PRELIMINARY EVALUATION OF NOTEBLOGGER:
PUBLIC NOTE-TAKING IN THE CLASSROOM

K. M. Davis, Michael Kelly, Roshni Malani, William G. Griswold, Beth Simon
Computer Science and Engineering
University of California, San Diego

1 Abstract

Note-taking in classes is a prevalent activity for most students in higher education. Though notes are of significant educational value to students, their note-taking abilities can be improved [2]. Also common in lecture courses is unidirectional communication, which may cause diminished comprehension, unnoticed misconceptions, or lessened interest among students. We claim that the use of a tool for public note-taking by a handful of students can address these issues for many students in the classroom.

NoteBlogger (NB), a Tablet PC-based application, allows self-selected "blogger" students to ink notes in class on top of the instructor's prepared slides and live ink. Other student "watchers" can view the blogs via a Web interface. We deployed NB in two university courses, interviewed both bloggers and watchers, and analyzed the contents of the blogs. Bloggers consciously established a range of public note-taking styles, from traditional note-taking that emphasized clarity and organization, to alternative explanations of the material, to problem-solving hints for their audience. Watchers used the blogs heavily and reported a positive impact on their learning experience. We found evidence that NB's ambient communication medium succeeded in actively engaging students in classroom activity, in particular by enabling in-class peer instruction with minimal distraction.

2 Problem Statement and Context

Note-taking, a dominant activity for students during lectures, has been shown to aid learning by allowing students to encode and store lecture ideas [2]. Since note-taking is rarely formally taught, most students do not apply meta-cognitive strategies to improve their note-taking styles. Thus, the quality of their notes may not be as good as it could be.[2]

The unidirectional nature of communication in traditional lectures presents challenges to the learners. Students are presented with a single view of the material (the instructor's), with little chance for exploring and comprehending the material. If a concept is misunderstood, students may not ask questions because they are unaware that their understanding is incorrect or they do not feel comfortable speaking in class. If misconceptions accumulate, students may fall even further behind and lose interest. Conversely, students who already understand most of the material are also likely to become distracted in the course. Misunderstandings and disinterest among students are difficult to detect in a lecture-based classroom.

3 Solution Employed

We present a tool for public note-taking as a potential solution for the problems outlined above. NoteBlogger (NB), a Tablet PC application, allows "blogger" students to receive automatically the prepared lecture slides and the live ink from the instructor in class, and to add their own ink on and around this material. A view of the blogger's application is shown in Figure 1. Furthermore, both instructor and blogger ink is uploaded to the server in real time via an

Internet connection. All students enrolled in the course can view the ink data via a Web interface, either by watching live in class or reviewing later. The Web interface used by "watcher" students is shown in Figure 2. We invoke the metaphor of the recently popularized "weblog" or "blog", in which an ongoing personal narrative is shared through a website, to highlight the ongoing, live narrative of the bloggers' notes being shared with watchers through our website. NB is a prototype implementation, and additional communication features are planned.
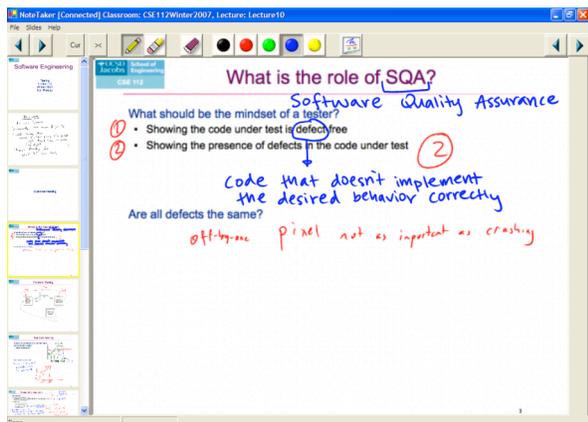

