Understanding the Nature of Self-Regulation Behavior of Learners Using Variable Speed Playback in Digital Video-Based Instruction

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Abstract

Scores of inexpensive products and services are on the market today that facilitate the simple creation and distribution of media-rich presentations for instruction and training purposes. The control affordances of these instructional offerings vary greatly, impacting self-regulation strategies employed by learners. This grounded theory study sought to better understand the regulatory practices of learners using variable speed playback (VSP) functionality in a media-rich accounting course. All participants employed quite effective self-monitoring and regulation strategies. VSP seemed to play an important early role in their regulatory behavior. Once the highest comfortable speeds were found, other control affordances became more dominant. The recording of Galvanic Skin Response data was piloted as an observation tool with limited success. It is hoped the study will help individual learners and instructional technologists proceed more knowledgeably when deciding how to begin using VSP functionality.

Statement of the Problem

Variable Speed Playback (VSP) functionality, or a user's ability to dynamically control the playback speed of multimedia presentations, was previously available only through specialized software or hardware. Today, however, this ability to control the playback speed of digitized audio and video is available to learners on two of the three largest media players on the market. Learners can now listen to audio/video-based instruction at their desired speed, regardless of whether the instructor, designers, or developers ever intended the materials to be accelerated. This does not inherently present a problem, but research to be discussed later in this paper does suggest that above certain speeds, comprehension dramatically falls off for most people. On the other hand, users able to moderately accelerate presentations have reported increased attentiveness and comprehension. From an instructional design and development perspective, it would be helpful to understand the motivations behind learner's use of VSP, and how learners might be using VSP to support their learning or, unwittingly inhibit it. Perhaps, one might even discover what constitutes appropriate or wise VSP use in given settings. While this study will not likely answer the latter question, it does seek to generate hypotheses on the nature of self-regulated learning (SRL) behavior of students using variable speed playback functionality in a digital video-based course.

Researcher Identity

Let me start by stating my epistemological stance (Creswell, 1998, 2003). I favor the existence of objective "reality", but also maintain a belief in the "realities" perceived and constructed both individually and socially, that to varying degrees approach objective reality. It is these constructed realities that largely define our mortal experience, the ones we deal with on a day-to-day basis, and it is these that I investigate in this study—that is, how do learners perceive, report and self-regulate their study behaviors with regard to using variable speed playback functionality, in this course. In describing the researchers role in phenomenological research, Van Manen (1997) states,

> To establish a strong relation with a certain question, phenomenon or notion, the researcher cannot afford to adopt an attitude of so-called scientific disinterestedness…To be strong in our orientation means that we will not settle for superficialities or falsities (p.33).

To be sure, I am no "disinterested" or objective observer. My interest in this topic is personal. It springs from many of my own experiences and observations that I will describe in the following paragraphs. In the spirit of full disclosure, I was the chief designer of the software used to deliver the instruction some three years prior to this study. There were no financial incentives of any kind for my pursuing this research, nor was I directly affiliated with any ongoing software or course development. Even more relevant, this study was not a formative evaluation of the courseware, nor a summative effectiveness study; Instead, it hoped to focus on learner processes by looking at usage patterns, self-monitoring abilities and regulating practices/strategies of learners. While the participants may not have been affected by my having created their course materials—because this was not disclosed, this is not to say that the research as a whole is unaffected. As researcher, I found it difficult at times to stay out of the usability testing mode, and remain focused on my primary research question. My focus, unlike in previous studies, and on other projects, was no longer looking for ways to improve the product or software, but rather to understand the learner. The differences remain subtle, and I reflected on them in a journal entry as I traveled home from gathering my data:

> I wish I knew then about qual[itative] research, what I know now. It would've been so helpful…I guess while every tester should be a qual researcher, it may not go the other way around. I was worried that I might keep slipping into product eval[uation] mode, because it seems so close to what I've been doing the last few days…As long as I mentally focused more on the study questions (SRL) and the learner as I asked my questions, I was ok, and not thinking ahead about the programming necessitated to fix what they were complaining about…Both that looking forward[to future software updates] and looking back[at what we'd developed] were hard to avoid due to my previous intimate involvement with the project.

Description of the Problem

I have long held that instruction can be both inhibited and promoted with the use of technology. Some of this is due to features of the technology itself, with other variables being dependant on the learner. That is, people's perceptions and attitudes towards technology can be equally inhibiting or facilitative to learning. In this semester-length accounting course, my participants were not required to come to class on a regular basis. They are provided with multimedia instructional materials on six CDROMs or one DVDROM. A course schedule, including regular online quizzes, exists to help students manage their time, but by and large, students are expected to "personally activate and sustain behaviors, cognitions, and affects, which are systematically oriented toward the attainment of learning goals" (Schunk, 2004 p.355). According to Schunk, this is the process of self-regulated learning.

One technological innovation that I have worked with in the last few years is, Variable Speed Playback (VSP) as applied to video-centric, multimedia presentations for instruction and learning. Today's VSP technology allows one to speed up and slow down audio and video presentations without pitch distortions. It has recently experienced a resurgence in both availability and popularity and is included now by default in Microsoft's Windows Media Player in Windows XP.

