Supporting Classroom Discussions Using a Trust-enhanced Private Backchannel

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ABSTRACT

Classroom discussions between students or with the instructor can help them clarify the complicated or less clear materials of lectures and deepen their understanding; however student initiated discussions are not always encouraged in the classrooms, because of the fast-pace of the lectures, fear of asking dumb questions, or the large number of students in the classrooms. Classroom digital backchannels in the form of public chat-rooms have been used to address this problem, but mainly due to increasing distractions they are not widely adopted. In this paper, we introduced a trust-based backchannel system as an augmentation over private chat system, that enables users communicate with a group larger than the group of close friends and virtually access the knowledge of all students in the classroom, like in public chat, but with less distraction due to smaller number of interruptions. The initiated discussions are routed in the students' personal trust-networks according to the expressed and inferred trust relationships between students. The instructor interface of the proposed system provides awareness of the backchannel discussions including backchannel's activity level and the frequent keywords of the discussions. The proposed system is compared to a private chat system in a pilot mixed-methods study by 5 students during two 45-minute lectures and the combination of qualitative and quantitative results suggest that students found it helpful as a feature on basic private backchannels, but not as a substitution.

Categories and Subject Descriptors

D.3.3 [**Computers and Education**]: Computer Uses in Education – *Collaborative learning, Computer-assisted instruction.*

General Terms

Design, Human Factors.

Keywords

Backchannel, classroom, trust network, education, active learning,

1. INTRODUCTION

Students' discussions in the classroom is a method of cooperative learning and have positive effects on breadth and depth of their learning experience and is considered as a common strategy for active learning in classroom. There are several obstacles to student-initiated interaction in large classrooms: first, due to the fast-paced nature of some classrooms students do not find appropriate time for their question especially when they are unsure of the value of their questions. Second, as the number of students in a classroom grows, the students are more intimidated for asking questions. Also several other reasons such as weak communication abilities (e.g. in international students) or lack of self-confidence and fear from asking dumb questions, may lead to not using possible opportunities for clarifying the learning materials and deepening understanding. Computer-supported backchannels are designed to facilitate student-initiated discussions in the classroom, by allowing students to ask their questions and start discussions without interrupting all the students and the presentation, and clarify or complement the front-channel (instructor's presentation). However the negative effects of backchannels such as distraction and off-topic discussions are not negligible.

1.1 Laptop usage in classroom

Many universities require students to have laptops [10] and as time goes students perceive computers as a useful educational tool [13,32], which makes it easier to adopt laptop-based learning methods.

Several studies on positive and negative impacts of using laptops in classrooms have been conducted and depending on the conditions of the class and course materials different results have been achieved. Some of the positive impacts were facilitating student-student and student-instructor interaction and increasing engagement and active learning [15,35], especially in large classrooms [6] and increased motivation and participation [37].

On the other extreme, several studies have shown negative effects of using laptop such as distraction of students using laptops and students close to them[7,40] and found a negative correlation between uncontrolled laptop use and learning [17] in a large lecture-oriented introductory class. Also some studies found that determining specific rules for use of laptop and monitoring student activities by the instructor make their usage more effective [25].

Ultimately, technology effects on classrooms and students' performance highly depends on how instructors integrate courses with the technology [26], therefore different systems should be developed and tailored for different types of classrooms and instruction styles.

Augmenting classroom discussions using digital back-channels have been one of the common conservative solutions for integrating technology and classrooms. Also the increase in use of laptops in classrooms has made the adoption of digital backchannels even easier.

1.2 Functions of backchannels

Potential benefits of backchannels include asking question and receiving answers without interrupting the lecture, sharing information on topic to deepen understanding of the lecture or to clarify the more challenging parts of it. The major theory that supports using backchannels in classrooms is the constructivist learning theory. Based on this theory learning is an active process in which learners construct the new ideas and concepts based on their current and past knowledge through discussions, selecting and transforming information, creating hypothesis and making decisions [14] .

The impact of digital backchannel on user's interactions and experiences is specified by a number of factors including environment, topic of discussion, participants, and the relationships among them [27]. In this study, our focus is on classrooms as the environment, typical lectures as topic of discussion, and students with the same interest and goal for attending the class.

