Enabling backchannel communication between a lecturer and a large group

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INTRODUCTION

Large classes complicate communication between students and lecturers. In a large lecture theatre setting, the lecturer is situated far away from the students, and additionally sitting in rows hinders group discussions and promotes anonymity. A recent tutorial, offered to approximately 200 students in such a setting, brought to attention that some of the challenges students were experiencing and expressing to each other never reached the lecturer's attention, and hence, were not explicitly addressed by the lecturer.

To increase the lecturer's awareness of the students' understanding and to reduce the students' apparent threshold of asking questions in front of their peers, a "backchannel" tool was designed: a website, where students can anonymously post questions. Those questions appear in real time at a moderator's screen, where they can be deleted or forwarded to the lecturer for a response at a suitable time.

Evaluation of the pilot run showed that students appreciate the opportunity to ask questions anonymously, and lecturers welcome the insights. However, students took advantage of the tool much less frequently than expected. We present this to discuss both the advantages and disadvantages of our approach and offer suggestions for modified approaches.

1.1 Backchannel communication – a background

Backchannel communication is a secondary conversation that takes place in parallel to the primary focus of attention, typically a lecture, lecturer-lead activity, or a conference talk. Historically, side conversations in the backchannel consisted of whispering or passing notes. This backchannel still exists in today's lectures. Overhearing conversations between students, where students were discussing an exercise and made assumptions that were clearly wrong, led to the realisation that the students had difficulties at a very different level than what the lecturer expected. The idea of explicitly opening a new communication channel was born. The aim was to set the threshold of asking questions as low as possible to encourage students to seek clarification earlier rather than later.

Studies investigating the media use of students find that most students do have access to mobile devices[1,2]. Research on students' media use additionally shows that Google web search is the most accepted service, joined by Wikipedia and Facebook and the like, whereas Web 2.0 services, such as

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Twitter, which are commonly discussed as tools in higher education, show only low levels of acceptance[3,4,5]. Additionally, media applications are only used when they have proven useful in everyday life, and in order to pursue goals that students already had[6].

Research on backchannel communication is mainly focussed on professional or academic conferences, making participants act as social reporters to the outside world[7]. In university contexts, chat rooms are often used[8,9], and the main focus lies on collaborative meaning-making[10]. In the following, we present tools that are already used to facilitate backchannel communication in higher education settings.

1.2 Backchannel tools used in higher education

Backchannel communication can take place through different tools and for different purposes. The spectrum ranges from self-organized backchannel communication at an asynchronous level, for example, through a Dropbox for sharing of lecture notes or old exams, or over Facebook groups that enable both document sharing and synchronous and asynchronous discussion. At the sophisticated end, there are tools specifically designed for backchannel communication, which are made available by the lecturer, and whose use is encouraged.

A backchannel tool that is becoming increasingly common at scientific conferences and heavily promoted for use in higher education is Twitter. Twitter connects users to user names and profiles, which are often connected to the users' real names. Users find posts relating to a specific event by searching for a hashtag that was created to identify that event. Twitter also offers GroupTweet, enabling contributors to use the same account and choose whether to hide or display their names.

Another online backchannel tool is TodaysMeet[11], a linear chat stream. Participants are not required to create accounts, but instead identify themselves by names they chose. Live Question Tool[12], a web-based tool that allows to create sessions and offers additional functionalities, e.g. for questions to be posted, answered, and rated. Integrated in the course content management tool used at Hamburg University of Technology, the chat forum Blubber[14] allows students to comment, with the replies appearing directly below the comment they were addressing, and rate other comments. Blubber is connected to the students' user IDs in the system and hence not anonymous. Even more interactive is EtherPad[13], an open source online platform that can be hosted by anyone, and where users can edit documents simultaneously. Participants can, but do not have to, identify themselves.

A well-researched tool is Hotseat[15], which offers commenting, reading, and voting facilities. Students log in with their student ID, but can choose to post anonymously to the class. Moreover, discussions can be opened to allow outsiders to participate. Hotseat captures and displays analytics, and it has been shown that participation in discussion is often related to grades – the more actively a student participates, the better their grades[16].

