

# Podcasting in School

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## **Abstract**

Podcasting is a new phenomenon in Swedish schools. This paper describes a project where the main goal is to analyze if the students' attitudes towards mathematics are affected if the mathematics is made accessible via podcasts and ipods. Teachers at eleven schools were encouraged to produce podcasts as a part of their mathematics teaching in school-year eight. The results indicate that the possibility to look at mathematics wherever and whenever you want was an important aspect for the students. We also found that the technical difficulties for the teachers were underestimated in the project, and that teachers had difficulties in finding time for the production of podcasts.

## **1. Introduction**

During the spring 2006 a pilot study was carried out (Gårdare, 2006) where a teacher together with a media pedagogue were introduced to the possibility to produce podcasts as a part of the teaching of mathematics in school year 8. Teaching mathematics is a difficult endeavour. The serious problems found in the Swedish school system connected to mathematics, for instance the large focus on rote learning, will not be avoided just by using podcasts. However, podcasts might offer opportunities to develop the teaching and address some of these problems, maybe problems related to the low interest and motivation among students.

## **2. Project description**

PIS – Podcasting In School<sup>2</sup> was a project that involved 11 schools and 22 teachers of mathematics in lower secondary school in Sweden. One class of approximately 25 students from each school participated. The teachers were equipped with laptop computers and video cameras. After a one-day initial training they were encouraged to start testing on their own, and to produce short simple video recordings (podcasts) to be published on the web. Examples of podcasts in mathematics from the pilot study were presented, but no other instructions concerning the content were offered. The idea behind the low amount of instruction to the teachers had to do with issues of scalability, that support could be hard to offer in a large-scale implementation.

Each school in the project was supposed to involve one class and two teachers. The teachers should produce podcasts with a mathematical content, and the students would be

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<sup>2</sup> The project was founded by Rektorsakademien, The Swedish National Agency for School Improvement, and Apple.

offered to look at the podcasts on a computer and on a video iPod<sup>3</sup>. In some schools other subjects than mathematics were also considered. The iPods were provided to each class for half the project time, i.e. one term with an iPod and one term without.

The research part of the project were given the following overarching question:

"Does the students' interest in learning increase when you introduce *youth culture* into the school?"

Youth culture is here represented by podcasting and ipods. The research design will look at affordances (action possibilities) and constraints (limitations) concerning podcasting in mathematics education, in connection to interest and motivation for learning.

One school in the project (here called School 11) was treated differently from the rest in that there was a close contact between the researchers (who are researchers in mathematics education) and the teachers. The ways in which the teachers produced podcasts were here developed in dialogue with the researchers. Issues concerning process goals, communication skills, problem solving and mathematical reasoning were raised to enhance the podcasts. The analysis of the data from School 11 will not be a central part of this paper, but some observations will be mentioned.

## 2.1 Research Questions

Students attitudes towards the learning of mathematics is central in many discussions of the problems found in the Swedish school. Of course it would be very interesting to be able to measure how students' performance in mathematics were affected by the use of iPods and podcasts very clearly. However, as in many other situations where a new tool or a new way of working is implemented, so many things are changing that it is as good as impossible to connect a change to a single variable. Therefore we will focus more on student attitudes to mathematics, since it is reasonable to believe that an increased student interest will result in better student performance.

The research questions we have formulated are the following:

1. How are student's attitudes towards mathematics, and the learning of mathematics, affected by the use of podcasts?
2. To what extent are the teachers producing podcasts, and what characterizes the podcasts in terms of what is presented? What are the affordances and constraints?
3. In what ways and to what extent are the students using the podcasts?  
What are the affordances and constraints?

The first question is very closely related to the overarching question. In order to reach clear answers to the first question, we need information concerning the podcasts as well as information on how the podcasts were used by both teachers and students.

It is also important to point out that this report deals with only the first half of the project, and that not all research questions will be addressed. For example, a discussion about the mathematical content of the podcasts will not be a part of this report.