Figure 1: NoteBlogger application interface used by bloggers. Bloggers automatically receive the instructor ink (the numbers and bottom-most line) as she blogs (the rest of the ink).
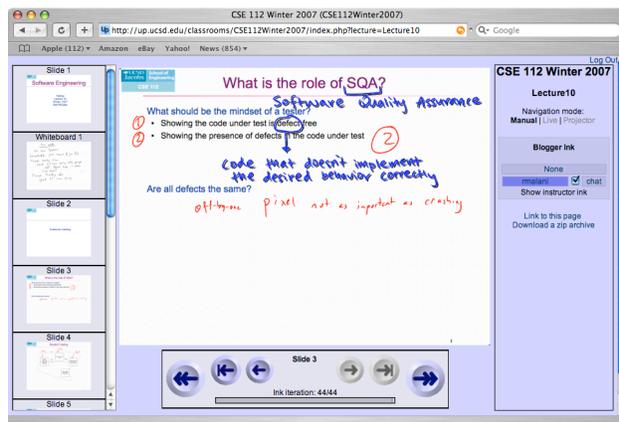
Figure 2: Web interface used by all students to view both instructor and blogger ink. Any user's ink can be toggled on and off in the right-hand panel.

The NB mode of operation is distinct from similar tablet-based note-taking technologies such as LiveNotes [1]. With LiveNotes, students take notes cooperatively allowing some students to add content while others transcribe the instructor [1]. Since bloggers automatically receive the instructor's ink, our goal is not to capture all of the lecture material. Rather, the purpose of NB is to act as a forum for students to provide their personal reflections on the material, analogous to weblogging. Furthermore, we believe that these live, personal reflections can provide unique value at a more opportune time than previously prepared notes. NB also serves as a unique form of unidirectional backchannel. Bloggers communicate to other students without requiring group cooperation; watchers may view the blogs however often they choose. The backchannel is set explicitly in the context of the prepared lecture slides to minimize distractions, such as those created by chat-based systems. Thus, bloggers communicate by inking on the lecture slides, and watchers use the same interface to view both instructor and blogger ink.

We hypothesize that transforming the private practice of note-taking into a public one will enable students to learn from each other in class as well as encourage better note-taking practices. Additionally, we hope that providing students with more student-centric, class-related resources will engage interest with minimal distractions. With only a few Tablet PCs, NB has the potential to impact every student in the class positively.

4   Evaluation

4.1   Experimental Setup and Methodology

NB was deployed in two courses: introduction to computer science with Java and beginning physics focusing on mechanics. The computer science course, taught by one of the authors,

placed a heavy emphasis on active learning and peer programming. Out of the 119 students, approximately 40 to 50 students brought Web-enabled personal computing devices to class. In this course, an application process with a mid-quarter re-election was used to determine which 4 to 5 students were given tablets for note-blogging. The beginning physics course, taught by another UCSD faculty member, utilized some active learning exercises. Out of 211 students, approximately 25 to 35 students brought Web-enabled machines to class, because many of the exercises were developed around Clickers. In this course, two self-selected students were given tablets for note-blogging.

Two of the authors conducted and recorded interviews of four bloggers and two watchers, using a preplanned protocol and some improvisation. The interviews were transcribed, broken up into quotes, shuffled, and then analyzed to find emerging patterns. Also, a survey about NB was given in the programming course in the middle of the quarter. We discuss the behavioral and perceptual changes, evident from the data, of the bloggers and then of the watchers in the sections below.

4.2   Changes in the Bloggers

Overall, bloggers actively thought about their note-taking behavior. They focused on the clarity and organization of material as well as providing alternative explanations and problem-solving hints. As they took on a more active role in the classroom, the blogs became a medium for self-expression and individuation. We elaborate on these changes below.

A computer science blogger CSB1 "signed up to note-blog because [he] could kind of give tips or ideas that [he] thought would help the learning process" for his peers. He explained that NB "kind of forced [him] to take [...] good notes, because other people are relying on them in some way or another." Later in the interview, he emphasized that "when [he] took notes, it was for the purpose of trying to make things clearer for other people." CSB2 claimed that her note-blogs were "more like a student's point of view of what the content is rather than the instructor's point of view," in that they might "stress a point" that the professor might not because she didn't have sufficient background knowledge. Thus, with her note-blogs, "the content becomes more detailed and easier to understand for the other students." CSB3 described the content of his blogs: "usually [he] would just write like little comments, [...] like if [the professor] said something out loud important that she didn't, um, write down, [he] would write that down, [...] or just like if [he] had a question about like a program that [he] didn't understand, [he]'d write that, and maybe like someone would ask it or something like that, and [he]'d like underline, circle important stuff." Thus, bloggers clearly had their audience in mind and tried to please them by taking clear, complete notes with an emphasis on important concepts.