We designed and implemented a trust-enhanced backchannel that incorporates the users' trust relationships in the basic private backchannel (e.g. instant messenger) to make the current public backchannels more helpful. We ran a pilot user study to compare the proposed backchannel and the basic private backchannel mainly in terms of distraction and the likelihood of getting more helpful answers with distracting fewer users but more likely the right ones. The combination of quantitative and qualitative results weakly (due to the small number of participants) suggests that users preferred the trust-enhanced backchannel to the basic private backchannel overall and also found it less distracting.

2. Related work

Classroom support systems are often designed to support interactions between the instructor and students, usually for providing feedback [3]. Some of these systems are designed for classrooms where instructor is not present [29] and therefore all the communications between students and instructor will go through the system. Others have tried to incorporate new interactions [2] to enrich students' participation in instructor-oriented discussions. Considering the different role of such systems, backchannels can be used as a complement by facilitating rich student-oriented discussions.

The previous implementations of backchannels have supported main communication channel in meetings [38], conferences [19] or classroom environments [39]. One of the last implementations of backchannel is Backchan.nl [19], a web-based system designed for academic conferences that manages the questions for the presenter. It provides a ranked list of audience comments and [17] questions, based on votes, for the presenter.

A more comprehensive study was conducted at University of California at Berkeley [39] with a public chat-like environment for free discussions. The goal of their exploratory study was exploring the effects of using backchannels in long period of time and their study reported both off-topic and constructive discussions among the backchannel communications. Another noticeable research effort was ActiveClass [34] implemented and installed in University of California at San Diego, in which students could use their mobile wireless devices to anonymously ask questions, answer the polls and give feedback on the class to the professor and due to the engagement of instructor in the channel, it was a hybrid back and front channel. Prior less significant efforts in this area are covered in [39]. Also a review on backchannel functions and possible interactions is available in [11].

In the previous studies, backchannels were in the form of public [19,34,39] or private [38] chat rooms, both of which had problems with increasing students' cognitive load, thus decreasing the ability to concentrate on the primary channel and ultimately distracting the user. Considering the different types of cognitive load imposed on the students [33], besides the negative effects of split-attention, the backchannels are supposed to decrease the intrinsic cognitive load of understanding the front-channel which is caused by inherent complexity of the learning material [28]. However the problem is more serious in public backchannels, because each student is subject to distraction because of any message that enters the channel. On the other hand another major problem which is mainly associated with that of private chats, is achieving the goal of discussion which is usually clarifying or deepening understanding of a topic. Because in private chat setting, people tend to ask their close friend (s) and if s/he could not help because of the similar or lower level of understanding of the topic, the value of the discussion will be reduced substantially. Although such discussions may have some benefits in improving the understanding of the domain, in a classroom backchannel it is usually preferred to find a helpful answer as fast as possible to avoid missing the content of the primary communication channel between instructor and the students. This is of less concern in a public chat settings because usually at least a few students can help with each question or discussion.

Our goal in design of trust-enhanced private backchannel is to deal with the problem of distraction mainly in public backchannels and the problem of having helpful discussions mainly in private backchannels.

3. Trust-based backchannels

Trust-networks are social networks that relationships between people are indicating their level of trust to each other. Based on the existing relationships in a trust-network, non-existent relationships can be inferred using a trust inference algorithm. Trust-networks and trust inference algorithms has been vastly studied [4,9,30] and they have been adopted in several applications including P2P commerce networks [31], security [23], recommender systems [18], and collaborative web search [8].

To deal with the problem of insufficient available information in a students' group of trusted friends, the first level trustees can be augmented using a trust inference algorithm. We use the concept trustee instead friend, because the nature of discussions are supposed to be about the classroom topics and the friends that people choose to communicate with, to address their information needs, are the ones that they trust their knowledge more than other friends.

Augmenting students' trustees group using a trust inference algorithm and facilitating their communication with other students in different levels of their trust-networks increases the amount of practically available knowledge. Based on this idea we have designed a basic private backchannel augmented with trust-network in which students do not have to ask questions from a specific person and instead they can ask their trust-network and their question will be routed through their trust-network until someone can respond or can help the discussion. The proposed system uses the explicitly expressed scientific trust network of students in initiation phase of discussion. Therefore, when a student expresses an opinion or asks a question from his trust-network, the discussion will be routed to the first non-busy trustee and if he could not help (can be determined by asker or answerer) the message will be passed to next trustee and so on. The notion of busyness is added to the system to prevent overloading a single student or a few students that are scientifically trusted by a large number of students. Despite the friendship networks that people usually have different close friends, in a scientific trust-network usually some students are trusted by a large number of students, which made us incorporate a basic load-balancing method in our design.

