# Northumbria Research Link

# *Group Tagging: Using Video Tagging to Facilitate Reflection on Small Group Activities*

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## Abstract

Collaborative learning in class-based teaching presents a challenge for a tutor to ensure every group and individual student has the best learning experience. We present Group Tagging, a web application that supports reflection on collaborative, group-based classroom activities. Group Tagging provides students with an opportunity to record important moments within the class-based group-work and enables reflection on and promotion of professional skills such as communication, collaboration and critical thinking. After class, students use the tagged clips to create short videos showcasing their group-work activities, which can later be reviewed by the teacher. We report on a deployment of Group Tagging in an undergraduate Computing Science class with 48 students over a semester. Through our analysis of

interviews and log-data, we show that Group Tagging helped the students remain attentive and on-task during group-work and encouraged them to participate more during group activities.

## Introduction

The benefits of group activities and collaborative learning in the classroom are well established. Collaborative learning is very effective at stimulating higher level thinking, developing problem solving skills (Michaelsen, Fink, & Michaelsen, 1997), creating shared knowledge and understanding (Bossert, 1989), encouraging social interactions and team work (Roschelle & Teasley, 1995), as well as helping to manage the different level of skills and knowledge between the students (Johnson, Johnson, & Stanne, 2000).

However, group activities can be problematic when some group members dominate the discussion (Michaelsen et al., 1997), rely on 'social loafing' (putting minimum effort relying on others to do the work) (Karau & Williams, 1993), or avoid participating altogether. Groups can also get distracted and stray off topic due to focusing on inconsequential details or external interruptions. Group-work can also lead to simplistic reporting regardless of how good the discussion was during the task (Barkley, Cross, & Major, 2014)

Reflection, during or after an activity (Nunes, Nunes, & Davis, 2003), encourages students to think about the activity, focus more on the task, and review what the group did, and may thus alleviate some of these issues (Boyle, 1997). During the activity, students could pause and think of what they did so far -prompted by facilitator or technology- allowing them to examine their progress and decide how to proceed (Kharrufa, Olivier, & Leat, 2010). After a learning activity, students could write reflective essays, or discuss their work with the teacher and other group members. This enables the identification of mistakes and behaviours that can be improved, or highlight areas where students did well (in terms of group dynamics or task-related activities) and how that helped them in their work (Collins & Brown, 1988). Some argue that reflecting on an experience is more effective for learning than repeating that experience (Di Stefano, Gino, Pisano, & Staats, 2014).

In this paper, we explore whether video-supported reflection can improve the effectiveness of class-based group-work through the design, deployment and evaluation of Group Tagging (GT). GT is a web application which, coupled with 360-degree cameras: 1) enables students to record and tag short video clips of their group-work 2) allows students access to the group's clips to see what everyone has recorded, and 3) supports the creation of a short film that includes several clips the students chose that can be used to showcase the student's contribution

We deployed Group Tagging in an undergraduate computing science class throughout a semester (10 weeks, 2 hours a week) to investigate whether such technology, designed to support reflection, could: 1) encourage students to remain on task (being actively involved in and focused on the learning activity (Astin, 1984)) during group-work 2) support more evenly distributed participation across the group and 3) improve students' overall group-work skills and learning experience.

## Theoretical Background

Collaborative learning involves people working in groups to achieve a shared goal. In addition to supporting learning, it has psychological, productivity and learning attitude benefits (Springer, Stanne, & Donovan, 1999).

Johnson et al. 1991 suggested five requirements for successful group learning activities: 1) Interdependency: each student's contributions should be required and valued 2) Personal accountability: students must be aware of their responsibility and what is required of them individually to complete a shared task 3) Social and group skills: students need to develop and demonstrate skills such as communication, leadership, and management; 4) Team reflection: the group should be able to set goals for their collaboration and identify what is working and what requires changing to reach those goals; 5) face-to-face interaction: to allow for the social aspects of an activity such as feedback, discussions, encouragement, and support.

Ellis et al. 2014 focused on the process that can promote individual/team reflection. They studied the effectiveness of "Systematic Reflection", which is the process of having the learner constantly analyzing their behavior and evaluating their contributions. The process can be individual or team-based and comprises of three steps: 1) Self-explanation: analyzing and evaluating the outcome of the task and explaining failure or success; 2) Data verification: examining data from a different perspective to avoid biases (this decouples the experience from the outcome and forces the students to consider aspects of their performance which they might have overlooked); and 3) Feedback: two types of feedback lead to reflection; the outcome of the task which can motivate reflection, and examining the reasons behind the outcome to identify ways of improving performance (Ellis et al., 2014).