There are also very sophisticated tools being developed, for example EduApp[17]. This tool's functionality exceeds that of a simple backchannel, as it can be used to answer clicker questions and display a personal timetable, or the room number of the next lecture.
Lastly Backstage[18] aims to counteract the anonymity and passivity commonly found in large classes. Here, students have the functionalities of a chat site, where the degree of interaction between students can be regulated by the lecturer, in addition to annotating slides, and many additional features, such as activity monitors are being tested[19].

1.3 Choosing a backchannel tool

Using general-purpose communication tools as a backchannel can have adverse effects in lectures[19], for example, by disconnecting the students from the lecturer and distracting the audience[20]. Therefore, when deciding on a specific tool, several important considerations need to be made, in particular, whether direct communication between students is desired, and at what level. Desired communication levels can range from students seeing each other's comments, over being able to vote on them, to responding and engaging in actual conversation.

An argument for allowing communication between students is that it helps build community. This allows students to support each other's learning, thereby practicing explaining, deepening their own understanding as well as relieving the lecturer. An argument against furthering communication between students is that it might not be on topic, not constructive[21], not scientifically accurate or could

take the attention away from the lecturer. Having students vote each other's comments up or down can be either used as a social decision as part of the learning process, as a guide for the lecturer on which topics seem to be of general interest, or as a democratic decision.

Another choice to be made is whether students remain anonymous. Anonymity helps protecting students and lowering the threshold. On the other hand, it might enable non-relevant comments, and it prohibits the use of activity in the backchannel in evaluation and grading. This leads directly to the next decision point - should activity in the backchannel be part of the assessment? For different didactical scenarios different choices will be made. Our choice is presented in the next section.

2 OUR BACKCHANNEL TOOL

2.1 Description

Weighing the arguments presented above, we decided that for our purpose – allowing for the lecturer to gauge whether the audience was having difficulties and what topics needed more explanations – a very simple approach seemed most beneficial. None of the tools we could find exactly fit our purpose and we therefore decided to develop a tool that allowed for anonymous one-way backchannel communication from the students to the lecturer. The lecturer's response would then take place in the front channel.

The tool design choice was based on three different roles: The students, a moderator, and the lecturer. Firstly, the students, using their own mobile devices[1,2], access a very simple, open web form, where they can anonymously their questions. Secondly, these questions instantly appear on a second, password-protected site, where the moderator can filter them and, choosing an opportune moment, forward them to the lecturer, or delete them. The role of the moderator was introduced in order to "protect" the lecturer from too many, or non-relevant, questions. Lastly, the lecturer receives the filtered questions and has now the options of either addressing the questions right away, later, or not at all. Since the lecturer receives the message on a screen not directly in his line of sight, he only sees incoming messages when he chooses to check that screen.

2.2 Usage

The tool was tested in three different settings throughout the mechanics canon (Winter 2013/2014 in Mechanics I and III and Spring 2014 in Mechanics IV) at Hamburg University of Technology. After point-wise testing in Mechanics I and II, we chose to test the tool throughout the whole topic "Theory of Oscillations", which ran over a period of 6 weeks, spanning 10 lectures.

When introducing the tool, the lecturer pointed out that the aim was to address questions right away, but mentioned that unanswered questions would be addressed in the subsequent lecture. This led to questions being posted outside of the lecture times, too. As we were still testing the tool, including whether the lecturer felt interrupted by the questions, the moderator always decided instantly whether a question would be forwarded to the lecturer, hence the second "waiting" option was not used. For operational uses of the tool we could imagine the moderator sitting in their office passively monitoring the tool, or even asking students to moderate, giving them the opportunity to take responsibility for their and their peers' learning. For the purpose of this study, the moderator did attend all lectures in which the tool was utilized. In addition to forwarding questions to the lecturer, the moderator took detailed notes describing the content, teaching method, the students' and lecturer's behaviour, and the general "state" of the room. These protocols are used in the following to classify phases of the course, e.g. repetition, introduction of new concepts, or demonstration of experiments.

3 RESULTS

In the literature, 6 dimensions to measure the success of an information system have been established: system quality, information quality, use, user satisfaction, individual impact, and organizational impact[22]. While comprehensively evaluating our tool along all of these dimensions is beyond the scope of this paper, we present some results for each.