In my five years as a professional non-linear video editor I learned the value of being able to swiftly navigate and view--"speed read"--vast amounts of media at high speeds while still being able to comprehend the content. In my later years as an instructional media designer/developer I built VSP functionality into a video-centric hypermedia course allowing students to dynamically control the playback rate or speed at which the instructional presentations (audio, video, graphics and

animation) played. It is important to note that prior to introducing VSP to the multimedia course, student surveys indicated quite positive attitudes toward the course. The single biggest frustration, however, was that the professor spoke too slowly, and repeated himself too often. I recall some students directly asking--pleading--for a way to speed him up. As the courseware developers, I and my team were personally all too aware of the student's sentiment. We had just spent months videotaping, digitizing, editing, programming, testing, and revising the course materials and knew first hand of what they spoke! A solution to accelerate the hypermedia lectures was identified and integrated midway through the second semester that the multimedia course was offered. Course feedback and positive ratings skyrocketed that semester—we were on to something, but were not sure what. We had struck something valuable, but did not understand its properties nor its effects.

As the designer, I was very pleased that since introducing VSP functionality, student frustration levels had subsided, and I hoped now that motivation and comprehension might also increase, and that students would use acceleration responsibly. I feared, however, that the positive response might have been simply due to the fact that they could "whip" through the material faster than before. I was left with questions as to when, where, how and why students might use VSP technologies to support their learning. In an earlier survey study following the integration of VSP into the accounting course (Galbraith & Spencer, 2001), students reported regularly accelerating through instructional presentations up to 2.5 times (2.5x) the normal playback speed over the course of a semester. At the same time, a few students choose to use no, or very little, acceleration. Their self-reported motivations for speeding through the material varied widely from the individual's familiarity with the content, to needing to catch a bus. In light of this information, and the rather high average speed reportedly used by students, I was concerned about whether students were sufficiently capable of self-monitoring and regulating their use of VSP to support their learning. Was the allure of "getting through" the material at a faster rate--even at the expense of learning--just too enticing? How was this tool being used, and what were students' perceptions of its utility?

All the literature I had come across on accelerated audio focused primarily on listener comprehension of accelerated speech, or the effectiveness of various speech compression algorithms, but not the usage patterns--and certainly not couched in the context of self-regulated learning. I found one usability study published by Microsoft that evaluated such technology in a modified version of their media player, then called "Netshow" (Omoigui, He, Gupta, Grudin, & Sanocki, 1999). Like other studies, it did not assess learner intent and motivation--why users were motivated to adjust speeds? but it did record and report on how their viewers interacted with 5 video samples that varied in content and duration, over the period of a couple days of viewing.

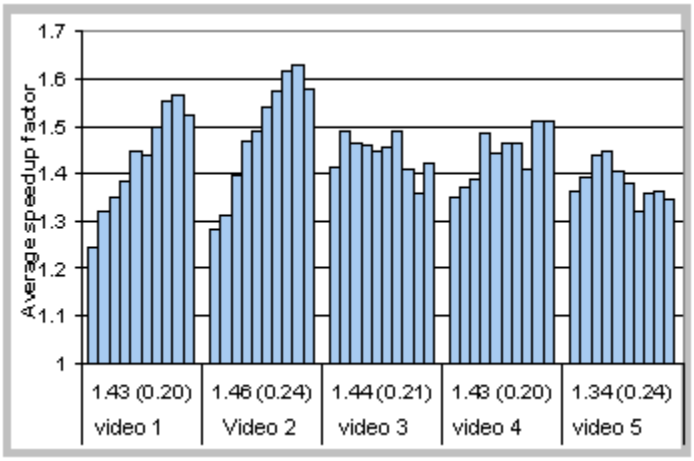

Figure 1--Chart from Orr et al. study (1999)

Figure 1 shows how the researchers tracked average speeds of users for every 10% segment of the video. Of their observations, they noted, "…we clearly see that the subjects are watching them faster as they get deeper into the video. There is some slowdown right at the end, an area that corresponds to the concluding remarks" (Omoigui et al., 1999, p.5). I was generally impressed with their study and with the detailed observation data they were able to collect, but it was the last line about an implied, but not corroborated, connection between viewing habits and concluding or summary remarks that really stood out to me. During another project's usability testing, a sight-impaired student came and tested one of our online courses using a popular screen reader software employed by many blind students on campus to read web pages and other online documents. He revealed how

blind students--according to him--employ similar “reading” techniques to accomplished speed readers. From a selection of synthetic computer voices, their software reads screen text at very rapid rates (up to 10x times normal speed), and they rarely read entire passages or texts. He had learned “by necessity” to skim texts, jumping to the beginnings and ends of paragraphs to get the gist of what authors were saying—often disregarding the whole middle sections of paragraphs. The tools he used facilitated this behavior.

I was intrigued by his account and demonstration on how blind learners commonly navigated text on computer screens and self-regulated or modified their navigation behavior based on comprehension. Because screen readers can navigate text non-linearly, convert text to audio, and play the audio at a very rapid pace, I saw many correlations to the accounting hypermedia course used in this study. Incidentally, and contrary to my expectations, this individual was not at all impressed with the control affordances of our accounting courseware. While it did not require reading a textbook and allowed him instead to hear an instructor’s voice, and it did allow for acceleration, and non-linear random access, it did not, in his view, facilitate the easy navigation, or jumping from the beginnings to ends of the instructor’s spoken paragraphs that his screen reading software did with text. It was a humbling moment (or week?) for this designer to discover he had missed a small but important audience he was hoping to have served.

To understand how sighted students were using the courseware, I knew that I wanted similar kinds of data to the Microsoft study. It would help us understand first *how*—and only thereafter, *why* users were interacting with course features the way they did (specifically VSP functionality). Moreover, as the instructional designer, I desired to understand how conscious they were of their motivations and usage patterns, and what they did with that awareness. This study aimed at exploring these questions.