However, reflection can be a challenging task for students as it requires questioning and evaluating their thinking and actions as well as considering alternatives. Students can have harder time reflecting on their own experience due to their feelings, which can be offset by the instructor and their peers (Leijen, Valtna, Leijen, & Pedaste, 2012). Technology, which is now integrated into the classroom, can be a useful tool in facilitating reflection. Different types of technology (videos, blogs, and portfolios) have proven to have a positive effect on reflection (Kori, Pedaste, Leijen, & Mäeots, 2014).Video can provide a rich source of data on the experience, offers a different point of view on what happened during the activity, aids recall, and gives opportunities for noticing missed details (Sherin & van Es, 2005).

Thus, The design of GT was based on Ellis et al. (2014) systematic reflection framework, supporting the students to follow the three steps of reflection, while adding an element of reflection during activity as well.

**Related Work**

Video reflection is a method that is widely used in training and education and it has been shown to be an effective method of learning (Kharrufa et al., 2010; Nunes et al., 2003). An example of using video to encourage reflection is the study by Fadde et al. 2009 -a video editing activity for a teachers' class preparation. Teachers were given access to videos of their teaching, which became the basis of a

written reflective analysis. Later they were asked to select two or three segments (2-3 minutes each) to be edited and uploaded in addition to writing a report. They aimed to examine whether the editing process would make the teachers more reflective and concluded that teachers who did the editing were more self-critical of their teaching. Teachers reported feeling nervous about being filmed; yet appreciated the opportunity for self-reflection. The activity was for individuals and was resource and time consuming.

Another example is Reflectable, is a digital learning environment that combines design activities with video-led reflection. Students are videoed working together on a design game. Participants have a button to press if they felt that something important happened. The resulting video is segmented into short clips, displayed in a grid, and can be viewed simultaneously. Button presses are marked on the videos and students can re-watch those moments later. This method of reflection showed a potential in helping students understand their own design approach and decisions as well as have a better understanding of the theoretical concepts related to design activities. The system was task specific, created for design students to connect theoretical and practical aspects of their studies (Hook, Hjermitslev, Iversen, & Olivier, 2013). Likewise, most examples of video enhanced reflection in higher education (e.g. in the medical field, teacher's training, psychology, etc.) are task-specific (Birbeck et al., 2015). The motivation for GT was to provide a more general solution and cut down the time usually spent reviewing videos after class for reflection.

## Design and Development of Group Tagging

**Motivation and Inspiration**

The motivation for the application came from concerns that students were not benefiting fully from group activities. Lecturers had observed students being distracted, straying off topic, or even giving up on a task quickly, (a well known issue in group activities ( Barkley et al. 2014; Karau & Williams 1993)). Initially, existing tools were trialled, including Group Spinner, a tool to help teachers evaluate engagement in collaborative learning activities (Kharrufa et al., 2017), and Bootlegger, a video commissioning app and platform that allowed users to record short video clips of an event as a group

(Schofield, Bartindale, & Wright, 2015). However, these tools did not serve the purpose. Group Spinner was designed for the teachers to assess the students' engagement and using it would have added substantially to the lecturer's workload. Bootlegger required the students to record short videos using the app on their phones and then combine them to create a 'highlight' video, this proved too disruptive, students had to stop and disengage to record videos and it was hard for the students to anticipate the right moments in the activity to capture.

Therefore, GT- a web app motivated by the above two systems to allow the students to record and tag short video clips in real time during the activity quickly with a tap on their phone screen – was developed.

**Design Process**

The design team consisted 3 teaching staff and 2 developers. The required features and interfaces were decided through multiple meetings. Development happened in several stages with parts built being tested by the lecturers and volunteer students.

**Technical Description**

Group Tagging is designed as a web application, to allow an accessible, multi-platform solution. The interface of GT was designed targeting mobile phone screens, i.e. to be minimal, including only the required elements. Storage and editing of videos was done through the Bootlegger platform (Schofield et al., 2015).

**How Group Tagging Works**

**Tagging in Class**

Each group is given a 360-degree camera, which they can place any where they want, to record the activity. The students individually access the Group Tagging app to tag and record their group-work. Individuals using their own devices (any device with a browser and internet access) were responsible for tagging for their group, and all members would be able to access the group videos. During the session,

students would use the tagging interface (Figure 1) to record contributions they thought corresponded with the tag.