A major concern from the developing stage of the tool is system stability, i.e. whether messages posted on the web interface make it into the database. This is an important issue both from a technical perspective, as well as from a didactical perspective. If posts from students never reached the database, students would be under the impression that we did not value their input enough to even

acknowledge it, while we, at the same time, did not even know they were trying to communicate with us. This would undermine our credibility as lecturers and jeopardize the relationship to the students.

Our approach to stability testing was two-fold: One was to repeatedly run a script that sent 50,000 requests to the server in order to estimate if and how many posts were lost in the process. This test revealed that 0.2% of the requests were not saved by the database. Further investigation showed that every 1002nd post was lost. For the purpose of this application we decided that this was acceptable, and we did not investigate to the cause.

In a second test, “real life” conditions were simulated by assembling colleagues with various web-enabled devices in the location where the tool would be used in order to test that specific hot-spot. We ended up asking the colleagues to send identifiable and consecutively numbered posts (A1, A2, A3, … for one colleague; B1, B2, B3, … for the next). Over a period of 20 minutes, the server saved 992 requests from 11 different devices. Devices included the most common mobile, tablet and laptop devices at our university. This second test yielded in either missing or duplicate posts in approximately 1% of the cases, which is likely mostly due to human error. Over all, these tests led us to confidently use the tool.

A problem was identified during the second session in the Mechanics IV lecture. The moderator, using the backchannel tool, tried to send a message to the lecturer, but the message was not saved in the system, nor did it result in an error message. After some trouble-shooting, it was found that messages that contained special characters (e.g. ß, ä, ö, ü, all very common in the German language the class was conducted in) did cause the loss of messages. This problem was solved on the same day.

The information quality of the tool is hard to evaluate – in the end it depends both on the quality of questions that are posted and on the lecturer’s response. In this case, the quality of the questions was perceived as “very good! Every single one is legitimate and not stupid” by the lecturer. In addition, voluntary use is often taken as a measure of success of a system. Per lecture, zero to 15 questions were registered in the system while between 150 and 250 students were present in each of the lectures.

After the very first test of the tool, in order to estimate user satisfaction, students were asked to participate in a target feedback evaluation of the tool. They were asked to place their position in a space spanned by the axes describing their satisfaction with the tool itself and how well they think they understood the topic of that lesson, Friction. For this purpose, large sheets of paper were taped close to the exits of the lecture theatre and students left their feedback as they were leaving. The marks cluster in the upper half of the diagram, indicating that the students feel like they understood the topic of the lesson well. In one case clustering is clearly towards liking the method, in the other case there is no clear preference visible. More data on user satisfaction will be collected at the end of the semester in a general evaluation of the course, which at the time of writing has not been evaluated by the central independent unit working on student evaluations.

The lecturer reported an overall positive impression of the tool and appreciated the feedback he is getting through the high-quality questions. The tool as a medium through which questions are being asked is perceived as agreeable because no written response is required. The lecturer is motivated to continue using the tool in future teaching. However, the current setup of our tool adds an extra stressor to the role of the lecturer: In addition to the traditional way of teaching, he now has to remember an additional device to see the students’ comments, which needs to be brought to the lecture theatre, be charged (or connected to a power supply) and regularly checked over the course of the lecture.

The tool does not seem to have had a substantial impact on the behaviour of individual students: less than 1% of the student population reacted to the existence of the tool at all. However, after having used the tool for only one week in Mechanics IV, the organizational impact consisted of lecturers from three other courses, who heard about the backchannel through some third party and inquired whether they could use the tool for their own courses.

