Realizing students’ ability to use technology with silent video tasks

Bjarnheiður (Bea) Kristinsdóttir[1], Freyja Hreinsdóttir[1], Zsolt Lavicza[2]

[1]University of Iceland, School of Education, Iceland, bjarnhek@hi.is, [2]Johannes Kepler University, Linz, Austria

Teachers who encounter difficulties when implementing technology in their classes often hesitate to give it another try. They expect too many technical problems to emerge, reducing time spent on learning mathematics. Still, if a task requires only short classtime they might try. Four mathematics teachers in different upper secondary schools in Iceland assigned a silent video task in their classes in fall 2017. Such tasks consist of asking students to record their commentary to a short silent mathematics film. Teachers were positively surprised by their students’ technological abilities. Nevertheless, because the task was not directly related to final test preparation, they expressed that they would unlikely use it again. In this paper, a review of technology and silent video activities and related research will be outlined.

Keywords: silent video task, upper secondary school, in-service mathematics teachers, use of new technologies in class, formative assessment.

INTRODUCTION

Leung and Bolite-Frant (2015) ask for the design of tasks that encourage discourses for mathematical knowledge mediated by tools in the classroom (Leung & Bolite-Frant, 2015). Silent video tasks are an example of such tasks. Not only do they encourage classroom discussions about mathematics, they also seem to open teachers’ eyes to the fact that students are capable of using technology and that the intended use of technology in mathematics class must not necessarily evoke worries or anxiety for the teacher. This article aims at offering some answers to the question: What are Icelandic upper secondary school mathematics teachers’ expectations of and experiences with using silent video tasks in their classes? Some preliminary results will be presented regarding three particular issues connected to teachers’ anxiety when it comes to using new technology in class.

Silent video tasks

Silent video tasks were developed and tested in a Nordic and Baltic collaboration project in 2014. Silent videos are animated, short films without any text or sound that show mathematics dynamically, each video focusing on one mathematical concept. In a silent video task, students get the assignment to watch a silent video as often as they like, discuss it in groups of two, and add their commentary to it, i.e. to record a voice-over to the video.

This activity can be implemented as an introduction to a new mathematical concept or as a summary of a topic; the former serves as a tool for collecting preconceptions and initial ideas and the latter helps assessing pupils’ understanding of previously studied concepts and to overview possible misconceptions and misunderstandings. In both cases, problems can arise from imprecise language use and it can be addressed to clarify concepts. Ideally, students should receive feedback on their solutions and in a follow-up lesson some student solutions can be chosen for viewing to initiate a group discussion.

Silent video tasks as formative assessment

Suurtamm et al. (2016) claim that the primary purpose of an assessment is to improve student learning of mathematics (Suurtamm et al., 2016). One cognitive aspect designed to improve student learning is when students get the opportunity to explain to others and/or to receive explanations from their classmates. Silent video tasks not only offer students an opportunity to do so, but also that they become aware of the fact that once they are able to explain to others what they have learnt, they also improve their understanding. One of the students who completed the silent video task commented the following in an online survey: “You don’t know the material well enough if you cannot explain it to others in a good [understandable] way.”

Teacher feedback to silent video task solutions can be used to suggest what can be worked on further and not only to measure the students’ current ability. In other words, silent video tasks can be used as formative assessment, supporting students’ learning of mathematics.

THE STORY BEHIND SILENT VIDEO TASKS

The idea of silent video tasks emerged in the winter 2013-14 in a Nordic and Baltic GeoGebra Network teachers’ and teacher educators’ collaboration project. After developing the task, teachers in four countries participated in a teaching experiment and tried out silent video tasks with their pupils in grade 5-13. They divided their pupils into groups of 2-4 to work on and record their commentaries. In some exceptional cases only one pupil worked on a solution. In total, approximately 450 pupils and 21 teachers participated in the teaching experiment. Teachers answered an online survey with two open questions regarding their pupils’ results in general and five Likert-scale questions each for every group of pupils regarding their reactions to the task. The teachers reported that 94% of their pupils’ groups reacted positively to the task and their pupils’ groups communicated more than in usual class.

As one of the teachers who participated in the teaching experiment, I felt sceptical before assigning the task. Listening to my pupils’ solutions I had an “aha!-moment” realising the potential of the task to offer insight into my pupils’ conceptual understanding. I wondered what expectations and experiences other teachers had and that is the key topic in my ongoing PhD study.

MOTIVATION

The Icelandic mathematics curriculum for upper secondary schools lists several goals regarding students’ mathematical understanding and their ability to apply mathematical methods to tackle various cognitive demands. Still, according to a report written for the Ministry of Education, Science and Culture in Iceland, mathematics teaching practice in Icelandic upper secondary schools is mainly limited to standardized calculation methods and running down lists of things to cover (Jónsdóttir et al., 2014). This resonates with the international TIMSS study that revealed at least 80% of the lesson time in 8^{th} grade mathematics class was used for solving problems and that on average in all countries but Japan most problems (between 63% and 77%) were problems of low procedural complexity (Hiebert, 2003). To reverse this trend, I was interested in seeing whether silent video tasks might be used to break up the common teaching practice routine and awaken teachers' interest in practices more related to idea of the *thinking classroom* described by Peter Liljedahl (2016). Namely, a *thinking classroom* is organised in a way that students are expected to think and given opportunities to think through activities through continuous discussions (Liljedahl, 2016).