Each 'tag' produced a 30-second video, recording 10 seconds before the tag, 20 seconds after (times based on informal testing). Students were encouraged to tag for their group-mates rather than themselves to overcome a possible lack of confidence in their participation, and to keep the conversation flowing naturally.



**Figure 1 The**

**Video Review and Creating Edits**

After class, the videos are copied from the cameras to a computer to be synced and sliced to 30-second clips using the tags information from the app using a python script. The clips then would be uploaded to the server and made available to the students. The students have access to all clips and tags made by their group and they can change the tag associated with a clip if they wanted (figures 2,3). Multiple tags can be applied for the same clip if the student thought that it shows more than one skill. Each student can also create a short video (Edit) that contains up to five clips of their choice. The limit was chosen to keep the edits short and make the process easier. The student can create multiple edits per session, which allows experimentation. Text descriptions can be added to the edits, adding context to the video.

**Teacher's Feedback**

The instructor's dashboard shows all edits submitted by students for feedback and assessment. The lecturer can watch the video and write a short comment to the student who can see the teacher's feedback attached to their edits.
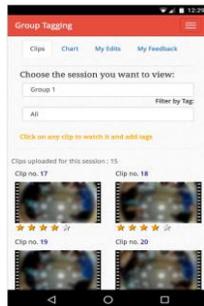


**Figure 2**
**recorded clips**
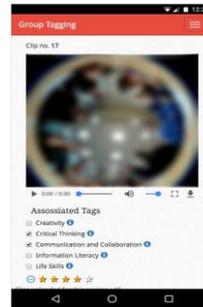


**Figure 3 video**

# Methods

## Study Context

The study took place in a final year course for a computing science degree. It was a flipped classroom course (Berrett, 2012) where students prepared for class by engaging with a set of online materials. In-class time was used to develop deeper understanding of the concepts delivered online by engaging in a variety of group activities such as design, problem solving, and prototyping. The students received 10% of their final module mark from participating in these activities every week, and GT was the tool used for assessing the students' participation. For this study, the lecturer chose five skill categories from the 21'st century skills (P21 2015)-critical thinking, creativity, communication and collaboration, information literacy, and life skills as tags. The choice was related to the nature of the activities in the module and those skills were used to assess students through the videos they submitted.

## Participants

In total, 48 students (8 females) participated in the study. Students worked in groups of 5 or 6, where each group had a unique 'tagging' session every week, making a total of 68 sessions. The students decided the groups and they had the freedom to move and change groups at any time. They were informed of the study on the first day of the module and 18 consented using their videos and online activities during the module for further analysis.

**Data Collection**

Data was collected and analyzed to answer the following questions:

1. How did the students use GT?

2. What was the effect of using GT on the students' engagement and participation in activities?

3. What was the students' perception of GT?

Qualitative and quantitative data were collected from three sources:

- GT log files: the application recorded all user activity. This included details on users, sessions, tagged clips, and created edits.

- Semi-structured interviews: five students (1 female) were interviewed after the end of the module about their experience and how they used GT, as well as their thoughts on the concept and execution of the application. The interviews were 30-minutes (average), and questions were based on the preliminary analysis of the data obtained from GT log files and usage data.

- Videos (Edits) created by the students to showcase their participation in class were 1.0-2.5 minutes long and included (2-5) clips.

**Data Analysis**

- Frequency Analysis was conducted using SPSS statistics software to summarize the data from GT log files. The analysis aimed to determine how the tags were used and look for trends in how the students used the application each week when tagging in class and when creating edits after class. The results from

the analysis were used to inform the design of the interview schedule and the themes for analysis (Pagano, 2013).

- Interviews were audio recorded and transcribed. The transcriptions were analyzed thematically by one researcher (Braun & Clarke, 2006). The analysis was guided by pre-determined themes from the interview questions and the observed behavior of students in class.

- The videos were analyzed by a researcher who watched each video multiple times while noting the tags used, number of clips in each edit, the time edits were created, description included, and quality of clips generating a summary of how each student used the tags and what they tried to convey with their edits.

## Results

The study results are presented in three parts. The first includes the findings from the quantitative analysis of GT log data. The second describes the results of the videos analysis conducted on the students' submitted edits, while the third reports on the findings from the qualitative analysis of the students' interviews.