It is important to note that VSP use is not an isolated event. The slider control that is used to adjust acceleration is integrated into an interface which includes numerous other ways to control the media. Other controls include play, stop, pause, “jump back 10 seconds” buttons, and a detailed

index or “table of contents” hyperlinked to various portions of the media.(See appendix E) These other controls are important, because they play a facilitative role in how students use VSP. For example I often observed students clicking the “jump back 10 seconds” button. During interviews they discussed using this button frequently if they were momentarily distracted by a room mate or a non-course related thought. Because they proceeded swiftly through the material, the “jump back 10” button was often used in tandem with acceleration. There were other less relevant course features like a calculator and glossary that will not be discussed here.

Thick, descriptive answers to the self-regulation behavior questions of this study, are critical for instructional designers and technologists designing video-centric course materials. They are not easily obtained through the surveys, and focus groups commonly used for gathering feedback in instructional development contexts. These methods usually fail to describe self-regulated learning behavior and usage patterns adequately.

In 1971, Gilbert Ryle first introduced the notion of thick description as a means of differentiating between what is really happening when the same action occurs under different circumstances. I too was interested in trying to understand processes behind similar observable outward behaviors. Are there different motivations behind similar actions? (i.e. the act of accelerating a presentation). Clifford Geertz (1973) extended Ryles notion by emphasizing the importance of understanding intent and meaning behind the culture’s signs and that descriptions are always multilayered. Ricki Goldman-Segall (1998) suggests additional descriptive layers in adding the affordances of digital media. In digital form, her thick descriptions integrated fieldnotes, video, audio, text, documents, images, and perhaps most importantly, participant-generated points of viewing—their comments, annotations, constructions and reflections on the researcher.

Our whole body is a learning system, and our physical bodies are believed to both reflect and influence our behavior, our feelings and thoughts by way of more “covert” processes (neural, cognitive, autonomic and affective). My courseware design and development experience in higher education has illustrated to me how few college learners are skilled at self-monitoring, and how

unaccustomed they are to “think aloud” activities, and to analyzing their highly routinized behaviors and learning strategies for researchers. Thus, additional methods of gathering data--observing--are required--methods that help learners be more self-aware and better equipped to describe and critique the instructional products they use, such as VSP. This qualitative study employed a combination of research techniques to help participants more fully reflect on their VSP use experiences in relation to their learning.

Through my graduate studies I have gained a greater appreciation for the notion that not all learning and behavior is conscious. The exploratory use of Galvanic Skin Response (GSR) data in this study as a form of observation data was perhaps uncommon but not unprecedented in either educational or qualitative studies (see Clariana, 1990, 1992). Qualitative research in nursing and care-giving has long valued quantitative data such as heart rate, blood pressure and blood sugar in service of better understanding their patients and the quality of their health. In this study, the quantitative GSR data was to also serve the qualitative process by providing talking points during the interviews. For the researcher, GSR observations can be made of more covert, automatic and fleeting processes in the learner. For the learner, the GSR data was to help promote deeper reflection and self-monitoring. During interviews, it was hoped that a joint review of learner GSR data might trigger new awareness, or memory of previously subtle or forgotten thoughts and feelings regarding the participant’s regulatory habits vis-à-vis the interface and the content. It was to act as a form of member check or triangulation.

The ability to self-monitor and report one’s attentiveness and level of activation is a characteristic of a self-regulating learner. As early as 1907, Carl Jung claimed that “verbal responses do not tell all” and that electrodermal activity, such as GSR “revealed the secrets of mental life” (Stern et al, 2001 p. 206). Some research suggests that subjective reports of arousal, stress or anxiety seldom correspond with physiological measures (Glynn, Christenfeld & Gerin, 1999). Admittedly, GSR is anything but clearly interpreted. Nevertheless, it has had a relatively long, stable history and is a good measure of emotional response and some cognitive processes—more specifically, attention,

arousal, anxiety and stress levels (Stern et al, 2001; Clariana, 1990,1992; Reeves et al., 1989; Schwartz & Shapiro, 1973). As GSR is reflective of a host of physiological and emotional conditions the data alone is not useful to this study. Thus only in combining the data with my observations and subsequent collaborative interpretation with my participants, could the data be made useful and relevant. Unfortunately, although good GSR data was collected, being able to bring that data into the interview with participants, in conjunction with video from the observations, proved to be unwieldy and impractical given the technology and time available to me in this study, and was therefore dropped early in the data collection process.

Gaining Access

The participants in this study came from a large and fairly unique introductory accounting course (Accounting 200) at Brigham Young University (BYU). I arranged access to the students through the instructor, with whom I had worked closely in the past to develop instructional tools. Importantly, the video-centric course employed the Variable Speed Playback (VSP) technology, which made it an ideal setting for my study. By way of reminder, unlike many large 200 level college courses, this course does not meet regularly in a classroom. Instead students study course materials on their own presented in the form of interactive multimedia lectures. The mode of instruction arguably requires a good deal more self-regulation than traditional face to face classes.

Applications to IRB offices at both BYU (study site) and Penn State (my location) were required to help ensure the rights and safety of research study participants before gaining access to the site. The site was undeniably selected, but not wholly, because of existing trustful relationships with the instructor. In the future, I would likely explore similar questions with students in other contexts using other tools, but for the time being, I was delighted with the opportunity to more deeply understanding this context. Perhaps noteworthy, I chose not to disclose to students that I had been the designer of the software they were using. This was a conscious decision on my part because I did not want that information to unduly influence their conversations with me. I believe that most

student simply perceived me as I had been introduced to them—a former alumnus of BYU, currently pursuing a Ph.D. at Penn State, now at the BYU campus to conduct a research study.

