“I Felt Like a Contributing Member of the Class”: Increasing Class Participation with ClassCommons

Honglu Du, Mary Beth Rosson, John Carroll, Craig Ganoe
College of Information Sciences and Technology
Pennsylvania State University, State College, PA, USA
+1-814-865-9838
{hzd106,mrosson,jcarroll,cganoe}@ist.psu.edu

ABSTRACT
In this paper we describe the design and first deployment experiences of a platform-independent, interactive video commenting system, ClassCommons, using a large public display in two sections of a large-enrollment university class. Our preliminary evaluation suggests that students enjoyed the activity of commenting, that they participated a great deal, and that their sense of community was greater after using the system. Further analysis revealed that reading the comments and posting relevant comments are associated with increases in community members’ sense of community. We discuss lessons learned and describe further work we are planning using this and similar interactive activities.

Categories and Subject Descriptors

General Terms
Design, Experimentation, Human Factors.

Keywords
Public display, video commenting, sense of community.

1. INTRODUCTION
Public displays have become pervasive in everyday life. Recent technological development has decreased the cost of such displays and they have been adopted increasingly in places where people meet each other, e.g., town centers, cafés, classrooms, libraries, offices.

Currently, most public displays are non-interactive[9], serving a broadcast function (TV news, ads, etc). Our informal observations around public displays in our own building indicate that people pay little attention to the displays. In fact, it is generally accepted that most large public displays are under-utilized. However, given their strategic spatial positioning such displays might easily be used to attract the attention of people who are working or relaxing in the area; if the displays also accept input from these individuals, they can enable social interaction and networking[9]. The work reported here explores the question of whether social interaction through a public display can also promote a sense of community amongst the participants.

Feelings of community within a group of individuals can have important consequences for their behavior. The phrase sense of community has been defined to be the “feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members’ need will be met through their commitment to be together”[26]. In neighborhoods, a sense of community helps to build social capital[32], encouraging neighbors to request and offer help to one another in times of need. In workplaces, employees who have a sense of community realize that they are expected to be responsible citizens in the organization as well as in the larger society[6]. In educational settings, studies have found that for schools with a strong sense of community, the number of students who feel lost is reduced, students’ feeling of anxiety, depression and loneliness is ameliorated, and personal growth, motivation and retention rate are improved[2, 8, 23].

However, simply working or living in the same place does not guarantee a sense of community. According to Gusfield, community involves two dimensions: shared territory and social relationships[16]. To build community, people who share a space must also build and maintain relationships. Sometimes people who live in the same neighborhood do not engage in the social interactions that can be a basis of relationships[21]; this may lead to what is known as “absent ties” in social network theory[13].

One way to facilitate community development is to increase the amount of social interaction among members. For example, studies have found that an environment that allows community members to interact in a cohesive manner can build a sense of community [14, 40]. Our project offers university students a lightweight mechanism for interaction, namely a large public display. Thus our research question is whether the interactions that result will build or enhance students’ feelings of community.

In this paper, we first review related work on interactive public displays. After this we describe ClassCommons, the public video commenting system we developed (commons refers to shared property in a community, and is often used as a metaphor for social capital). Next, our early deployment experiences in a university classroom setting are described. Although classes are only semi-public, the lessons we have learned from this
experience can be used to guide future work with interactive displays in public places.

2. RELATED WORK

Most research on public displays falls into two categories. One is the use of large public displays as a collaborative workspace to support group activity awareness[15, 18], and to aid group memories[11]. In this line of research, public displays are tools that deliver information to loosely collocated group members.

A second stream of research on public displays is aimed at exploring interactive techniques and applications that would integrate public displays into social contexts. In terms of interaction techniques, both personal device-based and multi-touch interaction techniques have been studied. Both have merits and disadvantages. Multi-touch interaction is device-independent, yet it suffers from the drawback that only a limited number of users can interact with the display at one time and they must be physically close to the display.