**Quantitative Findings**

The specialist undergraduate computing science module comprised 10 seminars, two hours each. In every seminar, the students engaged in 2-4 group activities. The lecturer would designate one activity per class as a tagging activity. Students were asked to tag in every session, but only required to submit 7 edits by the end of the module for assessment. The average session length was 15-30 minutes. The students recorded a total of (2174) tagged clips, with the lowest number of clips for a single session (one group) being 6 and the highest 75 clips. Figure (4) shows the total number of clips recorded each week. The weeks with the highest number of tags are the ones were the session's length was 30+ minutes, while the sessions with the smaller number of tags were shorter (about 15 minutes).
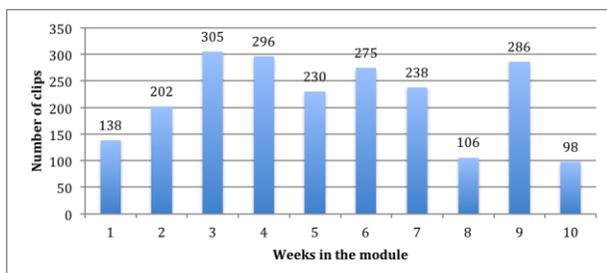


**Figure 4 Number of clips each week**

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The students created a total of 427 edits by the end of the module, 224 were submitted for assessment. Figure 5 shows that the largest number of edits was created in the second and last weeks. The second week was when the students learned how to create an edit and tested the process. The last week was the deadline for submission.
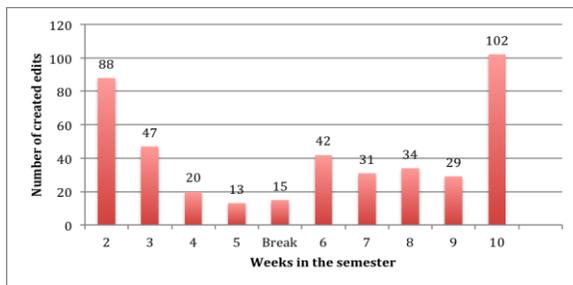


**Figure 5 timeline for edit creation**

**Analysis of Submitted Edits**

We examined the edits submitted by the 18 students who consented to the use of their videos for the study. Five students' edits were later selected for further analysis. These were chosen because they were the only students (of 18) who created an edit for 7 or more sessions. Those five were from different groups and one of them moved between two groups during the semester. Three of those students volunteered to be interviewed as well. The analysis was conducted to determine 1) how the students interpreted and used the tags as well as any change in that interpretation 2) what was the effect of reviewing the videos and creating the edits on the students' behavior.

To determine whether the clips were good examples of the skills they were tagged with, the definitions of each skill as provided by the 21ˢᵗ century skills framework (P21 2015) were considered

along with the feedback given by the lecturer. We considered a clip that shows a good example of a skill based on the definition of the skill and the lecturer's feedback to be correctly tagged. Overall, 40 edits were analyzed and table (1) summarizes the results of the analysis.

**Table 1 summary of video analysis**

| Student | No. of submitted edits | Average edit length in minutes | Total number of tags used | No. of correctly tagged clips | Percentage of correct tags | Edits created |
|---------|------------------------|-------------------------------|---------------------------|-------------------------------|----------------------------|---------------|
| St1 | 8 | 2.4 | 39 | 28 | 72% | Weekly |
| St2 | 8 | 1 | 16 | 13 | 81% | End of module |
| St3 | 8 | 1.13 | 18 | 16 | 89% | Weekly |
| St4 | 9 | 1.7 | 31 | 24 | 77% | Weekly |
| St5 | 7 | 1.07 | 14 | 8 | 57% | End of module |
| For all 5 students | Total=40 | Avg= 1.46 | Total= 118 | Total= 89 | Avg=75% | |

Four out of five the students were mostly tagging their clips properly, while the fifth used the tags correctly only half the time. Nonetheless, when tagged correctly, the clips (for all five) were a very good demonstration of tagged skills. The most common mistake was including clips that were tagged with a skill but either demonstrated another or showed the students doing something unrelated to the task. It was unclear whether those clips were included by mistake or if the students misinterpreted the behavior.

Two students created all their edits at the end of the module while the others did it throughout. Analysis shows that students who created all edits at the end of the module have the shortest edits on average (included less clips). This did not impact how they tagged the clips (they made the same mistakes in later edits that they did in earlier ones). However, the quality of the clips included improved noticeably for the students who did it weekly. Those students were getting better at capturing the right moment when tagging and the clips they chose for their edits connected to each other better and made a more cohesive video.