As a teacher with only two years teaching experience in upper secondary school, I made small steps towards becoming the teacher that I wanted to be. Participating in the silent video teaching experiment reminded me that I wanted to change my teaching practice. When I started my PhD studies, three years later, this experience still stuck with me. I came to realize that the experience that I saw happening with my students, as they perceived knowledge in the process of communication resonated with Anna Sfard's (2010) idea of commognition. That idea, in fact, requires us to think of cognition as a process of communication (Sfard, 2010). In an earlier paper Sfard explains two equally important 'metaphors' for learning: individual, cognitively oriented knowledge acquisition conceptualisations, and social and participatory conceptualisations of learning (Sfard, 1998). The latter one being what I experienced in my classroom in 2014 with the silent video task.

Last but not least, what I experienced from the teaching experiment in 2014 was that even teachers who were not used to using technology in their classes seemed to find the silent video task to be a reasonably easy start when it came to trying out something new in their teaching.

METHODOLOGY

The research question initiated from my motivation: What are Icelandic upper secondary school mathematics teachers' expectations of and experiences with using silent video tasks in their classes?

In total, there are 30 upper secondary schools in Iceland that prepare pupils for studies at university. Ten of these upper secondary schools were randomly selected, and out of them six schools accepted the offer to participate. One teacher in each school assigned a silent video task to their 17-years-old pupils. The research design included two short online questionnaires for students and three semi-structured interviews with the teachers:

The first teacher interview aimed at collecting background information (e.g. teaching experience, working atmosphere) and expectations, discussing the task in advance. The second interview revolved around the experience so far, the student solutions and planning the follow-up lesson, and the third interview focused on the overall experience of working with a silent video task.

The silent video task chosen for this study

For many students in Iceland, the first new mathematical concept that they encounter in upper secondary schools is the unit circle and therefore it was chosen to be the theme of the silent video selected to use in this study [1]. The two minutes long video shows a circle getting parted into four quadrants before a coordinate system appears, defining the circle to be a unit circle. All the time, a dot moves around the circle in a positive direction. Line segments point to the coordinates of the point and at the same time can be interpreted to denote the sine and cosine values. The video was made with GeoGebra and was based on an idea from Alf Coles, a senior lecturer at the University of Bristol School of Education. According to Coles, he got the idea from Dick Tahta and Caleb Gattegno, and the original idea probably came from the Nicolet [2] films (Coles, 2008).

The silent video task was introduced to the participating teachers via phone calls, in email communication, and on a webpage before the first interview took place. Four teachers completed all three interviews, one only participated in the first interview and one in none of them. The teacher quitting after the first interview reported lack of both time and student interest. That, however, contradicts the fact that most participants found the task interesting. The other teacher quit because only six students signed up for the course. All interviews were made in meeting rooms or teacher offices in the schools. Principals and teachers received information about the purpose of research and signed informed consent regarding their participation.

Students received information about the research project and were asked for a permit to collect their silent video task solutions, which was accepted by all students. Links to short feedback questionnaires, each with five Likert-scale questions and one open commentary field, were sent by email to students before (86% answer rate) and after (70% answer rate) the follow-up lesson. Results from the student questionnaires were partly used as a reference in the second and third interview with each teacher.

After transcribing the interview data, I first viewed it through the theoretical lens that I used in the preparation phase. This lead into a cul-de-sac. Then I coded and analysed the data using a Grounded Theory approach (Charmaz, 2006). Based on the findings, I will be using a top-down approach in the next step of analysis.

PRELIMINARY RESULTS

In this section, I will give some preliminary results and I focus on the first three interesting issues related to technology that emerged during coding. Further results will be outlined in future publications.

The first issue that I would like to address is that teachers are not aware of the technological reality of their students. In Iceland, youth and young adults use social media such as Snapchat and Instagram to share video recordings from their daily lives with friends as well as strangers (Gallup, 2017). This is not a specific Icelandic phenomenon and the same trend is apparent for teens in the US and in numerous other countries. According to surveys by the Pew Research Center on American teens’ social media use, 92% of American teens used the Internet daily in 2015, 71% used Facebook, 50% used Instagram, and 41% used Snapchat (Lenhart, 2015). As of 2017 social media use amongst teens and young adults in the US has increased to 79% using Snapchat, 76% using Facebook and 73% using Instagram (Edison Research, 2018). Most teens, therefore, are quite used to hearing their voice in a recorded form and are not shy of sharing such recordings with others. Despite this fact, three of the four teachers were very hesitant to play their students' silent video commentary recordings in the follow-up lessons.