The CityWall is a multi-touch interactive display installed in an urban setting. It is a novel application and has attracted much attention from the pedestrians. Yet, just as its title says “It’s Mine, Don’t Touch!”[29], it can support only a few users at one time. Similar problems were realized in[39], and the ideas of subtle interaction and implicit interaction for people not being able to interact with the display directly are proposed. Yet, still only a limited number of users can interact simultaneously and the level of interaction participants can get from the public display are not equally the same.

Another issue with multi-touch interaction is that it usually requires users to enact their behaviors in front of the public display, with other co-present (and curious) people watching. The social embarrassment caused by this performance requirement has been identified as a key factor in people’s decision to participate in the interaction activities[33].

In general, interaction with public displays using personal devices seems to be more promising because of the ubiquity of mobile devices, users’ familiarity with their own devices[3, 35], and the capability of supporting a large numbers of users at the same time[24, 36, 37]. ClassCommons adopts a device-based interaction approach.

With respect to the activities supported by public displays, previous researchers have explored applications of two general types. One is multi-media content sharing[9, 29, 30]; the other is gaming[12, 38].

The video commenting system described in this paper falls into the first category, but adds a real-time evaluative component. A related system is MobiLenin[36], which lets an audience vote for music tracks with mobile phones. However, MobiLenin interaction between audience and display is limited. Our ClassCommons system extends the voting concept by empowering audience members to speak out freely; the resulting comments are shared on the public display in close to real time, thus viewable to all other audience members.

Our work with ClassCommons is more than an exploratory design for public display interaction. We are particularly interested in the effects that public commenting may have for class members’ feelings of connection to one another. A deficit of previous work is that although instilling sense of community is often offered as a motivation for use of public displays, few studies have used quantitative methods to evaluate whether or not this goal has been achieved. The current study explicitly addresses this question in a large-scale trial, using a mix of quantitative and with qualitative methods for richer understanding.

3. CLASSCOMMONS

The design of ClassCommons is drawn from a more general design concept of providing a common area for people in a shared physical environment to submit and receive comments about content currently in view. Thus one might imagine an ArenaCommons for sports events, a MallCommons for shopping, or a CafeCommons in a bistro or coffee shop. For this project we focused on support of a semi-public shared space, a university classroom. In this setting, the people present are co-students in a class, so they may already feel a sense of community due to shared learning goals and activities. However, we expect that additional interaction mediated by the public display may enhance such feelings.

The requirements for ClassCommons were relatively simple: to present content in a controlled fashion, to accept input from audience members, and to manage the display of this input. As seen in Figure 1, The ClassCommons system accomplishes this with three basic components; there is a client device (any device with web browsing capability can be used, e.g., web-enabled mobile phones, laptops), a server and a large public display.

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The server is implemented using JSP and MySQL database. All comments are sent to the server, which schedules the sequence and timing for presenting messages on the public display. The server also takes care of functions such as logging the comments in the database, marking to which video each comment is posted and controlling the video player on the public display. Currently, the system supports two kinds of video players. One is Windows Media Player and the other is QuickTime Player. The comments are displayed on the public display in a “First In First Out” (FIFO) fashion, namely comments posted earlier will be displayed first.

The public display is the focus of attention for users. They watch videos, view comments as they are posted, and submit comments, either about the videos or in reaction to other comments. Figure 3 shows the layout of the public display. The upper part of the display is the video playing area; this covers about 90% of the screen. In the bottom is the commenting area, termed the “ticker.” A comment author’s first name together with his/her comment is displayed here.

AJAX is used to update the content of the ticker display every four seconds. New comments scroll up from the bottom of the ticker area, each displayed for four seconds. AJAX allows us to update the ticker without reloading the page, so that new comments appear in a seamless and non-interruptive fashion.

The whole system is implemented using JSP, AJAX and MySQL database. As a web application, it is platform independent and can be quickly deployed in any public display setting.

