Using Screen Capture for Teaching and Learning

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Abstract: - Video recording has been used to assist students with teaching and learning (T&L) and, in some circumstances, has been accepted as an innovative, effective tool in academic environments. Screen capture software allows the video recording of what is happening in a computer screen, often together with a narration by the teacher, so this can be naturally used for T&L. However, to be successful as a T&L tool to facilitate learning, screen-capture software needs to support a simple process to produce video segments to be used in class by the teacher to stimulate and motivate, and by the students themselves to reflect and review as necessary for their own personal learning.

In this research, we compare and contrast the features of different free screen capture software packages as per their functionality and ease of use. We propose a model for the production of T&L learning materials based on videos together with a reflection cycle, and provide exemplars of these videos first defining the desired learning outcomes, and then designing learning activities conducting to achieve them.

Key-Words: Video recording, screen capture, teaching, learning, academic, learning management system

1. Introduction

Over the last few years, the use of videos for teaching and learning has received close attention, as it has been found to improve outcomes in some circumstances [1]. For example, training videos of computer-based steps have proven to be effective to learn how software works [2] [3]. In principle, this success has been attributed to the possibilities afforded by videos to help students learn by receiving, processing, storing and retrieving information. However, research findings on the effectiveness of digital video for general learning remain inconsistent [4] [5].

This may be partly attributed to improper design of the video materials, arguably by the failure of developers to take into consideration the limitations of human cognition in their design. When developing digital video content for learning, teachers need to take into consideration the limitations of students' cognitive capacity; they need to understand that to ensure engagement and attention and foster learning videos should be designed and developed taking into account the learner's perspective. Therefore, at least initially, understanding how a video presentation may support students' learning requires a careful analysis of how this type of input is processed by the human memory.

Human memory is divided into three processing categories, namely sensory memory (SM), short-term memory (STM) and long-term memory (LTM) [6]. These memories are limited in terms of capacity and duration, and they interact by transferring information from one type of memory to the others. Information enters into the sensory memory via two different channels; a visual channel that processes visual information, and a verbal channel that processes verbal information such as narration and text [7] [8]:

- Although information entering STM is initially specific to each type of input, almost immediately close associations from LTM are activated and placed in STM. For example, a word may be presented visually, but very soon after this input associated meanings to the word, of all modalities, will be activated from LTM and placed in STM.
- Given the limitations of human memory, placing a high cognitive load on one channel has been found to reduce comprehension effectiveness. Instead, involving both channels reduces the cognitive overload in each, and makes the presentation more effective [8]. The effect is actually enhanced when the verbal and visual information are presented concurrently rather than one after the other—this is known as the *contiguity principle* [9]. In addition, placing printed words next to the animation can reduce the *split attention* effect [7]. Based on this dual coding theory, video with adequate verbal support is suggested as more effective in assisting students' cognition.
- The design of video material also needs to consider the potential cognitive overload caused by too much information being presented too quickly, and by the simultaneous appearance of moving elements, narration and on-screen texts as they may make learning more difficult [10] [8].

Due to these limitations, it has been suggested that videos may be only suitable as an additional tool to support students' understanding on certain topics—perhaps not across the entire curricula—and that their

contribution may lie in their use as supplemental material [4] [1]. According to this view, video presentations are not a universal tool to enhance learning for all students, but perhaps one component of an instructional design that addresses different students' capabilities and learning styles.

2. Teaching and Learning: What the Students Do

The discussion of the previous section focuses, however, only on the storage and recall by students of cognitive information. In this case the video/animation technology is used for the transmission of information (both visual and verbal), focusing on to what extent the student can register information, and recall it when required. As such, this is closely related to Remember and Understand, the lower levels of Bloom's Taxonomy of Cognitive Levels [11]. Usually these two levels are commonly associated with training, rather than education, for which the requirement is to attain higher levels of Bloom's (Apply, Analyse, Evaluate, Create).