Participants

Eleven participants were selected from among a host of volunteers. Volunteers responded to either an announcement made in class by their instructor, or to the same announcement posted on their course website. In volunteering, they were to indicate the following through email. 1) when they generally studied-what days, what time, what environment? and 2) How often they adjusted speed controls (hardly ever, sometimes, a lot). I quickly received over 100 volunteers, and knew I could only ever deal with up to 10 participants. I removed my announcement from the website confident that my research questions could be adequately addressed from those who had already volunteered. I set about building a participant pool by contacting volunteers to gauge how my research topic aligned with the potential participant's experience (Seidman, 1998). Generally, I attempted to get a variety of cases that would likely generate, to the fullest extent, as many diverse properties of the categories as possible (Glaser & Strauss, 1967 p.49).

As I was dealing with limited time, I was not able to arrange all my participants in this fashion. When I had "down time" between scheduled observation/interviews, I ended up "trolling" the computer labs on campus for prospective participants. As the course enrolls over 1,200 students each semester, finding students in this manner presented no significant challenge. At any given time of day, the large labs I visited had at least two-six people working on the accounting course.

The final result with regard to study participants was

- Observations and interviews with ten students
- Interviews (no observations) with one student and two accounting lab TAs,
- Numerous ad hoc discussions (no formal observations) with accounting students in various campus computer labs.

As an interesting side note, on March 31st I wrote this in my journal:

> Today (3/31/04) one Acc lab TA I talked to mentioned that I should contact evening TAs as it is they who deal with students who may have procrastinated trying to prepare for and take quizzes that are due by midnight (every Tuesday and Thursday night). Interestingly, it is those very students who might not have time to talk to me, and they would be an interesting group to include. I did not seek out people who were early birds, but sure seem to have found people that were staying well ahead of the game with the exception of only one I think.

As I noted in my journal, there was a group of students--procrastinators? whom I did not talk to who might have been struggling with self-regulatory practices and whose perspective would certainly have added to this story. Ecological validity was important for me. That is, it was important for me to observe participants in the environments that they commonly used to study. Of the student participants, one observation/interview took place in an apartment (student's bedroom), one in a parent's home (student's bedroom), one at the individual's office (during working hours), three in various general campus computer labs and five in the accounting computer lab. In my journal, I recorded some of my thoughts on three of my participants whose names I have changed.

> Dave was an interesting find. I overheard that he was an accounting major, and was surprised because of the amount of questions he asked of the acc TAs in the lab. He also seemed to be struggling with simple concepts. It was later when I approached him that I learned he was an accounting major. I also observed that he was viewing materials at 1.2 and 1.5x [comparatively slow]. Again, surprising since he was a major and should be getting this stuff. While speed use is no race, I was surprised to see a major proceeding so slowly and deliberately. It is good to see a tool that is so flexible, and can accommodate many different types of learners and their self-regulation practices.
>
> Chris was also of particular interest to me. Chris is a handsome trendy looking young man. I had run into his father on campus, an old casual acquaintance of mine. His father told me of how Chris was taking the class for the second time and that Chris was diagnosed as having ADD--but was currently not taking any medication. Since failing is so hard to do in this class, [in my opinion] and since his ADD would be an interesting case in relation to self-regulation, I was interested in his story and arranged to observe and interview him at his home the next day.
>
> Troy was anxious to talk to me. In response to my recruitment email, he said he had opinions on the course, and had taken many distance education and technology courses. I thought his perspective might be an interesting… for one, simply because he seemed so anxious to talk to me! I expected to get an earful!, and not necessarily about the topic of my research. Troy was a 40+- year old professional considering an executive MBA program. He seemed eager to continue his education, perhaps to secure a more stable life. Because I had followed a career path similar to his, and sought some stability for my family, perhaps I am projecting my rationale onto him. We'll see.

These were all interesting people to say the least, and I wish I had captured my thoughts and initial impressions on the others as well. I don't get the sense that these are extreme cases, but that everyone in the class--all 1,200 of them probably has equally interesting backgrounds and stories that bring them to this course. I felt extremely privileged to be let into these participants minds and their study time.

Collecting Data

While this is a Grounded Theory study, data collection on self-monitoring and self-regulation as well as on software usage habits is at its core, a largely phenomenological process--getting at the lived experience of learners involved in certain activities (Van Manen, 2001). The study's "grounded theory-ness" comes more from data analysis processes than from its data collection processes. In order to understand those lived experiences more fully, participant observation (Laurier, 2003) in the field was a must, as it is in many qualitative research studies. Participant interviews would of course also be necessary and Seidman (1998) suggests a "three interview series" (p.11) for such data gathering processes. 1) a focused life history, 2) the details of the experience, and 3) reflection on the meaning. Furthermore, he makes stipulations on interview durations (90 mins.), spacing (3-7 days) and on adhering to the sequence and structure of the interview series.