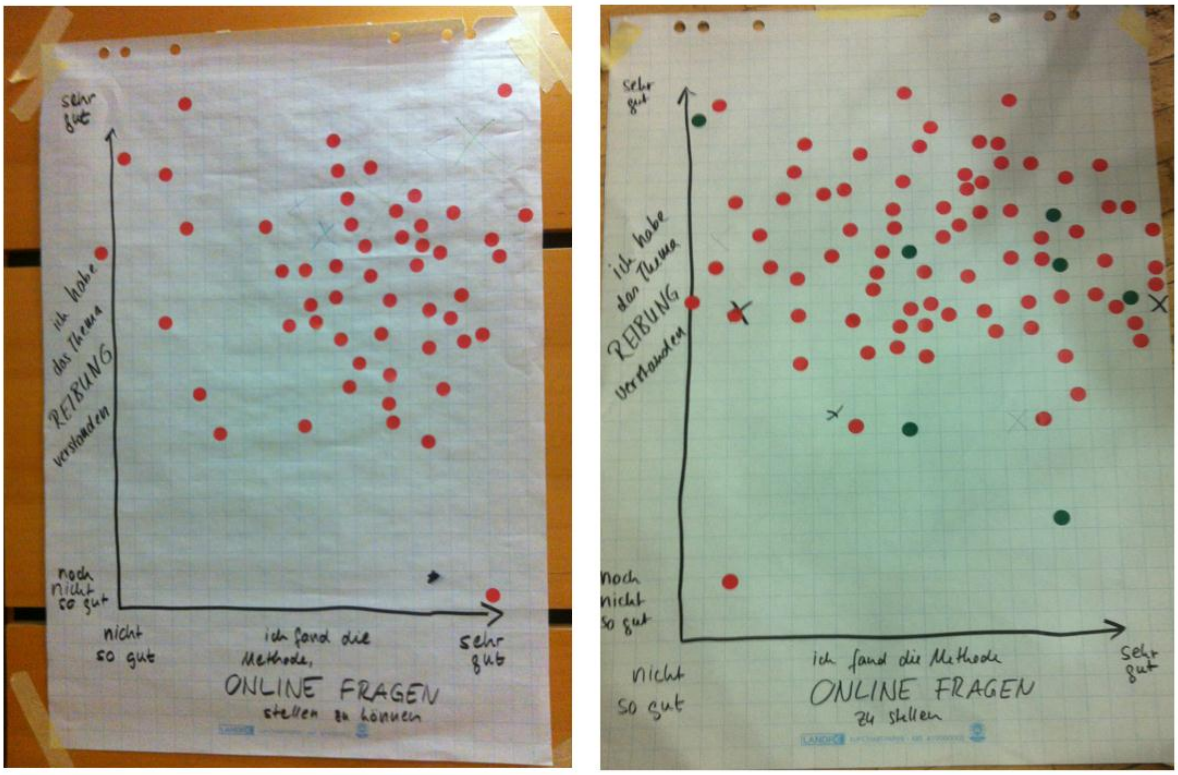

Fig. 1. Target feedback after the first test of the backchannel tool. On the abscissa the question “I liked the method of asking questions online”, ranging from “not so well” on the left to “very well” on the right. On the ordinate “I did understand the topic friction”, ranging from “not so well yet” at the bottom to “very well” at the top.

4 DISCUSSION

It is striking how much higher acceptance levels the tool reaches with lecturers than with students. Many lecturers heard about the tool and immediately showed interest, three approached the authors and asked for permission to use the tool in their own classes. In contrast, less than 1% of the students used the tool per lecture – much less than had been hoped for, and expected, by the authors.

The reasons for the other lecturers’ interest in the tool should be obvious from the background given in this article’s introduction. In addition, worries that the authors had prior to using the tool were dissipated: During the first session, students had to “test” the tool and the reactions that they could cause by posing questions outside of what the lecturers were probably hoping for. However, those disruptions were, with one exception, confined to the first class, maybe because they did not result in a discernible reaction. Interestingly, during the testing session with our colleagues, even they sent us “funny” messages in addition to the sequentially numbered posts we had asked them for.