4. FIELD TRIAL

We designed the video commenting system for use by students in an introductory class, which was mainly for first semester students, in a large university in Northeast America. We used two sections of the same course taught by a single instructor. Section 1 has 120 students and Section 2 has 134 students. The class meets in a large auditorium with a stage area at the front and seven tiers of seats with tables angling up to the back of the room (see Figure 4). The students are organized into teams of 6-7 students who sit together and spend considerable time working as a group. Both sections meet on Mondays and Wednesdays, one in the morning and the other in the afternoon.

We selected this particular course as a venue for trying out the activity for two reasons. One is that in large classes “feelings of disconnectedness are common among students” [34]. Toward the end of the semester, students still mentioned that “I had hardly known anyone outside of my group in such a big class”. Building sense of community within students in large classes can improve the quality of the educational experience a lot.

A second reason is the tradition in this course for teams to produce a 5-minute video as part of their final project; the last week of class is used to share these videos. In the past, students just sat and watched the videos; we wanted to support a more active viewing experience.

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Figure 3. Public Display view, video in the upper part, and comment in the bottom

Figure 4. ClassCommons in use, the dark rectangle under the video at the bottom of the display is the message line

Every student was given a login account. However, there are about only 64 desktop computers in the classroom. So students were encouraged to bring their own laptops or web-enabled mobile devices (iPhones, ipod touches, blackberry etc) to the class in order to participate.

During the class, students were invited to log in to the system using a classroom computer or any other device with web access. As the video were played at the front of the classroom, students could post comments. In a few seconds, each comment would be
displayed in order of submission. The students’ names were appended to the comment to increase their sense of accountability for what they said.

5. DATA COLLECTION
We used multiple methods for data collection, including a pre- and post-survey, usage logs, and informal observations.

Background survey. An email invitation was sent to the students through the course’s roster before the videos were shown. In the email, the ClassCommons project was summarized and students were invited to complete an online background survey; they were offered extra credit in the course for agreeing to serve as research participants (all students were able to use the video commenting system regardless of their participation in the evaluation process). In this survey, information about participants’ age, gender, major, and year at the university were gathered. We also measured their sense of community before using the system (PreSOC). We drew upon existing survey instruments[31] for these measures. The background survey was closed the night before the video sessions began.

Post-usage survey. After the video viewing and commenting sessions were over, students were invited to complete a second survey. In this one, their sense of community after using the system (PostSOC) was measured. Other information gathered in the post-usage survey included: their ratings of the video commenting system [5], their actual usage of this system and the usability of the system [22]. We also included four open-ended questions, probing students’ feelings while they were using the system and suggestions for improving it.

Log data. All the comments students posted to the public display were logged on the server. Log data include the comments, the video currently in play when a comment was submitted, and the time a comment was posted.

On-site observation. Observations were carried out during the class. Two researchers were in the classroom observing students’ use of this system. One researcher was in the front of the classroom and the other in the middle of the classroom.

6. RESULT
Our initial field trial of ClassCommons was successful. Students participated at a high level: the two sections posted a total of 3115 comments across the four video review sessions (about 250 minutes). This means that approximately every five seconds a new comment was posted. Combined attendance for the two sections was 192. The log data reveals that 129(67.2%) students posted comments, with an average of 24 comments each. One factor preventing some students from posting comments was the limited number of workstations in the classroom (6-7 students share two computers). Although students were encouraged to bring their own laptops or web-enabled mobile phones, but not all did this, and a number of students indicated that they did not participate simply because they could not access the system. Thus we expect that if there were more desktops in the classroom, the proportion of participating students would increase even further.

The distribution of the comments per student revealed a familiar exponential distribution (Figure 5): 20% of the most active participants contributed 80% of the comments and the remaining 80% contributed 20%.