Despite the admonition to use distinct interviews, I combined interviews 1 and 2 due to time constraints and have thereby arguably reduced a potential source of richness in my study. The result is hoped to be minimal. As mentioned, data was collected through three main activities: 1) Direct observation, 2) post-observation interviews and 3) physiological measurements (GSR). During the participant observation periods, I took notes on the environment-the space—the individuals, and of course their regulatory behaviors while interacting with the lesson materials. To these latter observations, I also wrote down the time of the observed activity. I generally sat beside and behind participants as they worked on the computers. I was aware that they were aware of my presence, and accordingly tried to avoid distracting behaviors like obvious note taking and large body movements.

This awareness was supported by the GSR data. In one of a handful of such instances, I inadvertently dropped my pen. As I leaned forward to pick it up, I noted the time in my observation log. Later when viewing the GSR data, an obvious spike was evident at that moment, and the participant confirmed being distracted by my actions at that time. While I had no delusions about being a fly on the wall, I did not intentionally try to be obtrusive. In an attempt to be reflexive (Rossman and Rallis, 2003), I chose to directly discuss my presence with participants during the interviews.

Speaking to my role as researcher/observer, Laurier (2003) would suggest that my intimate experience with the course and tools used by participants could be considered a strength. I certainly feel that this was the case. For example, I was aware of the multiple ways to repeat a lesson section. I therefore found the idiosyncratic ways participants went about repeating sections interesting and of possible importance—I was able to discern nuances that would go perhaps unnoticed by a less vested observer. I avoided the temptation to make assumptions or "read meaning" into observed behaviors by discussing them with participants during interviews. I had also planned on videotaping all observations for more careful coding and analysis, but after reviewing the first three videotapes, I realized the futility of that effort. There was simply insufficient observable activity to merit videotaping in my judgment. Anything that needed to be observed was easily noted along with a timestamps in my observation log (See appendix D for a sample log). In addition, using the video during interviews to refer to particular participant on-screen activities, proved to be logistically awkward and slow—and was therefore discontinued.

Similarly, my plan for using the GSR data also ended up deviating from the original plan. The GSR capture device was a small, lightweight, wireless armband worn on the upper arm. Physiological data (GSR) was recorded and graphed on a laptop computer present at the interviews. During interviews, the data was downloaded from the armband and displayed on the screen along a timeline. By way of "eyeballing" it, I suspect some 95% of events accounted for in my observation logs, also appeared on the GSR graph. There were however some instances on the GSR timeline for which I had no time-stamped observations in my notes. I also had no clear way to precisely (within

milliseconds) tie observed GSR events to specific observed behaviors. That is, GSR events and those observed in my notes occurred simultaneously—as far as my relatively unsophisticated method of timing could tell. What this meant was that I could not use the GSR data to infer motivation for any observed self-regulation behavior. Of course, any such inferences would have been subject to participant corroboration. In any case, this aspect of the study needs additional work, but still holds promise in my mind.

I felt the interviews went much better once I stopped taking notes. I was able to listen and feel secure that my recorder was picking up the interview. I stopped my note-taking after the second interview and found I was able to listen better during the rest of the interviews and was better able to focus my attention on my participants when I trusted my digital recorder to capture their comments for later analysis. I could still not avoid glancing down every now and then to make sure the recorder was still working and that the batteries hadn't run out.

The only things I really wrote down anymore were any additional questions that came to me during observations and the interviews.

Observations and interviews took quite a while, on average about 90-100 minutes. The time felt about right. After about 40 minutes, observations weren't yielding anything new, and interviews seemed to saturate at around 50 minutes. Some observations were a bit shorter due to students finishing their assigned lessons. Certainly more could be discussed, but out of respect for the time of the participants I ended the interviews and asked if I might contact them again with follow-up questions to which they all agreed.

Document analysis was fairly minimal in the course. It seemed that analysis of test scores was not likely to reveal anything too insightful, and furthermore that it might overshadow other more nuanced findings. Some of my participants took their quiz right after our observation period. Upon submitting their quiz, scores were immediately posted on the screen, including those from all previous quizzes and exams. No one objected to me seeing their exam scores, and in some cases I asked a question or two about them. I asked a couple participants to look at their scores over the

semester, and see if they could make any correlation between the scores they were getting and their study habits or speed use. Answers revealed a variety of reasons for particularly low scores and they usually reflected simply not having enough time that particular day or week to view the course materials. Other document analysis included a brief review of the student's notebooks. Student notebooks, purchased through the bookstore, included key frames from the graphics and animations presented with the video lessons. There were six frames per page with three blank ruled lines beneath each image for notes, much like the "handouts" page in Microsoft's PowerPoint (See appendix C).

I was curious as to how and whether they were taking notes. Here too, within my participants, there was great variety. Some took heavy notes in and around the key slides, most marked up the notes moderately circling key terms, underlining sections, adding their own thoughts, while one made nary a mark on his pages. Interestingly, despite the differences in note-taking, all participants had the notes open and in front of them while viewing the multimedia lectures, and only two of them appeared to stop the presentations now and then expressly for the purpose of note taking. It is unclear what relevance the note-taking has to self-regulated learning and VSP usage at this point of analysis, but at the time it seemed like an important facet of the experience to capture.

Findings

As mentioned, the qualitative grounded theory approach looked to be an appropriate method to explore the nature of student VSP use and self-regulation behaviors. It was a way to help the implicit emerge and become explicit; a way to generate theory or make hypotheses from social research data that is systematically obtained and analyzed (Glaser & Strauss, 1967). In this section, I will begin to describe what appears to be emerging from the data--a preliminary description of some major themes found in the interviews. It is not, however, reflective of the more thorough data analysis processes included in open, axial, and selective coding recommended for such a study by Strauss & Corbin (1998).