**Qualitative findings**

Three key themes were identified when analyzing the students' interviews. The first includes the students' experience using GT in class and how it impacted their behavior and strategy during group activities. The second theme provides information on the students' perception of GT and how they thought it impacted their conversations. The third theme shows the students' opinions of GT as a reflection tool.

**Tagging in class.**

Most students were tagging for themselves while occasionally tagging for others in their group. However, some groups decided early to pick one member to do the tagging for the whole group. The main reasons students adapted their strategies for tagging were: 1) the number of clips produced during a session, 2) the interpretation of the tags. When everyone in the group was actively tagging, the number of clips produced was high and many had the same or majorly overlapping content. This made the process of reviewing the clips harder and time consuming. The groups that chose to have only one member do the tagging decided that they wanted less clips to make the reviewing process easier, while the groups that had everyone tagging thought having more clips provides a better chance of covering the moments in conversation they wanted.

*St2: "There was a little bit of chat at the beginning, but generally we just, "Let's just all do it." But it's better to have more than you need than not enough"*

*St3: "I think the first one or two, everyone did it, and then we decided that that got a bit not manageable. [...] Whoever was in our group would just decide one of us would do it"*

The other factor in how tags were used was the interpretation of the tags and understanding of skills associated with each one. Some students reported having difficulty deciding which tag to use and admitted that it was a bit of a struggle thinking about it while following the discussion.

*St2: "I found it hard to know sometimes which thing to press and also there were definitely two categories [...] where we just hardly ever had clips for them"*

Other students stated that making quick judgment and identifying skills while being part of the activity was valuable and helped them think more critically about their participation and what skills they (and other group members) were demonstrating, which made the process enjoyable and beneficial at the same time.

*St3:" We tend to notice what skills we're looking for. It's like, 'put that down as that tag' and we press the button. I think it made us think about what we were doing to make sure we hit those targets a bit"*

One student compromised by using one 'placeholder' tag for all the clips recorded during the session. During review he would tag them properly before creating the edit. He thought this was the easiest way to tag important things while not getting distracted trying to work out which tag would be appropriate for it.

**Impact of tagging on conversations.**

The students interviewed agreed that the activities that used GT were different - they needed to contribute more to the conversation so that they will have videos later for the assessment.  They believed that the activities that involved tagging had more participation in general which led to hearing more opinions and ideas from students who would usually remain silent. The use of GT encouraged the students to be better prepared and pay more attention to the topic and the activity so they would have something to contribute.

*St2: "it got us talking; it got us all… properly engaged in a problem we had a common solution for. It got me really thinking about what the problem was so I could contribute something worthwhile"*

GT also made the conversation more formal. The students admitted that the knowledge that they were being recorded and assessed made them more careful. Words, phrases and jokes that may be normal in a casual conversation were avoided to be more professional. They also agreed that using GT encouraged them to stay on topic and not stray far from it. They thought that it was useful for them to be professional and learn the needed skills for future employment, but it was a change from the relaxed atmosphere in class and that could make it uncomfortable and not enjoyable.

*St2: "I think for the most part when it came up, I personally was acting very professionally, and then there was maybe one occasion of people in the group, just like, Hey, remember we're being recorded, this isn't… so I guess it was a good thing, because when I go and get a job […], I've got to be professional. But it was like a burden when it came up. We were just having an easy, not easy, but a relaxed environment, and then suddenly there was this change"*

**Reflection after class.**

The students said that GT was useful for reflecting on their behaviour in class. GT made them aware of people being quiet and not contributing much, or someone talking over or interrupting others when they speak. One student said that when he and his friend noticed a couple of students who did not participate much, they decided to encourage them by asking directly for their opinion, because they wanted the conversation to be more inclusive. Another noticed that she was interrupting others and pushing her opinions aggressively during discussion (to her dismay). She made a note of it in that week's edit with a resolution that she will be working on fixing that behaviour, and she talked about it in the interview and how she felt responsible for the other students not contributing.

*St4: "I immediately cut ideas if I don't like them, and it's not a very positive trait. […] It helped me realize things that I did in class and then try to change them"*

The point about interrupting others was brought up by students who questioned when it would be appropriate to cut someone off to keep the conversation going - a natural occurrence in a normal discussion - and some thought that purposely avoiding it makes the conversation unnatural

*St5: "In a normal conversation, you are usually free to speak over someone, […] you don't always wait for them to finish the sentence, right, you jump in, whereas in some of the groups I was in, people are a bit more […] laid back, so just waiting for someone to finish their point before saying something. […], it felt a bit unnatural, in that interaction"*

**Discussion**

In this section we evaluate GT and discuss whether it succeeded in its intended purpose of using technology-supported reflection to 1) encourage students to remain 'on task' during group activities, 2) support more evenly distributed participation across the whole group, and 3) improve students' overall group-work skills.

