eClass Notetaker

[Extended Abstract]

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ABSTRACT
Raising the student’s levels of learning and teacher’s level of teaching is always a major concern in societies. With the advances of technology, the learning and teaching methods alter and consequently so does the way students and teachers interact and behave during and after class. We decided to develop new tools for both teachers and students to have notetaking abilities using their laptops during class. The new tools that we developed were: Show’Em and Learn’It. Show’Em is the teacher application used to give class, using the slides he created, and to make direct annotations on them. Learn’It is the student application that is used during and after class. It has the uniqueness of being only browser dependent, thus, allowing for it to be used with any computer.

Show’Em and Learn’It were both used during a course in a semester and the results were satisfying. Teachers and students were both more motivated during class which positively contributed to the rising of learning in students.

1. INTRODUCTION
In a classroom there are different interactions between the students and teacher. Traditionally the teachers prepare, on paper, the content of a class, consults their notes as a guide and additionally writes on the blackboard aspects that they feels more relevant for students. Another widely used alternative to give a lecture, is to prepare a set of slides enabling at the same time, students to follow the teacher’s speech while watching the slides in a projector. In both of these scenarios, the usual way that students take notes is writing in a notebook or sheet of paper what the teacher presents on the blackboard or the slides and adds his own comments to them.

With the advance of time and consequent advance of technology, computers have become a powerful tool in the classroom [11]. There were specific tools such as Powerpoint, which replaced the traditional slides and projectors. Teachers now have a more efficient and orderly way to prepare for classes, archive and reuse their material prepared for class. Moreover, there is also a general need to increase the quality levels of communication and collaboration that exist in the classroom [15], particularly between the teacher and students and enhance the quality of tasks or activities carried out during the class [16]. These tasks can be simple, like having doubts or even a more complex interaction, like the collective response of pupils to a multiple choice question.

The points mentioned above serve as the basis of our focus. We want to benefit from the use of technology to facilitate the taking of notes by the students. By using the technology for education, pupils and teachers feel attracted by the ease and quality of learning offered, thus increasing the levels of learning and motivation of students. In this paper, we first survey the related work in the field of presentation enrichment and note taking during class and then describe the approach taken. We further describe our two prototypes: Learn’It and Show’Em (see figures 1, 1 and 1. Finally, we present the results of the tests made using both prototypes during real classes.

2. RELATED WORK
There are many efforts towards creating powerful learning tools for the task which we call learning. The transmission of knowledge within the classroom is usually done by the teacher. For this, there are many tools that support presentations using many technologies. The student has the main task of assimilating as much as possible of this knowledge, often using a simple notebook, to make important notes for
future review and consultation. We will present some of the work that was made in the enrichment of the teacher’s presentations that help them expose their teachings. We will also present work that help the students in their task of taking notes during class.

### 2.1 Presentation Enrichment

Lecturer’s Assistant [8] TMS and [12] are two tools that help in preparing and visualization of class presentations. These make the creation of slides more flexible and pleasant for them to be stored and reused in the future. Classroom Presenter [5, 4], Classroom 2000 [1, 2, 3], and Coral [14] are other tools with different features that allows classroom preparation with the use of traditional Powerpoints.

### 2.2 Presentations with Notetaking by Students

There are several tools that focus on giving the students notetaking abilities. DyKnow [6, 7] and Classroom Presenter [5, 4] allow student annotations over the teacher’s slides with many colors and ink formats to access in the future. Both systems provide an interface that allows to obtain images of the slides and synchronize them with the class in question. The students can then makes notes on the slides and everything they write will be visible only when the slide is selected.

The enrichment of the classroom with video and audio is also very important to make a lesson more motivating, enjoyable to review and follow. StuPad [20], Classroom 2000 [1, 2, 3] and iClass [10] are good references for tools that allow annotations with different types of media along with providing other features. Filochat [22], Dynomite [23] and Audio Notebook [19] are examples of tools whose only feature is to allow annotations over audio, while Marquee [21] and Notelook [9] are two tools for video annotations.