The proposed mechanism of enhancing a backchannel with a trust-network is just one of the possible ways, and can be considered as a start point of investigating the effects of incorporating trust in backchannels. Another way of trust-enhancement can be imagined over public channels. The big problem of using public backchannels is the high possibility of distracting users due to receiving messages from any other channel user. A trust-based filtering may help in alleviating this problem by just showing the messages from trusted and almost trusted people in the channel, or categorizing messages based on the trust levels, so that student would be able to decide whether to look for only possibly valuable discussions or all of them. This can be a way of reducing the number of interruptions for each student and lead to having a more focused classroom or conference. Moreover this may help preventing messages going unnoticed by friends. However people feel less responsibility toward helping each other in a public chat comparing to private chat settings.

The major drawback of this approach is that the people from whom one hopes to get help, should already have had expressed their trust to him for being notified by his message. Therefore this may not be helpful in responding to needs of less knowledgeable people which is a non-negligible aim of the backchannel communications.

3.1 Features of trust-enhanced private backchannel

The main characteristic of our approach is routing messages based on users' trust network. To do that, we needed a trust-inference algorithm to augment the small trusted group of each student to a larger group ideally including the whole class, to make it possible for everyone to use virtually the whole existing knowledge in the class regardless of the level of friendship.

Our decision in choosing the right trust inference algorithm was based on the fact that we needed a personalized trust inference algorithm and other than this criterion most of the general purpose inference algorithms could be sufficient, therefore we chose GePuTTIS [30] mainly because of familiarity of authors with the details of implementing the algorithm. In GePuTTIS, the trust level of a source to a destination of a non-existent trust relationship is calculated recursively by merging the recommendations on destination and the trust level of source to the recommenders.

Having a process for routing discussions makes it possible to incorporate other routing criteria, such as load balancing and interruption management in choosing the destination. As mentioned earlier, we have used a basic load balancing algorithm to avoid overloading generally trusted students, however if all other students in the askers' personal trust network were loaded, it sends the question to the most trusted peer anyway.

There seem to be good opportunities for managing interruptions in a backchannel using basic interruption management heuristics.

3.1.1 Interruption management

Considering that the most important negative effect of backchannels is cognitive overload and distraction, studies on interruption management can inform the design of backchannels.

Interruption management has been one of the frequently addressed issues in human-computer interaction research. There have been efforts showing the negative effects of interruptions and the necessity of managing them [1, 12] followed by research on finding rules for interruption management [5]. Several studies have shown the effectiveness of interruption management systems. Some of them are predicting task breakpoints [21,22], while others using probabilistic models of interruptibility [16,20,24] by taking advantage of a large number of sensors for detecting different types of user engagement.

In a classroom backchannel system, having the large number of sensors is less required; because we already know that the primary task on students is listening to lecture and taking notes. And with monitoring instructors' lecture and students' note-taking system (if it is not computer-based, webcam is required to monitor off-laptop behavior of the user) we might be able to predict breakpoint for interruption with an acceptable accuracy. For the prototype we decided to implement a basic breakpoint detection method based on instructor's lecture (speaking) by finding pauses and use them as interruptible moments; therefore instructor's microphone activity level was captured through a basic awareness interface that was designed for the instructor. High activity level of the microphone determines that the instructor is talking. Therefore the system delays sending messages until the activity level of the microphone falls below a certain threshold indicating the instructor is not speaking. However to evaluate the main contribution of the system which was the trust-based communication, we decided to inactivate this feature to make it fairly comparable with basic private backchannel and avoid having confounding variables in comparing level of distraction.

The need for capturing instructors' voice level and knowing the benefits associated with having an awareness interface for instructor, made us design an instructor awareness display. The awareness display can provide the instructor with aggregated information about state of the students based on their behavior in the backchannel. The signals perceived from the awareness information may help instructor to adapt his pace or sequence of presenting learning materials during the lecture which might help better managing the complexity and intrinsic cognitive load of students' learning process [36].

Details of the student and instructor interfaces are explained in next sections.