Students in general appeared to be quite good at self-monitoring—and quite deliberate about how they used VSP. Controlling the speed seemed to play an important early role in their regulatory behavior of all the participants. But, once comfortable speeds were identified fewer speed adjustments were made within lessons and other control affordances such as repetition, became more dominant. They did not adjust very often,(not dynamically) and chose instead to repeat sections rather than slow down. I wondered out loud with one participant if perhaps an acceleration foot pedal might be a nice device to have for speed control—sewing machine like. Would such a device encourage more dynamic and frequent use of VSP? The worst case scenario for use of VSP controls dictated that one participant set aside their notes from off their lap, lean physically forward, clear a space on the desk for the notes, put their pen down, grab the mouse, navigate to the VSP controls and then make an adjustment. It was not an easy and natural task, yet most participants situated themselves such that regulating playback speed in relation to their comprehension, took far less effort.

Another recurring theme was regarding attentiveness and concentration. "Speeding up helps me stay focused and keeps my attention better than normal speed" said Susie. "It saves time" said one participant.

> "I mean the quicker I can get through the lesson the better. But I also want to understand it, you know. At first when I started doing it, I started at normal speed but that just drove me nuts because it just seemed so slow. So then I put it on double speed and that worked good for a while and then it just seemed like it was too slow too, so I sped up to about 2.2 and that seemed to work out good. Also, like, it forces me to focus and to concentrate be cause it's going so fast that if I don't--like if I doze off or something I'll miss so much. Whereas if it's just on normal speed, it's kind of monotonous, it's easy to not focus your thoughts, so I think it does kind of help you to focus when its going faster.

Repeating (replaying) phrases became a more dominant way of regulating comprehension, but this still all occurred at higher than normal (1x) speeds. Jack mused that he expected his mind wandered less at higher speeds and that it actually reduced the number of times he'd have to rewind and repeat phrases or thoughts. This sentiment seemed universally held although a couple did relate

equal mind wandering when viewing too fast. Both points are borne out in the literature. (See Harrigan 1995, 2000; Gutenko, 1995; and King & Behnke, 1989 for a discussion on these issues.) In either case, when participants felt they missed particular content, they chose more often to repeat a few lines rather than adjust speed. This of course, does not shed light on the speed adjustments that did occur. Two of my three female participants, Laura and Trisha, adjusted speed a couple different times during the lesson for related reasons. Laura started out her lesson in the accounting lab by setting her speed at 2.0x (2 times normal speed –or double speed).

Figure 2--Accounting lab where 5 of 11 participants were observed

After about a minute, she released the mouse and sat back in her seat, listening with her course packet notes (see appendix C) open in front of her. She jotted down notes now and then, seemingly following along with the lectures. After about six minutes she leans forward and increased her speed to 2.1x, and sits back to view and write again. In about another eight minutes she slowed down the presentation noticeably to 1.7 times normal speed for about 1 minute, after which she accelerated back up to 1.9x. Never did she stop or replay sections. When asked what motivated her to slow down the audio, she said that the content was complicated, and she wasn't getting it—so she slowed down. Her lack of distraction was especially noteworthy to me since at one point the lab TA approached me and attempted persistently to engage me in conversation about what I was doing. I tried without success for what seemed like minutes to communicate that I was busy and didn't want

to chat. In interviews Laura recalled the distraction, but ignored it. Laura and I were both wearing headphones. It's an interesting idea that the use of headphones by all the participants, except those studying their materials at home, helped them manage and regulate their attention. Participants never said as much, but common sense would suggest it did help them concentrate and minimize distractions particularly in noisy lab setting like the accounting lab where TAs consulted with students and study groups met regularly and talked out loud (see figure 2).

Trisha also started her lesson out at 2.0x. She yawned repeatedly during the lessons. After one big yawn, she reached over and tried unsuccessfully to accelerate the presentation above 2.0x, but the control was maxed out. I chuckled inside. Since I was listening simultaneously with her, I knew what she was going through. Having not even had the background of this lesson, I understood the material and was ready to pick up the pace and wished (as did she apparently) that the presentation could have been accelerated at that point. Her particular computer configuration did not allow higher speeds than 2.0x. Rather than skip ahead and risk missing something, Trisha relied strictly on VSP and acceleration to pick up the pace. When she ran into a more challenging section, she, like Laura slowed down to 1.8x for about 4 minutes. Her "slow" period in contrast to Laura, was interrupted with numerous short section replayings—of course still at the relatively high speed of 1.8x.

Todd employed VSP in a unique way. He chooses to not adjust speeds during lessons sometimes even during the boring parts, instructor stories, or content he's familiar with. "During slow times, I'll get up and get some other things done…make me a sandwich and stuff." He said. "I like to keep the sound running so I don't miss stuff, but can still get other things done until I get to new material, and then I come back." He even described slowing lessons down a bit further, so he could get more other tasks done at the same time.

When I posed the question about what got in the way of her learning in this course, Laura stated emphatically "The instructor's examples! I think he waaaay over-explains things, way! And it bugs me cuz I still have to go through it." She also felt the need to accelerate through materials rather than skip ahead. This fear of skipping ahead is probably related to the medium of video. Video

cannot be skimmed in the same way or as efficiently as text. The use of VSP to accelerate presentations, as described by our blind evaluator, acts as a speed-reading tactic for learners.