In addition to the notes taken by students and teachers, it is important that they are able to share them during a lesson. The student may share a doubt or a note to the teacher and teacher can even ask for a solution to a problem from the students. The submission of responses using digital ink or answers to multiple choice questions make the lesson more participatory and in turn more exciting and productive. In both the cases and to make the classroom more attractive, the collaboration that exists between the student and teacher should be, such that the student does not have to get up to communicate with the teacher and vice versa. This is a less common feature within the systems analyzed, but there are already some tools capable of this. Classroom Presenter [5, 4] and Ubiquitous Presenter [24] have a module, Student Submissions [17], that is only dedicated to collaboration and interaction. NoteLook [9], despite its reduced functionality, which only allows notes like a diary, has the ability to share notes with other users. Forum [13], that is dedicated to conferences, also gives importance to cooperation between their participants.

Another important feature observed in some systems is the ability to access and edit after class the notes made during class. Most of the tools studied allow you to access was captured, or by HTML or by their own tools afterwards. Classroom 2000 [1, 2, 3] and MANIC [18] are examples of tools that allow access through HTML which is a clear advantage over Classroom Presenter [5, 4], where it is necessary to have a specific client to access the information that was produced earlier. Access to the notes is of extreme importance, but being able to edit the notes previously taken is even more important. For a teacher or student it is important since they may forget something during the class and therefore have the opportunity to change or add a note to the classroom afterwards. There aren’t many systems with this capability, however there are some systems that have an editable archive. Coral [14] and are DyKnow [6, 7] are tools with great scope in this field.

### 3. APPROACH

There are some features that are important to take into account when trying to build a tool to enrich the classroom allowing annotations and collaboration among participants. Our approach is to create tools based on the following characteristics:

- Use presentations with slides and enable teachers to make notes on them.
Our approach consists in the creation of two applications, Show’Em and Learn’It. There are some attempts. The implementation of the student application is to be used through a Web browser. Show’Em will be used by the teacher and will enable loading a presentation with slides, adding video and make notes over the slides and video. Show’Em will deal with the synchronization of the lesson with each change of slide corresponding to a time in the lesson. Unlike Show’Em, Learn’It is a web application that will allow the students to follow the lesson. The student will be able to see the teacher’s notes and make his own notes. In addition, Learn’It will be used after class and to review all the notes that were taken in that class. A class video will be available along with the slides for the students to view the class with the notes they made.

4. LEARN’IT

Learn’It is the student application used for both in-class and after-class note taking. This Web browser dependent application with a client/server architecture. Learn’It was designed based on these features and can be described as a Web tool that allows students to follow a presentation, make notes and share knowledge during and after class.

4.1 During Class

We will begin by first describing the characteristics of Learn’It that are present during class. These are: student authentication, follow presentation, view teacher’s notes, take notes using digital ink, taking notes using the keyboard and permissions.

The act of taking notes is personal and in many cases we do not want to share our ideas anyone. To ensure that the student has confidence that no one else with see the notes he makes we must ensure that there is an authentication mechanism. To use Learn’It, it requires that the users are properly identified to associate all their notes to them.

Learn’It is used when the teachers gives their class using slides. It is through these slides that they transmit their knowledge to the students. With the Learn’It, students can browse slides already submitted by the teacher without ever having access to slides not yet shown. The student can even return to review any slide during the class. In addition, Learn’It also automatically changes slide without the student interfering. There is also the possibility for the students to pause the presentation because they may want to stop the presentation to write a note in a slide without the automatic slide transition.

In addition to following the teacher’s slides, Learn’It also lets you view the notes that the teacher did over the slides. This is an important feature, because this way, the students do not need to rewrite these notes since these are already available for the student to see in the future.

One of the features considered important, was the annotations of the students. With Learn’It you can write directly on the slides, associating it with the slide. This means that when the students back to that slide, that note is displayed again. Learn’It also allows the student to change the ink properties. He can change color, change to highlight or even erase a note.

Apart from the digital notes that Learn’It allows you to do, this tool also allows text notes created with the keyboard. Because any student with a computer can use Learn’It in the classroom, it is normal that there are some students without a Tablet PC or other similar technology.

In order to satisfy the students who prefer not to share their notes and those that want to share them, we created two types of notes: private and public notes. As the names indicate, private notes are viewed only by properly authenticated student, and public notes can be seen by any student. Both digital ink notes and the keyboard notes can be public or private.