3.2 Student interface

The student-interface is consisted of three main tabs: trust management tab, history tab and backchannel tab. In trust management tab students can express their trust to each other using a traditional 5-star rating widget and see their explicit and inferred trust relationships (Figure 1).

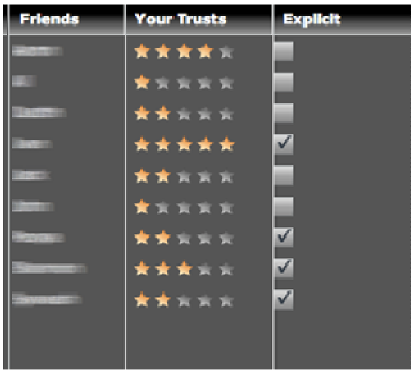

Figure 1. Trust management interface

Backchannel-tab included all the open discussions and a button for initiating discussions that opens an empty chat-box. Finally the history tab included all closed discussions which allows students to review their discussions.

The chat-box has three states: initial state, that is similar to a plain private chat-box with no extra buttons, asking state (fig. 2.b) which includes "Ask someone else" button to be used when the current answerer's responses are not enough helpful, and the answering state (fig. 2.a.) which includes "Pass it" button to be used when answerer for whatever reason does not want or cannot help with the discussion. Both "Ask someone else" and "Pass it" buttons mean that system should find the next trusted person in asker's trust-network for re-routing the discussion.

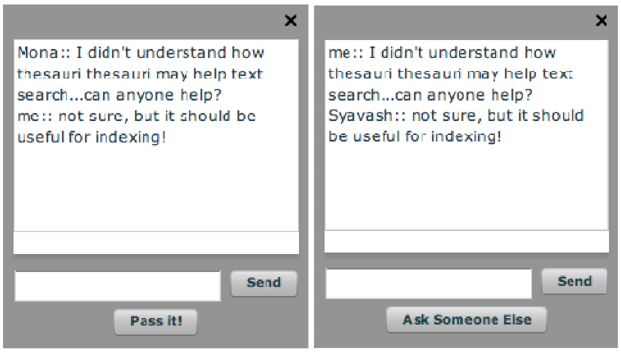

Figure 2. Different chat-box states
a. Answerer's view **b. Asker's view**

3.3 Instructor interface

The instructor interface is consisted of two visualizations; the first visualization shows backchannel activity based on the number of backchannel messages over time in a line-chart (fig. 3) and the second one was a simplified tag-graph of relevant words in students' messages and is designed to be used as indicator of main topics of backchannel discussions.

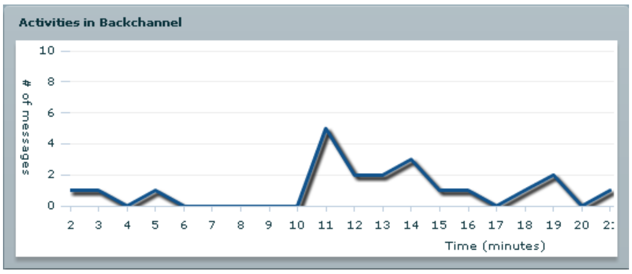

Figure 3. Line-chart of backchannel activity based on number of messages over time

To extract keywords instructor feeds the system with a list of keywords relevant to the lecture and during the class each of the messages are searched for those words and the 5 most frequent word are shown to the instructor as an indicator of the topic that might need more discussion in the primary channel (fig. 4.).

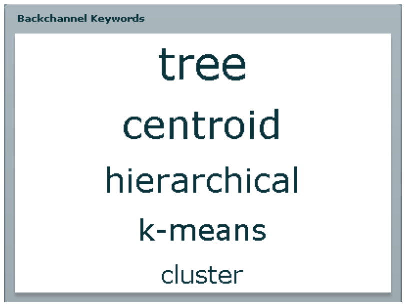

Figure 4. The frequent words in the backchannel discussions are shown in the instructor's awareness display. The size of each word is proportional to its usage frequency

4. User study

To analyze the effects of using trust-based private backchannel we compared it with a basic private backchannel (both implemented with similar interfaces using Flex) to test the following hypotheses.