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<sup>3</sup> Video iPod is registered trademark by Apple

### **3. Theoretical framework**

#### **3.1 Attitudes and motivation**

The importance of attitudes for mathematics learning is well accepted among mathematics education researchers, especially in connection with motivation (Op 't Eynde et al 2006; Han-nula 2006). Motivation is often divided into extrinsic and intrinsic motivation (e.g. Ryan & Deci, 2000). Extrinsic motivation has to do with rewards of different kinds (grades, praise from parents etc.), while intrinsic motivation is connected to the learner's curiosity and wish to learn. The use of podcasting and iPods will in this study be discussed as important for both the students' extrinsic and their intrinsic motivation.

One example of a quality in the use of podcasting that might affect the students motivation is that it gives the students the possibility to decide when, and to what extent, they are to be exposed to mathematics:

“Rather than having the teacher make all instructional decisions, offering students control over the amount and sequence of instruction, including options for review, can result in higher achievement and improve student attitudes toward learning. iPod, with its virtually limitless opportunities for playback, literally places control in students' hands.” (Pasnik, S. 2006)

This means that by giving the students control over their own learning environment, it is possible to achieve positive effects on the both extrinsic and intrinsic motivation.

In this study the iPod as a 'cool gadget' and being a part of a large project are two examples of what might effect the extrinsic motivation, and the possibilities to look at mathematics any time and new types of mathematical presentations are examples of what might effect the intrinsic motivation.

#### **3.2 Affordances and constraints**

We find the theory of affordances and constraints (Greeno, 1994) potentially helpful in the process of data analysis. In the case of the use of ICT, an affordance can be seen as a property of the particular application e.g. the use of digital media on the iPod. As such affordances are conceived as preconditions for activity and in particular for mathematical activity in the case of this project. On the other hand the affordances provided by a device or application may be seen as conditions for constraints. The existence of an affordance for some activity is not seen to imply that the intended mathematical activity will occur, although it contributes to the possibility that it will do so. The perception and motivation to engage in the activity on the part of the user becomes a key factor to consider.

Central to our thinking about what happens in a creative and constructive mathematics classroom is the notion of “activity” by which we mean personal, or group, involvement, intent and commitment that is not reflected in the usual meanings of the word in English. This draws on the socio-cultural theory arising from the work of Vygotsky who wrote about activity in general terms to describe the personal and voluntary engagement of people in context - the ways in which they subjectively perceive their needs and the possibilities of a situation and choose actions to reach personally meaningful goals. This work was built on by thinkers such as Leont'ev (1978) and Davydov and Markova (1983) who made clear distinctions between purposeful activity, conscious actions and relatively unconscious and automated operations. Operations are seen as habits and automated procedures that are carried without conscious intellectual effort. These distinctions are seen to provide a useful framework through which to analyse the central question of this evaluation related to students' motivation, readiness to engage in and attitudes towards mathematical activity.

## **4. Method**

The research questions in this study demand a variety of data collecting methods and analyses. Interviews and observations of podcasts are the main methods in relation to the research questions. In order to understand what initial knowledge and experience the participants had, questionnaires, both to students and teachers, were used.

### **4.1 Questionnaires**

At the beginning of the project questionnaires were sent out to each school, one to the students and one to the teachers. We received answers from all teachers and near all students. The questions to the students centred around four areas: questions on attitudes towards mathematics, questions about previous experience of podcasts, questions about the use of mp3-players, and questions about expectations on the project.

The questions to the teachers also concerned, apart from standard background information, four areas: questions about the participation in the project, questions about the teacher's own goals with the project, questions about the teacher's normal teaching and lessons, and questions about expectations on the project. The main use of the questionnaires was as a background for the interviews.

### **4.2 Interviews**

In May we visited eight of the eleven schools. Interviews with teachers and students were carried out at each school. All interviews were audio recorded and selected parts were transcribed. The selection was based on the existence of passages considered important for answering the research questions. The interviews were of a semi-structured format using a pre-designed scheme.

The teacher interviews ranged from 30 to 90 minutes, and in most cases one teacher from each school took part. The interview scheme concerned attitudes to mathematics and the use of the podcasts. In the section when we discussed the teacher's views on the possibilities and limitations we connected the interview question to the each teacher's answer to the corresponding question in the questionnaire.

The student interviews ranged from 15 to 30 minutes, and three or four students from each school took part. We were also very careful to explain to the students that their answers are very important for the research, and that they are one of our main sources of information.

All interviews were transcribed in a condensed form, followed by a complete transcription of important passages, i.e. passages where discussions clearly related to the research questions took place. The complete transcriptions were used in the analysis.