**Reflection during activity.**

Nunes et al. (2003) proposed that reflection during an activity happens when the student pauses to think about an action or an idea while solving a problem. They also explained that a tool that assesses cognitive strategies should provide the students with the ability to recognize and think about the strategies they are using, and that this recognition will help them expand their cognitive possibilities and gain autonomy. Our findings showed evidence that GT encourages this type of reflection by requiring the students to tag certain moments during an activity with the skills that were displayed at that moment i.e. they needed to be able to identify the skill and choose the appropriate tag within seconds so that the moment is not lost.

Our results also showed that the students had different attitudes towards the tagging process- a challenge that was addressed differently by the groups. Some students tried to identify the skills while working. Others chose to either put the responsibility of tagging on one member or use the same 'placeholder' tag for all the clips and think about the skills involved later. Therefore, while some of the students did not do the reflection and thinking during the activity, they had to take an extra step when reviewing the clips later after class. If we take Nunes et al. definition we can conclude that Group Tagging supported the students who wanted to do reflection during the activity and helped the other students, who chose otherwise, to come up with another strategy that worked for them.

The findings demonstrate that using the app to assess students' participation along with the students' awareness of being recorded has incentivized them to be better prepared before class so that they could contribute, encouraged them to talk more so they would have something to record and kept the conversations on-topic. GT worked well toward addressing the issue of disproportionate participation and

combating social loafing (Karau & Williams, 1993) by incentivizing participation and making it easier to spot quiet students.

**Reflection after class.**

GT's design aimed to help the students go through systematic reflection of their participation in group activities after class. This approach can be effective in improving learning outcomes if the students engaged in the process every week (Ellis et al., 2014). However, the students in the module did not engage consistently and many of them created their edits at the end of the module near the submission deadline, meaning that the reflection process was not happening as intended. Nevertheless, students who followed the process found it useful in improving their professional skills and their group interactions. As the interviews revealed, some changed their behavior after reviewing the videos and others became more aware of group dynamics and the lack of participation from others, which prompted them to take positive steps to address the issue.

**Reflection on GT design and functionality.**

GT was designed to fit most group activities in class. The instructor can change tags depending on the desired learning outcomes for the activity. This is facilitated by using an external camera to capture students' interactions in any setting. The customizability of the app makes it practical in a variety of small group teaching unlike other task-specific tools, such as Reflectable (Hook et al., 2013). The simple tagging interface makes the process of recording the clips easy and intuitive. The use of 360-degree camera removed possible distractions resulting from pointing a camera at specific students. Tagging occurs during the conversation with no pauses and without bringing attention to the camera and recording, making activities flow more naturally. Also, the clips the app records start 10 seconds before tagging so the students have time to decide whether the contribution is worth recording or not. This was not possible with tools such as Bootlegger (Schofield et al., 2015) that requires the user to know when to start recording, which may lead to the clips starting halfway through a sentence.

However, GT does not force any of the above interactions and the results of the deployment shows that some students chose not to use the app or leave the tagging to someone else. Some also did not review the videos every week, which affected their ability to identify skills. This design issue needs to be addressed in the future to add motivation for the students to use the app regularly.

Another issue that came up frequently in our analysis is overlapping clips, and the large number of duplicates produced when all students in the group were tagging at the same time. To address this issue the application could merge clips that have very similar content into a longer clip that includes all the tags.

## Conclusion

We explored the potential of using student-created videos to encourage reflection on group-activities and improve participation in class. We introduced Group Tagging (GT), a web application that allows the students to record video clips during the activity and tag them with specific terms that describe the content of each clip. The application provided the students with the ability to review and re-tag the clips as well as combine them to create videos they could share with others or submit for feedback.

The results suggest that Group Tagging helped the students stay on task and encouraged participation in discussions. GT also made students aware of their behavior in class and encouraged them to improve their skills. However, not all students did the reflection weekly, therefore the benefits were not equal for everyone and the design needs be adapted to regular usage.

### Statement on Open Data, Ethics and Conflict of Interest

- Access to data may be possible under appropriate agreement. Contact the author for details.

- The research received ethical clearance from the University of Newcastle. Students were informed of the study at the beginning of the course, and participation was voluntary. There is no potential conflict of interest in the work.

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