But why was student participation so much lower than expected? Considering that the target feedback was asked right after the lesson at the exits of the lecture theatre with queues forming, this data should be used with caution. However, it seems like students were at least not opposed to the idea of the tool, and from colleagues and tutors we know that students talk very positively abut the tool and state that they would like for it to be used in other lectures, too. One reason for low student acceptance might be that there is no need for the tool in the first place. The main goal in developing the backchannel tool was to lower the perceived threshold of asking questions in a large lecture. The concept was conceived in the context of a Mechanics I course. This is the common introductory course to approximately 600 students in their first semester at Hamburg University of Technology, and together with Mathematics I, this course acts as a bottleneck to student retention. However, the test

presented in this paper was conducted in a course during the second half of the students' second year at Hamburg University of Technology, so the implementation of our backchannel tool was likely too late for this student cohort. In our case, student numbers had gone down, with between 150 and 250 students attending the lectures. More importantly, most students seem to have become socialized in the university system and have gotten used to not understanding everything at once. They may have found strategies to have their questions answered, either by asking directly, or by doing the research on their own. Students, who have not developed some kind of coping strategy, have likely left before Mechanics IV is taught.

Low student acceptance could also be due to the teaching format the tool was employed in. Our first two tests were done in an instructional format, where 200 to 300 students work on problems in a large lecture theatre, and the solutions of these problems are later presented, whereas the main part of this study was done in a conventional lecture. Acceptance of the tool was much higher during the first two tests than during the conventional lectures: the instructional format of the first two tests might be more conductive to backchannel communication. One clear pattern in all tests was that questions were only posted during short phases when students were working on problem sets, not during the frontal part of the lectures. This could be due to the students only having time to consider whether they actually did understand something and, if not, formulate questions during these phases. Or students could be asking strategically only during those phases, because the act of formulating, typing, and submitting a question would be too distracting during frontal lecture phases. This would indicate that the tool might be more useful in more open teaching formats. For instance, in lectures where the density of content is less, and students are more familiar with the content and hence more easily able to generate questions.

Another reason for low student acceptance could be that the medium was not chosen wisely, since it has been shown that students are reluctant to use media that they are not already using[6]. Maybe the threshold of going to the website to submit a question was too high, because the website was not integrated in an online space that the students are using anyway, so students had to change away from the program they viewed the slides in to a web browser, thereby possibly loosing track of what was being presented simultaneously. This leaves open whether the acceptance would be higher, if the tool was combined for example with a way to view the slides.

Another problem with the implementation might have been the bug with the special characters that was only discovered after several sessions. We discussed possible scenarios of addressing this issue. One scenario involved announcing the problem – and that it had now been solved – to the students for the sake of transparency. The second scenario, which we ultimately chose, involved continuing with business as usual. This seemed least disruptive to the course and did not put trust in the technical functionality of the tool at risk. The concern that students would feel ignored even though we did not, in fact, receive their questions was countered with the argument that the students knew that questions were being moderated, so they would just assume that their question had been filtered out.

Opening the communication via the backchannel seems to have had a side-effect. Ever since the tool has been introduced, no questions were posted by students in the "conventional way" during the lectures any more. While there were few questions before – estimated as only one or two per lecture – this is worrying as it could indicate that the questions have migrated to the backchannel and students are not practising the skill of asking questions in front of a large audience any more. However, employing the backchannel tool should be a first step on the way to opening up the front channel, too. The challenge for the lecturer is to engage students in conversations based on the questions submitted via the backchannel tool while at the same time conveying openness to and interest in discourse with the students.

5 SUMMARY AND CONCLUSIONS

We implemented an online backchannel tool in the first and second year mechanics courses at Hamburg University of Technology in order to lower the perceived threshold of asking questions during classes. Even though the authors were at first disappointed with low levels of student acceptance of the tool, we feel confident that this tool can be valuable in some contexts. Specifically, we see potential in first year courses in more open course formats to engage students in asking questions, rather than passively consuming a lecture. Hence, we are planning on using the tool in future courses. By communicating more clearly to the students that the tool is open for all lectures, as

well as between lectures, and displaying the link more prominently, this might lead to higher acceptance levels.

If students were socialized into asking questions in the first semester, that cultural change might propagate and continue onwards into later semesters, too. Using the students' questions enables lecturers to specifically tailor later instructions to the students' needs, which can be considered as a low-key form of just-in-time teaching[23]. Therefore, this tool does not only act to support students to formulate questions, but additionally, shapes the lecturer's didactical approach to the course by taking into account the students' difficulties when planning the next lesson. In summary, we recommend integrating backchannel tools such as ours in classes to become more aware of the questions students are struggling with and to use it as a tool for reflection on the teaching and learning process.

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