Existing research indicates that the lower levels of Bloom's taxonomy are closely related to *surface learning* [12], and that to encourage *deep learning* the teacher should rather focus on what students have to do, and attempt to get them to ""think", "change", "connect" and "grow"" [13]. To this end, it has been argued that teachers should focus first on establishing learning outcomes, and then align learning activities and assessment to help students construct meaning [14] [15]. In this modality, teachers first specify the required level of understanding, and then set up a learning environment where this can be achieved. Biggs (ibid.) then posits four major steps:

- Defining the desired learning outcomes (LOs)
- Choosing teaching/learning activities conducent to achieve the LOs
- Assessing the student to determine to what extent they have achieved the LOs
- Deciding on a final grade

We argue that some of these steps are often missing when using videos in the classroom as discussed in the previous sections. The lack of effective learning using video technology may be due to the first three steps above not being carefully planned and executed. We believe that the best learning results will be obtained when the video is specific to the content being learned, and students are engaged in activities that make them active participants of the learning process. To this end, students would:

- Watch video clips to later engage them in questions to elaborate a concept, analyse a situation and make inferences.
- Analyze a video to find patterns and evaluate a case study.
- Watch phenomena to test their comprehension of, or to explore further, a concept.
- Watch a video that solves a problem, and then get them to extrapolate the solution to a new context.

This list makes it very clear that showing a video is only the first stage of the learning process. To encourage deep learning there must be learning activities related to the video by which the students are engaged in processing the material. Ideally, both learning activities and assessment related to the video should be developed and deployed, *in an aligned system of instruction* [11]. Biggs presents a view of teaching that is not focused on the transmission of facts or information, but rather on their processing by the students. The questions here are, 'what should the students be able to do to demonstrate understanding of a concept', and 'what learning activities are required for the students to achieve that understanding'.

With this approach in mind, we are proposing a reflection-based learning model as shown in Figure 1, based on a cycle of initial transmission of information (by the teacher), primary observations (guided by the teacher), reflection and experimentation (learner-focused), and finally a phase of analysis, reflection and experimentation by the learner squarely aimed at deeper learning. This cycle provides the learner with a cognitive path of increasing depth and complexity, to be able to achieve the higher levels of the taxonomy.

From the video production viewpoint, this scheme may be implemented using a standard teacher class, video and related reflecting learning activities. Given a learning objective:

3. Screen Capture Software

Screen capture software allows the recording into a video format of what is happening in a computer screen together with—if the software allows it—a narration by the recorder. As seen in the previous section, videos including visual plus audio have been successfully used by educators under certain conditions. Nonetheless, we have argued that the educational value of the video resides not only in the dynamic representations that are possible, but also in the many possibilities for observation and analysis, visualisation, prompts for discussion, relationship to problems and questions, etc. To be successful as a tool though, screen-capture software needs to provide a simple process to produce video segments that can be used in class by the teachers to stimulate and motivate, and by the students themselves to review as necessary for their own personal learning. A complex, long or cumbersome production process will discourage teachers from using the software, thus reducing the scope of applicability of the technology. In addition, students would also be able to create their own videos as a form of knowledge expression, so using an easy to use, flexible software product is paramount.

This paper compares and contrasts the features of different free software packages, including their functionality and ease of use.