Providing alternative explanations and different perspectives was the goal for some of the bloggers. For example, CSB3 explained that "people don't want to look at the same exact thing for each blogger, they want to read different stuff." So, he "tried to write as much helpful stuff as [he] could, and keep it interesting." He actually "looked at like the other people, the people [blogging] and tried to, you know, write different kinds of stuff, [he] didn't want to write the same stuff everyone else's writing." CSB2 also agreed that "if more people [blog], then yeah there is more variety of like watching some point that [she] might not think is important but some other people think that part is important." In addition, bloggers also tried to give hints or suggestions for solving the problems. CSB1 explained that for "some of the in-class problems, like, if you're completely new to computer science, like it would take you way longer than the professor gave you time for in order to solve the problem, and then by then the professor would have told you the answer, so then, [he] think[s] if, just the few hints of from, like, where to start,

like, what to focus on, could help them write the program a little faster, if they choose to read it." This blogger concluded that NB was "most efficient if the person that's blogging has […] his own ideas of tips and ways to learn the material," describing his blogs as "more like a during class, just like an extra self-tutor kind of deal" for the watchers.

In general, bloggers valued NB as a means for self-expression and communication. As already noted above, CSB3 strived to differentiate himself from other bloggers, to form his own persona. He also expressed how "everyone gets to see what I write […] and it's just like a cool way to get your opinion out there for everyone to see." Later, he expanded more about the nature of the communication: "it's a cool way to you know, if you don't understand something or something makes you angry […] you could write like an angry face or something without having to you know shout it in front of the whole class and everyone having to hear it, so it's a cool way to express yourself." CSB2 explained that she "can like point out and write what [she] thinks is important," "what she found difficult, or which other students should stress more on" as a response to what the instructor thought was important in the lecture. CSB1 compared note-blogging to traditional weblogging, and found that both allow him to "say things that [he] wanted to say without having to say it to anyone in particular [and without] interrupt[ing] the class to say it." However, the note blogs were not personal to him in the same way as traditional weblogs or journals were. This blogger described the flow of communication in the classroom as a "downward hierarchy, like, there's a professor, there's the bloggers, and there's the students, and then, you can see everything that the person above you writes, but you can't write back to them." Thus, he concluded that "it's a forum that happens during class as opposed to after class [and that makes a big difference] 'cuz a lot of times, like [he]'ll have like questions during class, um [he] won't bother to ask like or find the answer, and then when [he] goes out of class, [he]'ll forget about it because it's not on [his] mind at that time, […] but it feels like if [he] could write it down, […] then it's as easy as that."

Hence, qualities that the note-bloggers endeavored to achieve included clarity, emphasis on important concepts, a student perspective, various explanations, and suggestions for starting to solve a problem. All of these were achieved through attempts at self-expression and individuation in an ambient peer-to-peer communication medium.

4.3   Changes in the Watchers

Two-thirds of the students who participated in the survey (n=48) in the introductory programming course indicated that they watched blogs during class (with varying frequencies), while many who indicated that they never watched blogs in class because they did not bring a laptop to class. Clearly, a change in student behavior in the classroom has occurred. Our interview data indicates that the watchers valued the blogs as a source of assistance, encouragement, and reassurance.

Watchers changed their in-class habits by turning to blogs to keep themselves engaged or amused. A computer science watcher CSW1 commented that "the questions, like the, the input they have is really helpful," and that he "would be a little more lost" if the blogs weren't there. He explains that "since it's [his] major class, [he] should try taking notes, and then, [… he] didn't find [him]self like looking over them, rather like, [he found himself…] going to the blogs." CSW2 indicated that he used classroom idle time, such as when the professor was "writing something," to "look over to the other blogs to see what they have to say."