4.2 After Class

Learn’It can also be used by students after the class ends. The notes they made and the teacher’s notes, can be reviewed with Learn’It after class. Furthermore you can watch a class video, navigate through the classroom slides and make extra notes on the slides and videos.

During class a video is being recorded with the teacher’s interactions and lecture. This video is the class video that is available with Learn’It after class. This allows any student that missed class or a students that wants o review the class to have access to the interactions and contents displayed during class.

Learn’It allows the student various alternatives to browse the archived class. The slides in the class were synchronized with the class video and a transition to a slide in the video is a transition to a slide in Learn’It. This synchronization allows the student to surf the class archive through the following ways:

1. Timeline: Allows students to go to a specific time of the lesson.

2. Slide Table of Contents: Allows students to browse titles of the slides and to go directly to a slide.

3. Slide Controls: Navigation buttons of the slides, allowing to go back, forward, and to the first or last slide.

Access to the student and teachers notes and editing them is one of the key features of Learn’It. The notes created by

- Allow the students to follow the lesson and make notes on the slides in the classroom.
- Make notes with audio and video.
- Allow collaboration and interaction between the teacher and students.
- Allow access and to edit the notes created after class.
- Allow students to use the system anywhere without having to worry about the installation of third (depending on only a Web browser).
- Use a standard client/server architecture.
the teacher and the student during class can be found with Learn’It after class. The notes that the students have access to depend on the type of notes that were create during class. He will have access to the teacher’s notes, their own private and public notes and also all other public notes made by all students for that class.

A completely new feature introduced by Learn’It is the ability to make annotations on the class video and on the demonstration videos. This is totally innovative and promotes a new way to enrich the learning of students. These notes are in the same way, associated with the video in question. However only digital notes are available over video.

5. SHOW’EM
Show’Em is a tool to assist the teacher during class. One of the major objectives and concerns is to make sure that this tool will not become a distraction for the teacher. Show’Em has the following characteristics: presentation configuration and control, capture slide transition, add video demonstrations to the presentations and to make notes over the slides and video.

Before starting a class presentation, the teacher needs to make some configurations. The configurations include selecting a profile, creating a new presentation and adding slides to that presentation. The profile contains the URL of the server, the server password, connected or disconnected mode and the name of the presenter. After selecting a profile, the teacher must choose between creating a new presentation or continuing an older one. To create a new presentation he will have to enter presentation information and select the create new presentation option. To continue an old presentation, the teacher must choose a presentation from the presentation list provided. The next and final step is to select the slide for this presentation. After all the slides are chosen the teacher is ready to start class.

There are many tools that control slide presentations. Show’Em also has this functionality, along with adding a second screen for the overhead projector that enables the students to view the presentation. The student may then follow the class and see the teachers notes without having a laptop. This feature does not bring anything new, but that does not make it dispensable.

During the presentation any slide transition made with Show’Em is stored with a timestamp referring to when the transition was made during that presentation. These transitions can be saved locally and remotely depending on the connection mode of the presentation. This transition capture has two purposes. The first is to allow students to follow in real time the presentation with Learn’It. The second is for the synchronization between the slides and class video, present in Learn’It after class. However Show’Em does not need Learn’It to work. All transitions and other events generated by Show’Em can be uploaded any other time after class for Learn’It to use.

Most of the presentations made by teachers only use slides. However, some teachers like to show video demonstrations illustrating some aspects of the lecture. With Show’Em the teacher can add a video to the presentation and its behavior would be very similar to the slides. The students will also see the video in the second screen along with any teacher notes made over that video.

With Show’Em, the teacher has the ability to make annotations on both the slides and on the video during class. These notes are important to highlight some aspect that teacher thinks is relevant in the slide or video. Annotations over video is one of the characteristics that distinguishes Show’Em from any other similar tool. The notes made are linked to the video and there is no need to pause the video to do so.

6. RESULTS
Learn’It and Show’Em was used during the second semester of the academic year 2007/2008 in a Computer Engineering course called Multimedia Content Production at IST-Taguspark. The evaluation was conducted over 17 classes and had a number of 24 students enrolled. There were 20 Tablet PCs randomly distributed to students. The classes were about an hour and five minutes, and there were two types of lessons: normal and invited. A normal class was given by the teacher using Show’Em and an invited class was an given by a guest lecturer in which the teacher still present, used Show’Em for the students to be able to follow the class using Learn’It.