Most of the comments were short; the average length was 4.97 words and Internet shorthand was common. For example, FTW(for the win), FTL(for the loss), ROFL(roll on the floor laughing), PWNED(previously owned), lol(laugh out loud), and similar acronyms were often used in the comments. Also, many emoticons, like :(, >_<, (sad), and i<3(I love you) appeared in the comments.

In a preliminary analysis, we classified the comments into four types: content comments, theme comments, functional comments and spam. Content comments refer to messages reacting to parts of the video, e.g., raising questions or criticizing what they are seeing. For example, “I like the Italian music.”; “Did they have cell phones in Sparta?!?”; “Why are they on their knees?” and “(It is) a bit disappointing after the intro.”

Theme comments reflect on the video. For instance, in a video on wireless security, a student commented “You don’t learn hacking from college. You learn it from shady websites and by not having a life.” Functional comments are requests to the teaching staff. For example, the comment “Need more volume and less blur” notified the teacher of sound problems in the back. Spam comments are irrelevant and at times inappropriate. These messages are annoying and interfere with harmony and sense of community. For example, in the post survey one student said that “I was disgusted ... for inappropriate comments not even remotely related to the videos or the class”.

As seen in Figure 6, the majority of messages were content comments (73%). Our informal observations indicated that a typical behavior was for a student to make a brief extemporaneous
comment as he or she saw something specific in the video. Theme content comments were less frequent, perhaps because the videos were played non-stop, and more reflective comments were quickly overwhelmed by content reactions to the video underway.

The fact that there are so many spam comments even in a classroom setting was surprising to us. We noted that spamming occurred most often when students thought the current video was boring. They used spam messages to vote against those videos, and some spam message tended to provoke others. Some were even quite offensive.

### 6.1 Effects of System Usage on Sense of Community

We now turn to an exploratory data analysis of how system usage (posting or reading comments) might be related to psychological variables (sense of community, and participants’ reaction toward the system). Specifically, we investigate the extent to which the usage of ClassCommons might increase students’ sense of community.

Our survey data comes from the 90 students who filled both the background survey and the post-usage survey. Two outliers were identified and deleted, so we ended up with a dataset of 88 participants.

We gathered several demographic variables: gender, age, year at the university and major. The survey result revealed that 72.7% (64) of our participants are male and 27.3% (24) are female. Most of them (92%) are between the age of 18 and 21. 5.7% (5) were aged from 22-25 and 2(2.3%) were between 26 and 30 years old. 52.3% (46) are freshmen; 28.7% (25) are sophomore; 17% (15) are junior and 2.3% (2) are senior. In terms of major, 52.8% (46) are majors in our department. 47.7% (42) are majoring in other programs, typically either business or liberal arts (e.g., business management, marketing, health policy and administration, finance and Spanish).

The psychological variables we investigated were students’ pre-usage Sense of Community (PreSOC), their post-usage Sense of Community (PostSOC), and their reaction toward this system. Subjects identified themselves in agreement or disagreement with statements in the survey on 7-point Likert Scales (1: Strongly Disagree; 4: Neutral; and 7: Strongly Agree).

Both PreSOC and PostSOC were measured using eight items adopted from [31]. Example items for PreSOC were: “I can get what I need in this class”; “I feel like a member of this class”; “I have a say about what goes on in my class”; and “I feel connected to the class”. The internal consistency was tested by computing Cronbach’s alpha coefficient which turns out to be 0.86. According to [27], a value of over 0.5 is acceptable for a scale intended to measure a single psychological construct.

For the post-usage survey, the SOC items were modified slightly to refer to the video commenting system. For example, we asked: “The use of this video commenting system makes me feel like a member of this class”; “The use of this video commenting system helps me have a say about what goes on in my class” and “The use of this video commenting system makes me feel more connected to this class”. We obtained a Cronbach’s alpha of 0.92 for the PostSOC items. The mean score of all the items was computed for each subject and assigned as his/her PreSOC and PostSOC scores.