> Teacher G: […] If you say "And then I am going to play the recording for everybody" then I think that it immediately has a certain influence on how they solve the task so I decided not to tell them that I was going to play their recordings and afterwards I thought "Can I really play the recordings or not?" so I ended up not playing any recording […] one has to ask them for permit to play the recording […] it is a fragile age and even though you don't hear anything wrong with it yourself then somehow they spot something and that can be risky […] they can freak out.

In the example above, the teacher did not introduce the task to students such that they would expect some selected solutions to be shown in the follow-up lesson. Another teacher who had announced that some selected solutions would be shown in a follow-up lesson, backed out and ended up not showing any student results despite his announcement. The idea that most students somehow feel ashamed when their solutions are picked to discuss in the follow-up lesson is not necessarily always valid and must be cleared, i.e. the teachers need information on their students' reality.

A second issue is the fact that some teachers fear technology will fail in their classrooms and are therefore anxious about using it. Before assigning the task, technology other than calculators was not used by students in class on a regular basis. All five of the teachers that participated in the first interview expected their students to have difficulties with technology. This expectation was partly based on former experience with slow computers or failing software. Whilst one of them looked forward to seeing the students struggle with technological problems before succeeding, others were anxious and over-protective, taking full responsibility themselves for solving technological issues.

> Teacher S: […] I was rather surprised […] I had expected that something like that [refers to problems with technology] would come up, but there was nothing.

Teachers assigned the silent video task in a manner depending on their own beliefs and ranging from giving very short verbal instructions asking the students to solve the technological part of the task themselves to handing out a long and detailed instruction sheet. Only one of the teachers experienced that students needed help with technology:

> Teacher M: As it goes then it was quite diverse [refers to how it went to deal with technology] and maybe they described that in their — I asked them to explain it clearly — in the online survey […] I feel it is quite a hurdle for this task in order to let the energy — I wish that more — a larger part of the energy would go into thinking about the mathematics rather than fighting the technology.

This teacher was very positive towards trying out new methods in his teaching, but it was apparent from the interview data that he did not trust his students with understanding a task without getting detailed instructions. Since his students are not very different from the other participating teachers' students, it is quite likely that without the detailed instructions, the students would have had no problems in dealing with technology. Nonetheless, his reaction to whether he would change something next time was:

> Teacher M: Yes, somehow because my instructions said […] and if I think about it in retrospect […] I should maybe rather add an extra step into [the instructions].

This brings us to the third issue that I would like to address; the transition from transmission-oriented teacher to an organizer or facilitator of learning. The teacher in the group that had most experience with using technology in class said:

> Teacher L: Then there was one who said "As soon as I checked all the buttons in the browser I realized that there is one for recording" […] did you know that this was possible? [asking if the interviewer had realized this possibility].

This teacher was the only teacher who transferred the responsibility to solve possible technological issues completely to the students themselves.

> Teacher L: They found it unbelievable to have figured out by themselves how to send me a sound recording from their phone […] it was so nice to hear how anxious they were (before starting the task) "Shall we figure out the technological issues ourselves?!" "Yes, you are so clever, you can do this" Then they just "But wait a minute, aren't you going to help us?" "No, you will figure this out," then they said "That will take us the whole time (referring to the length of the lesson) just to figure out the technological issues" […] and then when they finished (and they did so well within the lesson time) it was as if they had won the Olympics or world cup or something.

What this teacher experienced is that students can also teach teachers to use technology and that this is something that ought to be welcomed in the classroom. Also, underlying was this teacher's opinion that teachers in general should trust their students to get through the struggle and in doing so give them an opportunity to experience the good feeling of having succeeded.

DISCUSSION AND CONCLUSIONS

Teachers in this study reported having constantly limited time to devote to other things than preparation for the final test. They all (separately) agreed that the reason why they reacted positively to participating and trying out a silent video task in their class was that it only required a maximum two lessons and some preparation time. They noticed that the task helped to break up their normal teaching routines. Even if all but one teacher found it rather unlikely that they would use a silent video task in their class again, still, by participating, they were given insights into that most students are fully capable of solving possible technological issues themselves. Hopefully, this can encourage them to do more experiments utilizing technology in the classroom.

It was interesting to see how all but one of the teachers expected their students to be shy about their solutions being presented in class in the follow-up lessons. Possibly their memories of their own adolescent years affected their decision. However, two of the teachers did show examples of their students' solutions in the follow-up lesson, and the respective students showed no signs of timidity because of that.

Looking into the teaching practice of the teachers participating in this study, they all focused on preparing their students for a final test; more or less using transmission-oriented teaching methods. It might be interesting to ask teachers who use other more modern teaching methods for their view of the silent video task. At least, the teacher who was using less transmission-oriented methods than the others was the only one giving the impression to intend to use silent video task again in the classroom.

NOTES

1. The silent video task used in this study can be found here: https://ggbm.at/BfRqGSKq
2. Jean-Louis Nicolet was a Swiss mathematics teacher. He made some black and white animated silent mathematics films without any text called *Animated Geometry* in the 1930's that are still used in mathematics classrooms today (Tahta, 1981).

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