### **4.3 The podcasts**

We have full access to all podcasts produced in the project. After the first semester there are about 60 podcasts produced. The size of the podcasts varies from about 2 minutes up to 10 minutes. By observing the podcasts and the teachers' short comments on each podcast, we characterized them in four categories: introductions to a new area, presentations of a concept, presentations of a method, or presentations of problems. Of course, this characterisation could have been made in other ways, but by using our characterisation we cover all podcasts in the project in a sufficient way.

## 4.4 School 11

In one school the teachers in the project had recurrent meetings with the researchers in the project. Their podcasts, both content and form, were discussed in a rather systematic way. The content was related to the syllabus and process goals of the education. Questions like “what process goal do we want to address with this podcast” and “what known difficulty in mathematics learning can be focus here?” were asked. Four meetings, in addition to the meetings for all participants in the project, took place during the spring. Each meeting lasted approximately 1.5 hours and the researcher took notes.

## 5. Analysis

The find answers to the first research questions in this study, concerning how students’ attitudes towards mathematics, and motivation to learn is affected by the use of podcasts and iPods, we need information in how teachers and students have been using podcasts, i.e. the second and third research question. Therefore we will in this section first treat research questions two and three, followed by an analysis concerning the first research question.

In the analysis we have used the theory of affordances and constraints in order to find important issues that not only are interesting from the teachers’ or students’ perspective, but also indicate that it is the podcast or iPod in itself that gets attention.

### 5.1 Research question 2: Teachers and podcasts

Two issues were put forward by the teachers as central affordances in the use of iPods and podcasts. The first was the possibility for students to take part of content when they have been absent during a lesson. This was seen as one of the most important aspects. In relation to this it is not surprising that the podcasts to a large extent had the same content as classroom presentations, especially in the beginning of the project. In addition, this affordance can also become a constraint. If teachers are very convinced that this is the best way to use podcasts they may refrain from trying other types of podcasts.

The second affordance focused on by the teachers was the possibility to show out-of-school situations in order to present the setting for a problem, and also the problem itself. In some podcasts the problems were solved, in other the students were given the problem as homework. The use of podcasts to present problems was in many schools something that came after a few months of testing and trying out the technical issues in the production. It seems possible that the teachers after the initial period wanted to do something more than just copying the classroom. One might argue that presenting a problem in a podcast is no different from doing it on paper or any other media. However, some new possibilities occur, e.g. visualisations of problem situations or solutions. One example from a podcast in this study is when the concept of VAT<sup>4</sup> (25% in Sweden) is discussed and rectangular blocks are used to show that you need to remove 20% in order to get the price without VAT. All in all we must conclude that only a small number of podcasts in this study contained something that could not be done in the classroom.

One of the two constraints highlighted by all teachers was that there was too little time to plan, produce and publish the podcasts. Since few teachers in the study were compensated regarding their workload, the production of the podcasts had to take place in their free time. Most teachers had to carry out their normal assignment as well as taking part in the project, so it is not surprising that the production of podcasts declined radically for several teachers to-

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<sup>4</sup> Swedish: MOMS.

wards the end of the term. Some teachers could use the schools days for open-air activities to work with the podcasts, and some could use days specified for competence development, but on the whole, most teachers experienced the time issue as a significant problem.

The other constraint was that the teachers experienced a lot of technical difficulties, from the actual filming via the cutting and preparation of the podcasts, all the way to the final publication of the podcasts on the web. The most common problem had to do with the last part of the production, the uploading of the podcasts to the web, and the creation of an RSS-stream. Several teachers felt that they lacked a more thorough instruction concerning the last steps. In some school there were also difficulties originating in the fact that the project computers were Apple laptops (running Mac OSX), while the school (and the municipality) were Microsoft Windows environments only. The problems could for instance be that the Apple computers couldn't run Windows programs necessary to access the municipality intranet.

All teachers in the project had experienced a lot of positive feedback from students and parents concerning the project. This was regarded as important, both from a more general school perspective and for more individual reasons, like the possibility to get previously not so interested students to take part of the mathematics teaching to a larger extent.