Students’ reactions to the system were measured using six items adopted from [5]. Some sample items for this scale were: “I think the video commenting system is desirable”; “I think the video commenting system holds interests” and “I think the video commenting system is favorable”. The Cronbach’s alpha coefficient was 0.93. The mean score of the six items were computed for each subject and assigned a user reaction score (URT).

Three system usage variables were measured. One is the extent to which subjects read the comments (reading). It was measured through self-report on a 5-point Likert scale (1: not at all, 3: some of them, 5: every comment). The second usage variable was whether the student ever posted comments (0; did not post comments, 1; did post at least one comment). The third was the percent of relevant comments a student posted. One researcher read through all the comments posted by each participant and decided whether a comment was relevant or not. Basically if the comments fell into the content comment, theme content or function comment categories as have defined above, it was counted as a relevant comment. Otherwise, it was counted as irrelevant. Further the percent of relevant comments a student posted was calculated (e.g., 0.6 means 60% percent of the comments were relevant to the videos or relevant to the class). It was measured exclusively for students who posted comments.

#### 6.1.1 Increase in SOC

We used a paired-sample t-test to compare students’ PreSOC and PostSOC. The test revealed that students’ sense of community did increase significantly after using the ClassCommons system (mean PreSOC: 4.79, mean PostSOC: 5.08; t(89)=-2.96, p<.01; see Table 1).

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>PreSOC</th>
<th>PostSOC</th>
<th>t-test</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>88</td>
<td>4.79</td>
<td>5.08</td>
<td>-2.96</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Non-Posting</td>
<td>39</td>
<td>4.7</td>
<td>5.0</td>
<td>-1.79</td>
<td>0.08</td>
</tr>
<tr>
<td>Posting</td>
<td>49</td>
<td>4.86</td>
<td>5.15</td>
<td>-2.38</td>
<td>0.02</td>
</tr>
</tbody>
</table>

As a secondary analysis, we divided the 88 participants into two groups, according to whether or not they had posted comments. The log data revealed that of the 88 students who agreed to be research participants, 39 never posted a comment and 49 did. Separate t-tests revealed that the sense of community increased only marginally for the non-posting group (t(38)=-1.79, p=0.08) but showed a significant difference for the posting group (t(48) = 2.38, p=0.02). Not surprisingly, this suggests that the participants who were more active in commenting behavior may have been more influenced by the process.

#### 6.1.2 Increasing SOC through Reading the Comments

In addition to simply asking whether the video commenting process increased overall sense of community, we wanted to determine more systematically whether students’ usage patterns were related to this outcome. Thus we used multiple regression
procedures to explore the relationship of reading and posting behaviors to the PostSOC [28]. Because many of the predictor variables are correlated, we used stepwise regression; in this approach multiple dependent variables are used to predict a single outcome variable, and are added to the model only when they account for variance not already accounted for by other variables.

The design goal of ClassCommons is to promote interaction among students by having them share their thoughts and comments about what they are viewing. Thus we expected that simply reading the comments should have a positive impact on SOC. We also expect that students with higher PreSOC will have a higher PostSOC after using this system given the interactions afforded by this system; in this model PreSOC is used as a control variable to account for initial differences in SOC among students. The regression analysis supports our hypotheses as shown in Figure 7, suggesting that even after controlling for initial variation in PreSOC, the extent to which students paid attention to the comments was predictive of their PostSOC.

![Figure 7. For All Students, PreSOC and Reading on PostSOC](image)

Figure 7. For All Students, PreSOC and Reading on PostSOC

### 6.1.3 Increasing SOC through Posting the Comments

An additional analysis was used to examine the patterns of reading and posting for just the 39 students who did post comments. In this case, we included a third predictor variable, the percent of relevant comments posted (relevance is determined by whether the comment has some relation with the video or not as defined above). As shown in Figure 8, all three variables had significant and independent relationships with PostSOC. Of particular interest to us is that students with the greatest proportion of relevant comments reported higher PostSOC. This suggests that community members may increase their sense of community through contributions of meaningful comments.