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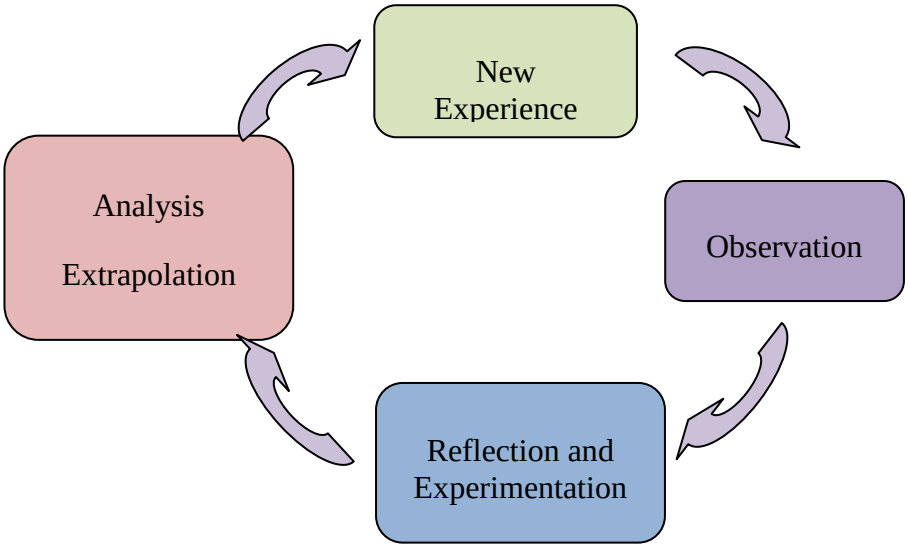

Figure 1 - Reflection-based learning model

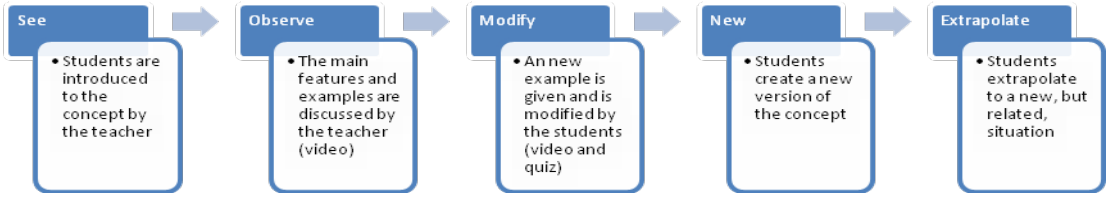

Table 1 shows some screen capture software on the column space, and their desirable characteristics on the rows:

	TinyTake 1.2.5	**Jing 2.8**	**CamStudio 2.7**
The software is easy to use	yes	yes	yes
The software is free	yes	yes	yes
Capture video directly to a hard drive	yes	yes	yes
Record videos as the standards: avi, wmv, flv, mpg, mp4, mov, swf, etc. Record audio at the same time	MP4 and audio	SWF, MP4 and audio	AVI, SWF and audio
Capture and record images: JPEG/JPG, PNG, GIF, etc	JPEG/JPG, PNG, GIF	PNG	none
Capture video from a webcam, network IP camera or video input device	Webcam	yes	PC screen
Records the entire screen, a single window or any selected portion	all	Rectangular screen	all
Responds to mouse wheel and drag commands	yes	yes	yes
Record video alone or video and audio simultaneously	both	Video only	both
Time lapse video recording		yes	
Create photo snapshots of a video		yes	
Add text captions, comments or time stamp the video	comments	yes	no
Adjust the video resolution, size and frame rate for capture		yes	yes
Work with existing image or video editor or DVD burning software	image editing and annotation tools	limited – image editor	none
Supported configurations – windows XP/Vista/7/8, MAC	Windows Vista, Windows 7, Windows XP	Windows Vista, Windows 7 & 8, Windows XP	Windows 95/NT/98/Me/2000/XP
Limitations: presentation length - limited to 5 minutes	yes	yes	no
Output to clipboard, file, and software website	yes	yes	yes

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Table 2: STUDENTS

ID	Name	Type	Department	Sex	Date Joined
S123456	Joe Bloggs	Local	Engineering	M	12/2/2013
S785694	Martin Kew	Local	Info Tech	M	21/2/2014
S093458	Inga Kelpie	International	Engineering	F	8/8/2013
S980980	Wan Tong	International	Social Work	F	9/5/2014
S354209	Nuria Bella	International	Engineering	F	10/9/2015
S098703	Mario Puzzo	Local	Info Tech	M	22/7/2014
S123408	Wendy Kile	International	Info Tech	F	28/10/2015

4. Screen Capture in a Teaching and Learning Context: An Exemplar

The example here: a tutorial should be video taped with the table 2 and the SQL queries below.