4.1 Hypotheses

Hypothesis 1: using this system will lead to less distractions comparing to a private chat backchannel. The trust-based routing mechanism in the proposed backchannel system facilitates the asking question procedures by automating the procedure of asking a question, waiting for the answer, then asking another friend, in case of not being satisfied, and so on. Therefore, this mechanism has removed the mental and mechanical work of the user in asking a question. Also, when users cannot select their friends to discuss, the number of distractions should be decreased as far as they have to start a discussion with a related question because of not knowing the receiver.

Hypothesis 2: the number of off-topic discussions will be decreased comparing to the basic private backchannel. We predict that using trust-based backchannel results in less number of unrelated discussions to the topic. The basis of this assumption is that user's mental model of the backchannel will change in this system. User is asking the question without targeting any friend and not knowing who the receiver would be, which looks like asking the question from the system to the user, as opposed to the basic private backchannel in which user is selecting a friend to start a discussion. Therefore, our assumption is that reducing off-topic discussions is a result of the change in the user's mental model, which can be seen in the user's behavior.

Hypothesis 3: the proportion of useful answers to the total answers that one will receive in reply to a question is higher in the trust-based system comparing to the basic private backchannel. Considering that a user can pass questions to others, in case she is busy or does not know the answer or for any reason she does not want to answer the question, the number of answers that are not useful should be decreased.

Hypothesis 4: users prefer to use trust-enhanced private backchannel to the basic private backchannel.

4.2 Participants

Participants were recruited using a public invitation to attend "two lectures on interesting topics for a backchannel experiment" and five SFU graduate students (1 female, 4 males) participated in the pilot study. One of the male participants left the experiment after about 40 minutes due to a personal problem. Participants were from 20 years old to 29 years old with different background in information technology, art, and science. All of them were master students except one PhD student. There was an appropriate division of knowledge and expertise among the participants in both topics of data mining and adaptive interfaces, which helped in making the system more helpful comparing to equal knowledge levels in the discussed areas that could have rarely lad to fruitful discussions. Three of the participants were fluent English speaker, which was another positive point for increasing the system usage. All of the participants reported using laptop in almost every class for different purposes. The most common reasons that they reported for using laptop in the classroom were checking email, searching the web for what they have found interesting in the lecture, or they have not understood from the lecture or even for unrelated topic. Also taking notes and online chatting with the friends were among the tasks they reported. We also asked them to report their behaviors while facing a question in the classroom. Different behaviors included asking from the instructor, asking after the class (either from the instructor or friends), and searching the web. However, as it was a preliminary pilot study, participants were not our target users of the system so that they do care about the topic in such a way that importance of the discussion makes them ask and clarify their questions for themselves.

All the participants were asked to bring their laptops for using the system.

4.3 Procedures and materials

For comparing the proposed trust-based backchannel system to the basic private backchannel, we ran a pilot study in which we presented two lectures to the participants. The topics of the lectures were selected based on the participants' votes prior to the session to ensure that the topics are of interest to most of the participants, which we expected to play a crucial role in getting involved in the backchannel discussions. Each topic was presented during a 45 minute-session, while each session was split into two parts for switching between the two systems, control and the proposed system, for both topics. Before beginning the session, participants were given a tutorial on the system and were asked to play with the system for about 10 minutes and express trust to their friends in the system.

We compared the proposed system to a basic private backchannel, but considering the short time of the lecture, to make sure that all users will use the trust-channel enough for analyzing usage patterns, we disabled the regular private chat in the experiment condition. We used a counter-balanced within-subject design, balancing two different backchannel systems (basic private chat, trust-enhanced private chat) and the lecture parts (introductory parts, more complex content) to avoid the potential order effect in using the systems. Assuming that the first part of a lecture is different from the last part of the lecture in terms of the potential for having questions; for the first lecture, the basic private backchannel was followed by using the trust-enhanced one and the order was reversed for the second lecture. In order to ensure that participants would use the system, during each session participants were given a few questions and were asked to find the answer using the backchannel.

After the lectures and using the system, participants filled a questionnaire consisting of a set of five-point Likert-scale questions on comparison of the two systems and also the degree to which they liked or disliked specific features of the system such as "interacting with their trust-network" and "not asking a specific person". Another source of our qualitative data was the contents of the discussions that participants had with each other, which we used for extracting scenarios in which the system was used efficiently. Having gathered both quantitative and qualitative data, we used concurrent embedded mixed method design for the study, which implies that our qualitative data has a supportive role in interpretation of the quantitative results. The intent of this concurrent embedded mixed methods study was to investigate the impact of using trust-based backchannels in the classroom on the students' productivity. We used chi-square tests to identify the effects of backchannel type on students' distraction, helpfulness and students' preferences.