Overall, course control affordances seem to facilitate SRL (see appendix B for a list of controls available to the learner). All my participants were ahead of schedule in their course, rather than procrastinating. They hadn't painted themselves into a corner—forcing themselves to go faster than they should have, just to meet course deadlines--although remember that a TA had mentioned that some class members did fall prey to that scenario. Students loved the flexibility of the course. Its asynchronous nature helped them manage their study time both in this class as well as in their other, less flexible, classes. Jack's words represent the feelings of all the participants in this regard:

> I like being able to do it on my own time. I'm able to listen to the cds and what not, and also you can get ahead. You can kinda plan your weeks out...If you have a lot of homework in your other classes one week, you can look ahead—and get ahead in the accounting lessons, and if that week gets too hectic for ya, you don't have to worry about it.

An interesting aspect of student's self-regulation is that despite their limited time, participants will wind up viewing far more material than they ever would have received in the face-to-face class. They choose to view everything. They view all the remedial lessons, and helps that were designed for struggling students. Most participants believed that because accelerated, they must be saving time. There were approximately 25 hours of additional instruction recorded for this course above and beyond what a student would have encountered in the face-to face version of the course. This fact, combined with the amount of replayed segments that I observed, was not likely compensated for by student acceleration rates.

The course quiz structure is not conducive to self-regulated learning, making it difficult to be learning for the right reasons. Perhaps out of necessity in such a large class, scores, and not qualitative feedback are continually being fed to students, instead of qualitative forms of feedback that might prompt deeper self-reflection (Corno & Randi, 1999). Yet, here too, students seem to be taking responsibility for their learning and not just studying to perform well on the quizzes. Elliott & Dweck (1988) found in a study with 5th graders that when children using performance goals (i.e. must

score high on quiz), failure and challenges are more likely to provoke a helpless response. But when children were instead focused on learning goals, failure and challenges were more likely to "provoke continued effort" (p.17). It would appear that in learning environments such as this multimedia accounting course, students that scored low seemed to feel like they just needed to study harder, slow the video down or study more effectively. One TA spoke to this issue when he described helping people in the accounting lab. "A lot of students will come to me and say, 'hey I didn't get any of this." And I'll ask, 'what speed did you watch it at?' The majority of the time they listened to it at an accelerated pace, so I usually tell them to go back and listen to it again, slower."

Rather than blame their intelligence, abilities or the teacher—the course seems to be structured to support self-regulatory practices and encourages students to take responsibility for both their learning as well as for the study strategies they employ. This is perhaps due to the "independent study" nature of the course and the levels of user control built into the course interface. As the designer of the technological aspects of the course (media and interface, but not pacing, assignments, course schedule or syllabus) it was my intent to build in a great deal of flexibility into a medium (video) not commonly known for its user-control affordances.

Conclusions

Additional research is needed to explore the relationship between control affordances and self-regulated learning. It is clear that SRL cannot occur without a certain level of learner autonomy and control. This course, as it is implemented, appears to provide learners with sufficient controls, allowing them to develop and exercise a variety of self-regulation behaviors. Of the available controls, variable speed playback appears to play a central regulatory role with these learners in this multimedia accounting course. VSP is pervasive in so many of the participant's SRL strategies, coloring the way they view and interact with their course materials. It's influence even carries over into their traditional lecture courses where some lamented not having the ability to accelerate all their university instructors in like manner.

Reflections

First I feel the need to defend what I've created here. The process of doing this paper, specifically letting the emic perspective (Rossman & Rallis, 2003) show through has been short circuited. I don't feel, I have done my participants or the data any sort of justice yet when it comes to data analysis. Now that that is off my chest, I can continue.

I feel I've incorporated many of my reflections already in the paper, but some other points stand out that are not appropriate for inclusion in the paper that I will mention here. Firstly, qualitative research is fun! I think I say this because it appears to be much more meaningful and human to me, and not because its mechanics are all that much more fun than other ways of conducting research. I thoroughly enjoyed my interviews despite the long hours, and was excited every day to get out and talk to more people.

I have only begun really listening to my interviews, and practice-coding one interview. The procedures are obviously new to me, and I still feel quite lost. Some of the themes presented in the paper may not be as emergent as I think, and felt quite forced for the purposes of the assignment. I was even uncomfortable trying to come up with them for fear that they would stick too strongly in my mind before I knew how they really reflected the data. It's funny how strongly I think I am (mankind is?) driven to find answers. It takes a good amount of effort to not jump to solutions, or jump prematurely to answers or conclusions when looking at the data. This process requires patience, but I feel the process will lead to a state of satisfaction that one has done justice to the data, and exercised due diligence in trying to understand what participants were saying.

Obviously, I need to understand GSR data a bit better, and may need more sensitive analysis software. I'll have to spend some time sorting that out over the summer. I'm encouraged by it, but need some better logistical protocols to make it work right. Some additional points or lessons learned are listed below:

- I should have gone to the lab at 11:30 p.m-midnight to get the "procrastinators" I was too lazy/tired to head back in to campus after a long day, and am still kicking myself about it.

- This takes time! I was able to schedule 4 on one day, But knew that I couldn't keep up that pace. Luckily I only had a few days to collect all my data.
- I found that my planned questions often dropped from any sort of order and became much more fluid with time. I'm sure I will still sound very stilted once I start listening to the interview recordings.
- Don't interview next to a water cooler. I should have known better from my video days, but I rendered some audio largely useless as a result—but not too much of it
- Be open about everything, ask about your influence on them during observation period. There's no hiding the elephant in the room!
- Listen! Don't take notes to remember, but rather for follow up questions (record the interview and listen to that later)
- Get better at asking the right kinds of questions—no matter how open ended your question are, it's what you ask that gets answered. Be aware of what you're asking, and NOT asking.
- Coming home at night with my digital interviews in hand reminded me of my old photography days where after a shoot out on the town, I wanted to get my film back so bad from the lab to see my images that I could taste it!—I now sit here wanting to get my data transcribed, knowing that there's no way I can do it all myself---so it sits, and I sit frustrated. I'll think of something.
- I admittedly took pleasure in coming up with new (but not very creative) names for my participants—not any name would do, it had to be one that suited my memory of them.