SELECT * FROM STUDENTS
SELECT Name, Type FROM STUDENTS
SELECT Type, Department FROM STUDENTS
SELECT Name FROM STUDENTS WHERE Sex = 'F'
SELECT Name, Type FROM STUDENTS WHERE Sex = 'M'
SELECT Name FROM STUDENTS
WHERE Department = 'Info Tech' AND Sex = 'F'

The OR operator should be mentioned, but no examples or detailed explanation should be given

Exercises:

Low Level:

Write down the result of the following queries:

a) SELECT Department FROM STUDENTS

b) SELECT * FROM STUDENTS WHERE Type = 'Local'

c) SELECT Name FROM STUDENTS WHERE Department = 'Info Tech'

d) SELECT Type FROM STUDENTS WHERE Sex = 'F'

Intermediate

Write queries as follows:

a)Write a query to select all students that are International and Female

b) Write a query to select all Engineering male students

c) Write a query to select all Info Tech students who are female and international

Advanced: (Remark: the OR operator has not been covered in detail in the tutorial)

Write queries as follows:

a) Select all students that are Female or Social Work students

b) Compare the result of these two queries:

SELECT Name FROM STUDENTS
WHERE Department = 'Info Tech' AND Sex = 'F'
SELECT Name FROM STUDENTS
WHERE Department = 'Info Tech' OR Sex = 'F'

c) What is the result of the following query:

SELECT Name FROM STUDENTS
WHERE Type = 'International' AND Sex = 'F'
OR Department = 'Engineering'

d) Compare the result of the following queries:

SELECT Name FROM STUDENTS
WHERE (Type = 'International' AND Sex = 'F')
OR Department = 'Engineering'
SELECT Name FROM STUDENTS
WHERE Type = 'International' AND (Sex = 'F'
OR Department = 'Engineering')

e) Compare the results of the queries in c) and d)

5. Benefits of screen capture for teaching and learning

Screen capture can have the following benefits for teaching and learning:

- Screen recording provides a convenient way to help students to learn and explore in classes or in extra-curricular.
- Capturing screen activities, lectures, interviews, and supplementary support resources can be easily disseminated to students, accessed from a range of electronic devices and viewed at a time and place that suits the student.
- Screen capture recording can support students learning by
  - providing diverse teaching techniques for learning,
  - increasing student motivation and enhancing learning experience
  - simplifying and explaining complex problems,
  - allowing students to access the learning materials as often as required,
  - allowing students to learn at their own pace, with instant playback, rewind and pause
- Screen capture recording can support teachers by
  - reducing the feeling of isolation for cloud based students, but also helps located students feel connected
  - enabling teachers to insert short snippets of interesting and relevant news that engage students in current, real-world examples,
  - providing more time for teachers to manage and guide students in subjects or units like computer course learning,
  - reusing the captured video

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Practical Implication of screen capture for teaching and learning

- Teachers and students at MIT can record demos and presentation as well including how-to create tutorials using screen capture software
- Screen capture software can automatically store and catalog in the cloud.

Conclusion

Video recording has been used to assist students with teaching and learning (T&L) and, in some circumstances, has been accepted as an innovative, effective tool in academic environments. Screen capture software allows the video recording of what is happening in a computer screen, often together with a narration by the teacher, so this can be naturally used for T&L. However, to be successful as a T&L tool to facilitate learning, screen-capture software needs to support a simple process to produce video segments to be used in class by the teacher to stimulate and motivate, and by the students themselves to reflect and review as necessary for their own personal learning.

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