The independent variable of the study is the backchannel type (basic private backchannel, trust-enhanced private backchannel). The dependent variables are distraction, number of off-topic discussions, user preference, and the percentage of useful answers. Distraction and user preference will be assessed through the results of a questionnaire that should be completed by the students after the class. Some quantitative data like the number of questions, number of responded (accepted) questions, number of useful answers (indicated by askers), and the number of off-topic discussions were collected during each run based on the system log.

4.4 Results

The following sections describe the results of our study regarding each of the four hypotheses.

H1: Distraction

In the first hypothesis, we assumed that users would feel less distraction using trust-enhanced private backchannel comparing to basic private backchannel. Two of the subjects specified using the trust-enhanced private backchannel as less distracting comparing to one subject who found the basic private backchannel less distracting, and one subject was unsure. We found no significant difference, $X^2(2, N=3)=0.515, p<0.773$, and hence it does not support our hypothesis.

H2: Off-topic discussions

The second hypothesis predicted that the number of off-topic discussions should be decreased in trust-enhanced private backchannel comparing to the basic private backchannel. Analyzing the content of the discussions, due to the small number of the discussions, we found only one off-topic discussion that had appeared in the basic private backchannel. However, it is predictable from the comments that it was less likely to start an off-topic discussion in the trust-enhanced system, because of being uncertain about who would be the receiver of their message which is slightly similar to the condition in a public chat that people tend to send appropriate messages, knowing that everyone can read their messages.

Although in the experiment condition people felt uncertainty and talked about it as a reason of not talking off-topic, considering that our proposed system unlike the experiment condition allows users to use both normal messaging and trust-based messaging, this feature will be less important, but shows opportunities of designing backchannels that are less interesting for students but still valuable and more acceptable for instructors.

H3: The ratio of useful answers to the total number of received answers

The third hypothesis stated that the ratio of useful answers to the total number of answers that one will receive would be higher in the trust-enhanced private backchannel. According to one of the comments, receiving questions in a trust-enhanced private backchannel is less disturbing, because when one does not know the answer, she can simply pass the question to the next person in the trust-network without feeling the responsibility of replying to this message which is the case when the message is directed to her by the asker, as in the basic private backchannels. Therefore, this lack of responsibility would increase the ratio of helpful answers to all answers as users would reply only when they know the answer and avoid replying with an unhelpful answer based on uninformed guess, when they do not know the answer. Also even if someone responds with an uncertain or ambiguous answer, the asker can easily ask another person to double check or ask for further explanations. The following example which is extracted from the discussion contents of the user study illustrates this scenario:

User9 asks his/her most trusted friend	***user9**: so what's wizard of oz?* ***user9**: aside from toto and dorothy?* ***user7**: yeah. think metaphor* ***user9**: and flying monkeys?* ***user9**: ah ok*
User9 "Asked someone else"	
Discussion is redirected to user10 who has earlier got the answer from user8	***user10**: the human takes over for the computer* ***user10**: it was done to see a little about what the level of accuracy would be if the AI in the system was perfect* ***user10**: thanks to user8* ***user10**: ;)* ***user9**: haha* ***user9**: thanks user10 :)*

Table 1. An example of using "Ask someone else" feature and spending less time on a discussion that is unlikely to be helpful.

H4: System preference

In our last hypothesis, we assumed that users would prefer the trust-enhanced private backchannel to the basic private backchannel. The results of the questionnaire revealed that 3 subjects preferred the trust-enhanced one for usage in the classroom comparing to one subject favoring the basic one. While the difference is not significant, $\chi^2(2, N = 3) = 3.59$, $p < 0.166$, the results indicate there is an overall tendency toward the trust-enhanced system. In comparing the usage in exam, the opinions were split. Some of the comparison results are shown in figure 5.

