student participants come from identified as male. 31.6% of non-Asian minorities stemmed from the classes outside Vu, even though those classes constituted only 9.1% of the students.

Total use included 169 valid prompts, however the number of prompts per class varied widely. One instructor stopped using TS after classes moved to online formats in the Spring of 2020 because of COVID-19; two instructors continued. When instructors did use TS, on average, they utilized the swap feature 75% of the time. 169 prompts garnered 4307 responses. Remarkably, the overall student response rate per class ranges from 49% to 100% over the course of the study.

Six categories of prompts were identified through an iterative process discussed within the research group. These included: (1) Pick a side (e.g., Edward Snowden: Patriot or Traitor?) (2) Opening up a polarizing issue (e.g., How many of you think that women or minorities get "special preferences?") (3) Opinion/Commentary (e.g., What kind of influence can Computer Scientists have when making promises about the future of technologies?) (4) Action Evaluation (e.g., Presentation 1: What questions do you have and how could the presenters improve their arguments?) (5) Exposing Understanding (e.g., Explain Blackburn's argument about relativism as if to a ten year old.) (6) Interpretive Definition (e.g., What is software?). Data are the result of single coder judgment, validated through iterative discussions between the first two authors (Saldana, 2015).

Discussion and Conclusion

With the introduction of TS, instructors have access to all the initial responses from students in real-time. Students can also have access to a swapped response from someone in the class. This, along with the contained anonymity, reinfrastructures the context in which discourse is conducted.

The current study found encouraging indicators. Roughly, instructors used TS in one class out of every two week period during the semester, utilizing the swap feature 75% of the time. Half or more students posted responses to prompts over the course of a semester. This is presumably an under-count because not all students attend all class meetings.

The types of prompts used by instructors varied. This is significant because it influences the kinds of discourse it subsequently promotes and enables. For example, Pick-a-side and Polarizing prompts help raise underlying controversies, or, as in our prior work (Dickey-Kurdziolek et al., 2010), the presence of unexpected

agreement. Exposing understanding helps the instructor and other students in identifying potential obstacles to learning. Each of these kinds of prompts help promote deeper discussions in a classroom populated by different amounts and varieties of information. Further, all the prompts can benefit from contained anonymity, especially if students express and expose diverse and possibly minority ideas, and partial understandings. This study has significant limitations, especially in that the instructors are a highly selected group of early adopters. Nevertheless, this preliminary report provides indicators that TS has the potential to enable Conscientious Discourse to occur with instructors' ways of using the tool.

The student who argued so passionately at the beginning of the semester that "this class is useless" could have been correct. This paper explores whether TS has the potential to act as a lever to help an instructor with some of the heavy lifting of replying to the student's evident disgust by taking the criticism seriously.

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