## **5.2 Research question 3: Students and podcasts**

In general, the students who had an iPod looked almost all podcasts. There were a significant difference between the group of schools *with* iPods and the schools *without* iPods. Few students without iPods had used the podcasts at all. They were all looking forward to the day when they would get their iPods. "The day the project really will start" was an often-heard comment, both from students and from teachers in these schools. The students with iPods the first period believed that the use of the podcasts would decrease when they have to do without the iPods and only look at the podcasts in iTunes. The importance of this affordance of the iPod is not so easy to value at this stage of the project. Maybe we can know more after the second half of the project when the iPods are switched between the schools. From the interviews we also believe that many students have looked at podcasts in addition to (and not instead of) their normal amount of mathematics outside school. This would indicate that the amount of mathematics the students have met during the project is larger than normal.

The most common perceived affordance discussed by the students were that the podcasts could be used for reviewing before a test and catching up when missing a lesson. The possibility to look at the podcasts anytime, anywhere appealed to all the students. "To be able to prepare for a test on the bus" and "during the lunch break we have no access to computers in school" were two statements that highlight the view that this affordance was important.

Interesting was also that in one class the students looked at a podcast before the teacher presented the content to the class. The students found it easier to follow the presentation and the teacher claimed that he got deeper questions from the students. Of course, this possibility exists in normal teaching also; the students can read the section in the book in advance. However, this is not common student behaviour according to the teacher. This affordance of the podcasts, that they might influence the students to look at mathematics in advance, is an important finding in this study, especially if we interpret this as a motivation to engage in mathematics to a larger extent than without podcasts.

Indications of another affordance were also found. Some students and several teachers reported on positive feedback from parents who had looked at some of the podcasts. After viewing the podcasts the parents suddenly could help their child in mathematics. It would be very interesting to interview some parents concerning this issue, but that is not a part of this study.

Among many of the students in the interviews, a perceived constraint of the podcasts was found, concerning the idea of putting a whole content area into podcasts. This had been tried in one school (not in mathematics, but in geography, concerning latitude and longitude) with very good result and positive opinions from the students. However, none of the interviewed students from other schools believed it to be a good idea. “You need someone to explain the content” was a common comment.

An interesting observation concerning the students’ use of the podcasts is that most students were in agreement that it was rather easy to download the podcasts to iTunes and to the iPods. Some cases of technical difficulties were found, but nothing serious, and definitely not at all on the scale that the teachers reported concerning the production and publication of the podcasts. The students were very satisfied with the quality of the podcasts. “It’s easy to see and the sound is very good”.

### **5.3 Research question 1: Attitudes and interest in mathematics**

It seems that the use of podcasts and iPods in this project have lead to an increased amount of mathematics the students meet in their learning of mathematics. Many students said that they spend more time with mathematics due to the fact that they have iPods and have podcasts to look at. It seems reasonable that increased time with mathematics is connected to motivational aspects of the learning. In that case, it indicates that the presence of iPods and podcasts have affected the students’ attitudes and interest in mathematics.

Other reasons for the increased time with mathematics are the affordances described in Sections 5.1 and 5.2. The possibility for a student to take part of the content after missing a lesson was a central aspect according to both teachers and students. The students also mentioned some other uses of the podcasts, for instance to practice before a test and to review a specific method. These affordances were often mentioned in connection to the affordance that the students’ could look at the podcasts anywhere, e.g. on the bus or between classes.

All students we interviewed agreed that the use of iPods was a cool thing in mathematics. “Mathematics is more fun with the iPods” and “you can review in a more fun way”. They also claimed that it was more fun and stimulating to look at a podcast compared to read in the book or review ones notes. They stated that mathematics had become a more popular subject in their school thanks to the project. Whether this was because the students could learn mathematics in a better way, or because they were the only class in their school to be part of a project where they got an iPod, was a question the students couldn’t answer. Student voices concerning the content were also heard. One student was very clear on this: “If I won’t benefit from the use I will not look at the podcasts.” Similar statements, but maybe not so direct, was heard from several other students.

Concerning extrinsic and intrinsic motivation, all students agreed that the iPod is a very cool gadget that definitely leads them to spend more time on mathematics. They also stated that it is not enough with an iPod, you also need to benefit from the content. It was clear that the students to a very large extent talked about extrinsic motivation using expressions like “making the course”, “getting good grades”, “be prepared for higher studies”. They rarely talked about intrinsic motivation, even if a few students mentioned things like “mathematics is more fun”, which can be interpreted as such.