![Figure 8. Students who Posted Comments PreSOC, and Reading on PostSOC](image)

Figure 8. Students who Posted Comments PreSOC, and Reading on PostSOC

### 6.1.4 Reactions to the ClassCommons System

In the Post-usage survey, students indicated high level of satisfaction with the system. Before we deployed this system, we worried that the stream of comments might be distracting. However, this was not the case. Most students (66.7%) reported that the comments were not distracting, and expressed a strong interest in using this system (85.6%); 79 (87.8%) found video commenting to be interesting; 83 (83.7%) would like the system to be used more in future classes; and 75 (67.2%) reported that they read most of the comments that were posted.

We conducted a related set of stepwise regressions to analyze the relationship among PreSOC, reading and user reactions (URT) as an outcome variable. The results were isomorphic to the findings for PostSOC; students with higher PreSOC reported more positive attitude toward the system and students who read more of the comments also will have more positive attitude (Figure 9). For the students who posted comments (Figure 10), the more relevant comments are posted, the more positive attitude they held toward the system.

![Figure 9. Reaction to ClassCommons for All Students](image)

Figure 9. Reaction to ClassCommons for All Students

![Figure 10. Reaction to ClassCommons for Students who Posted Comments](image)

Figure 10. Reaction to ClassCommons for Students who Posted Comments

### 6.2 User Experience

We have described some of our initial findings from the logged comments and the survey. The open-ended questions in the post-usage survey provided an opportunity for students to describe their own feelings, attitudes and understandings of the system in
their own words. In this section, we summarize students’ answers to these questions, with an intention to provide rich description of participants’ attitudes and behaviors involving the ClassCommons system. These data help to explain, confirm, reflect on and augment the correlation models presented above.

6.2.1 Having Specific Goals in Posting
Enticing people to take the initiative to interact with public displays has been a major barrier in designing interactive public displays[1]. The reasons for this are various. The usability of the system, whether the application is novel or not, whether there is encouragement or not, and whether there is demonstrations or not all play some roles [10]. However, we argue that the fact that people are not enticed to participate in the interaction may be due to people’s selective thought that they have no reason or goals that would lead them to do so [4, 7].

In our case, most of the students told us that they had specific goals when posting. Most said that they posted comments in order to discuss the quality of the videos, so as to provide feedback. For example: “My goal was to let people know what I was thinking about the videos and this system allowed the whole class to understand my thoughts”; “My goals was to compliment the groups of aspects of the project that they did well and to give advice on how they could have been improved”; “My goals was to make intelligent comments about the videos”. This is consistent with the fact that most of (73%) comments are reactions to video content (Figure 6).

From these responses, we argue that by specifying to people clearly what the goals are, people will be more likely to be enticed to participate in public display interactions.

6.2.2 Increased Interaction between Students
Students’ answers to the open-ended questions consistently reflected their engagement with the ClassCommons and an increased interaction between students. “(I felt) intrigued”; “It added some fun to the class so I enjoyed it”; “It was an interesting way to go about watching the videos. I found it to be a lot more fun than just sitting there watching videos. It got people to interact and be awake and alert”; “It was fun and entertaining. There was a lot of interaction between students”; “I felt a connection between classmates”; “I felt like a contributing member of the class”; “I felt like I was bigger part of the class than normal”; “I felt like it allowed the class to become more personal since we could share our opinions and see what others were thinking”; “It seemed fun. I really like that it was real time. It just made the environment seem fun to interact with everyone and everyone in the class could see it”.