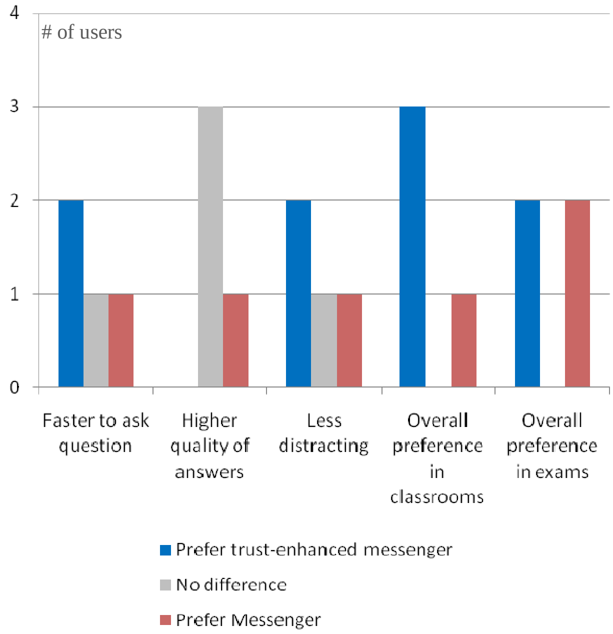

Figure 5. Comparison of trust-enhanced backchannel with a basic private channel

5. Discussion

One of the features of the trust-enhanced private backchannel was allowing students to pass questions to be routed in the asker's trust network when they do not know the answer. Interestingly, all users' opinions on usefulness of this feature were different, depending on looking from the asker's perspective or the receiver's perspective. As a receiver of the question, almost all of the four participants liked this feature that they could pass the question without having the feeling of being imposed to reply to someone's question that they also might not know the answer clearly, especially when they knew that the sender has not sent the question directly to them, and hence, he would not be informed of the 'passing' action that the receiver will take. But as a sender of the question, the users' opinions were reversed and they didn't like this feature because they were afraid of not receiving any answer as everyone can pass their question for any reason.

The concerns that some of the users showed on not knowing to whom the question is being routed, can be addressed by making the routing mechanism transparent and let the user know the state of her question.

Another problem during the study was a down time in server which led students asking their questions but not receiving answer for a rather long time. Due to this problem we removed the criterion of “faster to get answer” in our comparison.

Subjects’ familiarity and interest in the subject of the lecture definitely impacts the system usage by the subjects, for which we tried to control by using a voting system for determining the lecture topics, but could not achieve our goal due to attendance of few of the voters. However, we tried to compensate the lack of interest in some of the participants, by explicitly asking questions to make them use the backchannel for finding answers. Also the short time of the lecture which was about 1.5 hours and the effect of attending an experiment rather than attending a regular lecture or a conference in real conditions, led to finding few types of scenarios in the discussion contents, for analyzing users’ behaviour.

Another interesting result of our study was that although students did not like to be confined to using only trust-channel, considering that there seem to be no difference in quality of answers, using a trust-only channel might be interesting from instructor’s point of view in which lower possibility of off-topic discussions might be more important that students’ preference.

In sum, due to the small number of participants and short duration of the lectures, user opinions about the proposed system features and the comparison with basic system, were split in most of the questions; Therefore, it is crucial to run a larger study in multiple sessions and using more participants to be able to inferentially analyze and identify the effects of the proposed system and the results of this pilot study revealed a number usability concerns and design issues that can be addressed to prepare the system for the evaluation in the real world conditions.

6. Conclusion & future work

In this paper, we integrated the idea of trust-networks with the private backchannels to address some of the usability issues of classroom backchannels. Also we designed and implemented an instructor interface to make the instructor aware of what is going on in the backchannel’s discussions by visualizing the backchannel activity. To evaluate the trust-enhanced private backchannel system, we ran a pilot user study and compared the proposed system with a basic private backchannel. Results of the pilot study suggest that users prefer the trust-enhanced system to the basic private backchannel. Although due to the small number of subjects we did not reach to any significant result, the qualitative data collected from the questionnaire, weakly supported some of the hypothesized expectations including less distraction and reduced number of off topic discussions in using the trust-enhanced private channel.

Based on the users’ comments on the system, we plan to address some of the usability issues of the system and prepare the system for a larger user study. We are also particularly interested in investigating the system usage in distributed user groups in which the front channel is a one-way channel and users cannot easily use other communication media.

The results of this study will inform the design of backchannels for the classrooms or conferences by introducing the opportunity of taking advantage of users’ trust network in backchannel communications.

7. ACKNOWLEDGMENTS

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