From the interviews with both the teachers and the students it seems clear that the iPod was a very important part of the project. When we compare the schools with and without iPods, there is a significant difference in the level of activity, both among the students and the teachers. This must of course be interpreted carefully. Since the iPods are considered as very

'cool gadgets' by the students, it is only natural that the students are affected and it is not necessarily so that the students' really are more interested in the learning of mathematics.

#### **5.4 School number 11**

The first podcasts produced at school 11 was similar to most other podcasts in the project in that they consisted of presentations of the same kind as in the classroom: introductions to a new area, presentations of a concept, presentations of a method, or presentations of problems.

The second group of podcasts were of a different type. Here the teachers went outdoors, interviewed people, and made things not possible in the classroom etc. The idea was now that the podcasts should be a complement to the classroom activities, not the same thing in another package. The teachers also instructed the students that it was mandatory to look at the podcasts in advance, and that they would discuss the content during the following class. Due to some practical circumstances this was not carried out fully, but the teachers are planning to use this strategy after the summer.

In one podcast the podcast consisted of a number of short interviews around large numbers and the use of prefixes. In the interviews a lot of different uses of prefixes was heard, and also some erroneous statements and concepts that are not prefixes. Here is one example of a passage:

*Interviewer:* How big is the hard disk in your computer?

*Victim:* Around... I would say... One cubic decimetre.

*Interviewer:* OK... And how much memory does it have?

*Victim:* Well, eighty gigabyte.

Here the victim uses two different prefixes and also the word "cubic". There are opportunities to discuss several aspects of the use of prefixes in everyday life starting from this short passage. Questions like "when do we use prefixes", "why do we use them" and "is 'cubic' a prefix" may trigger students interest in a way that might be different from a normal classroom situation.

### **6. Discussion**

The results from this study indicate that students' attitudes towards mathematics are affected in a positive way in this project. There are of course several possibilities for this positive effect. The students all got a 'cool gadget', they were part of a research project, their teachers (in some cases) got extra time for the teaching of mathematics and so on. However, in the interviews some other reasons were found. The possibilities to take part of the content after missing a lesson and to review the content before a test were important aspects. Especially the possibility to look at mathematics anywhere and anytime, was highlighted by the students. This is also supported by Pasnik (2006), who means that giving the students control over the learning environment (to some extent) has a possibility to increase students' motivation. One might argue that the increased interest is a temporary situation, only while the situation is new, and that it will go back to normal after some time. One thing that supports such a belief is that the main part of the positive factors the students reported had to do with extrinsic motivation. On the other hand, several students pointed out that there had to be a gain in the learning of mathematics if they would use the podcast to any extent.

There were several effects found in the study that were caused by the specific use of podcasts, and not only by the fact that the students got a device or that they were part of a research project. One example is when the students looked at a podcast before the same content was presented by the teacher in the classroom. This lead, according to both the teacher and the students, to better possibilities for the students to understand the content and to pose

more accurate and profound questions. Another example is that several teachers reported on positive feedback from parents who, after looking at some of the podcasts, experienced increased possibilities with their child's homework. However, the most prominent affordance with the podcasts concerned the use of iPods, that the students got an option to look at presentations of mathematical content whenever they wanted: in the bus, when waiting for a lesson to begin, during the lessons, at home etc.

One serious problem in the project was that many teachers experienced that they could not find enough time to produce podcasts the way they wanted. Almost all teachers raised the time issue. Of course, in a longer perspective, the production of podcasts in mathematics must be one part of the teachers' work, since we cannot assume that mathematics teachers suddenly will get more time for mathematics just because they use a new working model. One important question in a possible future use of podcasts is to find a balance between podcast production and other parts of the work as a mathematics teacher. What can be reduced and what can be made in more rational ways? What can be removed? If podcasts should be a normal part of the job as a mathematics teacher, without an increase in workload, something must change.

This paper has mainly discussed the availability of the podcasts, and the effect that student use of podcast might have on student attitudes. In the second part of the project we also want to include the quality of the podcasts. Why is one podcast interesting and another not? What is it in a podcast that catches a student and affects attitudes? Can we characterise what it is in a podcast that students find interesting?

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