6.2.3 Students Felt More Empowered
According to McMillan, to build sense of community, it is important that the community members can have some way to honestly present their feelings to others [25]. Students consistently reported that the use of ClassCommons system made it easier to them to speak their opinions to the whole class. “I feel like I could add my opinions to the group and to the class. It was great”; “It’s hard to talk aloud and express your opinions(in class), but over the video commenting system, it makes it much easier and more convenient”; “I felt like my opinions was more widespread and expressed to everyone”; “I felt more empowered. It felt less like I was anonymous in a huge cybertorium, but that I was a contributor to the class”; “I felt more empowered, like I could have my opinion heard”; “I feel free to put anything down”; “I felt like I had a voice in the class, and my thoughts were expressed on the video.”

6.2.4 Students Learned Something New
Some students reported that they learned something new by reading others’ comments. For example, “Some comments helped further explain or enforce what was being seen in the videos”; “by reading those posted, I got a glimpse of how some people think, i.e. how their minds work and how they process what they see”; “People noticed a lot of different things than I did when we were viewing it, or used terminology I didn’t know, so when I went home I looked up anything I could remember”; “A few people commented on the user of copyrighted songs in our videos, which made me think about my business law class”; and “There was a comment about the terrorism video that made me think more deeply into the meaning of the video itself”.

6.2.5 Self-organized Counter-Spam Actions
As reported earlier, 19% of the comments were spam messages. Not only we are surprised at this, but also students expressed their opinions on the spam messages. “I felt sort of uncomfortable because of the inappropriate comments that people were posting”; “I was ... scared to post commentaries in “improper English way” and perhaps be a subject of mean commentaries to my person from other students”; “I felt a little bit of frustration from people using the system as a way to mock people”.

We were delighted to see that students took the initiative to fight against the spam messages. During the video reviewing sessions, if many spam messages started to appear, one or more individuals would take a stand, posting messages trying to stop the spammers. Some of these messages were directed at a particular individual, e.g., “xxx, stop posting!”; “seriously, 3rd row, stop playing now”. Some messages were also posted at the beginning of the video playing session to remind people not to post spam messages. For example, the message “Good comment only” appeared at the very beginning of the second video reviewing session for one section, and the comment “Keep it clean” appeared at the beginning of the other section’s second review session.

In the post-survey, one student stated explicitly that “My goal was to antagonize other commentators because they were simply wasting space on the screen/time”.

Our informal scanning of the log data suggests that these counter-spamming behaviors did have some effect in stopping spamming. However such effects were not long lasting. In future usage, especially in public places, some external spamming controlling mechanisms (e.g., automatic filtering, moderation) are needed.

7. DISCUSSION

7.1 Distinct Features of this Context
Our study of ClassCommons has achieved a certain level of success, given the high participation rate and vast amount of text comments students posted. In retrospect, we feel that this success is at least partly due to the distinct features of this classroom context. One of these is the audience. In our case, the audience is comprised of young college students, who are active, characterized by being energetic, curious about new technology and would like to try new things.
Another distinct feature is that we were viewing a number of high quality videos (and some not of such high quality!) that had been produced by students themselves; this community-generated content may provide a reason to attract people’s selective attention. In the literature, how to produce engaging and interesting content has always been a challenge for public display applications. We are fortunate that this content issue was not a barrier here.

The contribution of this research lies in the new chain of thoughts that it inspires, namely the real time public display commenting idea that was implemented and tested. Our quantitative and qualitative analysis suggests that community members’ sense of community increased as a result of both reading and posting the comments.

One design implication of this research is that a public commenting system might add value to other shared content, i.e., not just classroom videos. In this sense, it means that commenting implementation could be an independent module separated from content design, but it can be a great complement to the content.

7.2 The Tragedy of the ClassCommons

The Commons have inevitable tragedy[17], so does the ClassCommons. As we reported above, about 19% of the comments were classified as spam messages. This behavior was distressing, given the classroom environment in which the system was used, and the university norm of respect for one another in classroom settings. Further analysis revealed that most spam messages emerged when the current video was boring or of low quality, which indicated that students may have been using spam to “vote against” low quality content.