What did the watchers want to see in the blogs? According to CSW1, he "would look at notes if [the bloggers] outlined stuff… or if they like provided like their own like content." What did the watchers actually see? CSW1 indicated that when an in-class activity was underway, he

would "scroll down like through [all the bloggers]" and he found that "they won't like give you like the answer directly, as much as they'll […] give you […] hints or like how to solve it or the logic behind like solving it." This watcher noted that a blogger was "a student too, but just [one who] helps the students learn, and to I guess like complement [the professor's] teaching." CSW2 also "look[s] for solutions, for how to figure out how to do this" and for "ideas on ways to attack the problem." He explained that "when [he tries] to solve a problem, [he's] not sure if [he's] doing it right, not sure if the blogger is doing it right either, but it gives you a feeling that you're probably going the right way."

Although the learning outcomes of watching note-blogs have not been evaluated yet, the students' initial reactions indicate that blog watching helps gain confidence.

4.4   Other Preliminary Observations

Both bloggers and watchers found that NB retained their attention and interest towards class content, was not a distraction, and encouraged communication.

A physics blogger PHB1 who did active learning with Clickers claimed that she "learned more through the blogs than the Clickers." NoteBlogger allowed her to "read," "underline," and "rephrase" lecture content whereas Clickers were "just like, like read the question and then answer". She also cited frustration with the Clickers for difficulty submitting a response and getting feedback that her response was received. NB does not have a feedback issue since ink appears as one makes a stroke.

When asked about how many note-bloggers should there be for a course, both bloggers and watchers agreed that 4 to 5 bloggers per lecture is perfect, claiming that much more would result in information overload and that any less would not provide enough variety.

When asked about qualities of an effective blogger, CSB1 preferred someone who either has prior background in the course content or is a very smart student, so that "they would be able to help the other students as opposed to just kind of all be confused at the same time." This blogger also said that "you probably would not want like a failing, or borderline failing, student to be taking notes that other students are going to read, [because] apparently they're not doing too well themselves, so how could they help the other students?" This blogger reflected that "towards the end, though, when the material that was being covered, like, [he] wasn't as like proficient in it, [he] noticed that [he] was actually taking less and less notes, because of the fact that [he] didn't […] have much to say about the material because [he] didn't know much about it to begin with."

CSB1 also observed that speaking is synchronous communication, whereas writing is asynchronous. "If you speak [in class by asking or answering a question], you're the only one that can be speaking as well as everyone else is listening to you speak. The thing about writing is, um, you don't have to be the only one writing, and like [the other students] don't have to be seeing what you write as you write it, […] it doesn't draw attention to yourself as much [and] anyone can see it if they choose to see it and if they don't want then they don't have to." Hence, the bandwidth of classroom communication widened, sparking interest with minimal distraction.

4.5   Analysis

The evidence above indicates that instances of peer instruction occurred with NoteBlogger. Bloggers actively sought to teach their peers by providing concrete starting points for in-class activities or by elaborating on background information that the instructor assumed most students had, but some might not. Watchers using supplementary blogger-provided information had a better chance of solving in-class problems. Peer instruction, as a pedagogical

tool, is based on the old adage "the best way to learn something is to teach it to someone else." NB enabled peer instruction in a non-intrusive, ambient way.

As the data also demonstrates, NoteBlogger fostered asynchronous communication among students, or as CSB1 described it, "a discussion within a lecture." This ambient medium, feasible via tablet ink in a socio-hierarchical structure, enabled peer instruction to occur in a lecture-style classroom. The controlled dissemination of a diverse set of viewpoints encouraged the retention of attention and interest, because the bloggers focused on clarity, highlighting important points, alternative interpretations, and hints for solving in-class problems. Similarly, the watchers were busy seeking additional assistance and different approaches. Thus, to communicate on this shared ambient medium, set in the context of instructor-provided content, both bloggers and watchers took a more active role in the classroom, with little time for any distraction. Thus, NB, according to CSB1, is a medium that helps "to bring the class and all the information together and then make it clear to anyone who doesn't understand it as well."

5 Future Work

We agree with CSW2 that NB "is a good idea, but has not reached its potential yet." We plan to explore effects of expanding the bandwidth of communication by integrating a student-driven, content-centered chat interface. We also plan to explore the hierarchical structured dissemination of information by introducing a TA as a master blogger in a course. More detailed studies will expand on the preliminary results presented here.

6 Acknowledgments

7 References

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