6.1 Learn’It
The evaluation had the goal to see how much did the students use Learn’It during and after class. During class, the average number of total notes that the students made was 62.2. A note corresponds to a stroke made by a student, because it was not possible to see what strokes were part of what annotation. Another result is the fact that all students preferred to make private notes instead of public notes. The last result obtained during class is the number of slides per class that the students made any note. The results showed that, in a class, usually 7% of the slides have some notes.

After class there were 23 available classes for the students to view with Learn’It. The total number of notes that were made for those classes were 3276 and 98% of these were digital notes.

A questionnaire was done to the 24 students to know their general opinion of Learn’It. 21 of them said that it was very useful and 19 were satisfied with the experience.

6.2 Show’Em
Show’Em was used during an average time of one hour and five minutes with an average of 76.2 slides per class. The average notes made by the teacher was 233.7 during these classes. With all these results we can say that for every teacher note, 1.139 notes is made by each student. During the invited classes the teacher made more notes over the slides. This is because he was acting much like a student was. The teacher was satisfied that he was able to make notes during class and also to have the ability to introduce video.

7. CONCLUSION
There is a great desire to use new technology to perform all kinds of tasks. The use of new technology motivates users to want more and more. The first benefit we present confirms these facts. By allowing the student to make notes with digital ink in class and then be able to consult them at home very easily, and the ability to view make annotations over it, captivates the attention and desire to want to use our approach. This benefit ends up being the result of an innovative method of learning and the student’s mind is always open to accept new changes when new technologies are involved.

Another benefit in this approach is the ease of access to Learn’It. Anyone with a PC can access this application. There is no need to worry about which platform your PC runs on because the only thing you need is a Web browser. This is a great benefit, because it is not necessary to install anything or get the latest updates to work with Learn’It. Updates are transparent for the students, who can go home or wherever there is a PC available, and review the lesson with all the notes he made in that class.

By allowing to add video demonstration to the class the teacher can prepare it differently. A lecture with video becomes more interesting and more appealing for the student. Along with this benefit comes another that involves annotations over the video. After school the students can see the class with Learn’It and may also review these demonstration videos.

A final benefit comes from the fact that the teacher can give a class regardless of existing network problems. Although the students cannot use Learn’It with network problems, the teacher may continue to Show’Em, causing the class to continue and the existence of a class archive is guaranteed.

Event though our approach brings some new innovations, these still cause some limitations. The number of formats allowed by Show’Em are only two. This is a limitation because there are many video formats and are therefore restricting the types of videos added by the teacher. In addition, the size of the video is always displayed in 800x600 which can lead to a loss in quality of the image.

With Learn’It, a temporary failure of network cause the students to lose their input information made during this period. All notes made by the students are not saved and will be forever lost even when the network starts to work again.

Similarly, a student may no longer navigate through the slides during a network failure. The slides are not stored locally so any slide change needs a network access.

The two prototypes were only tested during half a semester for one course. This was not enough to establish a basis to compare results. However, we believe that our approach brings benefits for the students’ learning and with the increased use of the two tools, the classes will become more technologically motivating and interesting.

8. FUTURE WORK
The results of this dissertation lead us to point out areas where we can improve our approach and advance:

- Collaboration: Our approach allows interaction between the teacher and student, but the collaboration may be increased with the functionality to respond to questions posed by students. Student write a question they have over the slide and an indication of an existing doubt could appear in Show’Em for the teacher to answer.
- Ink Capture Technology: This approach gives a study base of the technology used to capture ink strokes. The quality of the ink is directly influenced by technology being used along with other mechanisms, such as anti-aliasing, to improve the stroke
- Writing Area: The area of the slide that is used for writing was a debated issue during class with the students. Since writing is done with a pen it is not easy to write small letters so the area of the slide becomes too small.
- Analysis of feedback in real time: With Learn’It it may be possible to get feedback from students of the quality of the slides and other details of the class. With this you can create graphics that correspond to a real-time snapshot of what is happening in class.
- Streamline/Workflow: The workflow for using Show’Em can be further simplified for the teacher to give a class and then to publish it. The preparation of the class may be more automated and thus more simplified. The idea is to make it as simple as a “walk-up-and-use” application.

9. REFERENCES