Given that even in a semi-public classroom environment we observed so many spam messages, we expect that there might be even more spam threat in fully-public places. In this regard, we were glad to see the self-organized anti-spam actions to protect our ClassCommons. We also realize that spam is simply easy to create and can be economically or emotionally advantageous for those who send it, but at the cost of the harmony of the whole community. Thus in the future we intend to include more spam filtering mechanisms in our public display experiments.

7.3 Reducing the Cost of Participation

From a cost-benefit perspective, we suggest that people can be enticed to participate in public display interaction by either increasing the potential benefit they get in from the activity or by reducing their cost of participation. Producing engaging content and providing constant encouragement are approaches to increasing benefits. Yet, the potential social embarrassment or awkwardness is still high in cost for participants. So to entice people to participate in public places, we must find ways to reduce the participation cost.

Compared to the multi-touch public displays, which require the user to actually perform on the display, the personal device based interaction method is less demanding on the users in terms of social cost. Yet, this method does involve other economic costs for users. In this study, the cost is the mobile Internet cost. For people who used their mobile network to post their comments, they had to pay Internet fees (this may not be a problem for people who already subscribed the monthly mobile Internet service, but for people who have not, it is an issue worth considering). Fortunately, it is expected that in the future with the increasing availability of Free Wi-Fi services in public places and the reducing cost of mobile Internet services, the cost would decrease.

Some other studies have used text-messaging[12] or Bluetooth as an input mechanism. Text-messaging has similar problems with the use of mobile Internet in that people has to pay text-messaging fees in order to post their messages. The advantage of text-messaging is that most people are familiar with it and that the mobile network is much more pervasive than the Wi-Fi network currently in most places. Bluetooth methods are cost-free for users, but currently Bluetooth channels can only accept at most seven client connections simultaneously; these channels also restrict the users to be within a ten meter radius from the service point [36].

We have analyzed the cost of participation at the individual level. Another kind of cost noteworthy at the group level is the production blocking [20] dilemma. In the current design, the comments are displayed in an FIFO fashion. As a result, comments submitted later can not be displayed until all the early posted messages in the queue have been displayed. The lag between submitting and displaying may limit the ability of students in the class to contribute at all. As some students have required in the post survey that for future improvement it should have “less lag and possibly show more comments at once”. It is expected that future research on addressing the production blocking problem can further increase the use of the public display.

7.4 Offline Interaction Affordance

In the survey comments we found that students felt an opportunities to interact more with their classmates by chatting and sharing thoughts through the ClassCommons system. We realized that in the future it would be interesting to investigate whether the online interaction formed through the ClassCommons system could afford offline interaction in the real world.

We have conducted some onsite observations in the classroom where the system was deployed. Because every team was assigned their own sitting area in the class, it was not surprising that we did not observe students who stood up and walked to some one and had conversations. However, it is believed that such offline interaction can happen as reported in a content sharing public display study in [19].

We suggest that to enrich future study in this line of research, we need to investigate whether and the online public display interaction can afford and shape the offline interaction. This implies that a more longitudinal evaluation framework, perhaps using diary methods to track users’ engagement and longer term impacts from use of a public display. Using such a paradigm, we might determine whether it has a substantial effect on community building and accumulation of social capital within the community.

8. CONCLUSION

To conclude, we have shown how the ClassCommons system can facilitate the interaction among students in two large university classes, resulting in an increase in students’ sense of community toward this big class. The regression models confirm that students’ sense of community increases in using the system, e.g., reading the comments and posting relevant comments instead of spam messages. In addition to that, students gained a new learning experience by using this system. We showed that the commenting idea can provide added value for public display applications,
which open a new chain of thoughts in the field of interactive public display research.

We have also learned some lessons from this initial deployment experience, including the necessity to deal with spamming, and the need for a deeper investigation of the offline interaction that maybe afforded by the public display interactions. Along this line of research, we will develop more such applications in more public places, like cafeterias, and town centers in the hope to build a more cohesive community that we all enjoy living and working in.

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10. REFERENCES