This has really been an eye-opening activity that has let me look upon research more favorably.

-Joel Galbraith

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Appendix A (sample interview questions)

Note: Not every question below was asked of each participant. Some questions emerged during one interview, and were then also asked of subsequent participants.

Primary Research Question: What is the nature of student self-monitoring and self-regulation when using variable speed playback (VSP) technology in a video-centric course?

1. What had you heard about this course (good and bad) before you took it?
2. Tell me generally how you use the speed controller (VSP)?
3. What kinds of things motivate you to adjust (or not) the speed of presentations (faster and slower)?
4. How do you use the other presentation controls (pause, rewind, stop, play, table of contents) with the VSP controller?
5. Why do you NOT use the speed controller?
6. Do you leave settings consistently fast, but stop and replay sections for better comprehension?
7. If so, do you repeat certain types of sections more than others?
8. Do you play the beginnings and ends of lessons slower or repeat them?
9. Do you play lecture summary statements made by the instructor slower, faster or repeat them?
10. Do you play the instructor's examples/stories different ways than other parts of lectures?
11. Do you play the instructor's "problem" sets and "walk-throughs" (answers) differently than other parts of lectures?
12. Have you ever viewed course materials on a computer without the VSP functionality? Tell me about that experience.
13. How might your particular study habits, learning strategies and/or usage patterns be motivated by your use of the VSP technology?
14. How do you think your speed control behavior might influence how you learn—on your study patterns? (does it make procrastinating easier?—you'll just watch the next section faster)
15. Do you ever feel your use of the speed control might be hurting your learning?
16. If so, do you do anything to compensate?

17. Is this how you usually study? (what time of day generally, why?)
18. Why do you study in this location? (apt. lab, library?)
19. Why do you go through all the walkthroughs? You got all the answers correct!
20. How aware were you of me? (The camera? The arm band?, my note–taking?)
21. Do you ever view the CDs with someone else? Why, why not?
22. How do you think you learn best? How do you use or control the course features to support that?
23. What things here [gesturing at course screen] get in the way of your learning?
24. Has this course helped you discover anything about how you learn? Or don't learn?
25. Do you recall moments when your mind wandered in this section? What were you thinking about (if you don't mind me asking?)
26. Were any parts/concepts particularly challenging to understand?
27. *[looking at GSR data] Here, here and here (pointing to spots on GSR data timeline) is where you adjusted presentation speed. What do you notice, and would you explain the GSR data in relation to how you adjusted presentation speed? (assuming any patterns exist)
28. *[looking at GSR data] look at this "spike" OR "gradual in-/de-creasing trend" OR "pattern" here in the GSR data. Yet, according to my observations, here you did NOT adjust speed or stop. Can you recall what this data might reflect? Lets look at the video at this point to see what part of the lesson you were on. (challenging content, frustrating concepts, poor explanation, going too fast, going too slow, just saw my girlfriend walk in the lab etc.)
29. *How do you think looking at this (GSR) data and having this discussion together might influence your study habits or awareness of how you use the VSP tool?

* Question area dropped due to logistical impracticalities.

Appendix B (control affordances)

The accounting course affords the following learner control:

1. Control over presentation *playback speed* (VSP)
2. Control over material *sequencing* (although a linear sequence is suggested for those with no background in the field)
3. Control over *how often to repeat* or replay content.
4. Control over within lesson pacing or playback controls; stop, play, pause, jump back 10 seconds, slider with position indicator for current segment of instruction.
5. Control over which media to watch (video and/or supporting graphics and animations can be viewed/stepped through independently or in synchronized mode)
6. Control over what supplementary materials to view and work through.(step-by-step problem solutions, hints, additional problem sets)
7. Control over *when* to interact with course content (weekly quizzes help "force" students to stay on track-although quizzes may all be taken early)
8. Control over *where* to view course materials (home, campus labs, work)
9. Students may opt to get additional help from upper level TAs in an accounting lab.

Control or choices not given to students include:

1. Software only works on the Microsoft Windows platform or on emulators such as Virtual PC on the Macintosh platform. This can cause significant anxiety for many users not familiar with the MS Windows environment, although none of our participants were affected in this way.
2. Students have no alternative method of taking the course (i.e. no traditional face-to-face section exists) although a textbook and study outline exists for students desiring such an alternative.
3. As discussed, students are given regular and frequent quizzes to help them avoid getting too far behind in the course. Students cannot choose to get too far behind without hurting their grades, but may elect to complete the course early.
4. Students are not given control over the learning goals or objectives of the course, that is, outside of being able to personally choose how they respond to the given or prescribed course objectives. This is generally antithetical to notions of self-regulated learning in the field (Corno & Randi, 1999)

Appendix C (sample student notes page)

What would the 12/31/X5 adjusting entry have been if the allowance account had actually had a debit balance before adjustment, meaning that the writeoffs must have totaled $1,280 rather than $920, and therefore the 20X4 estimate would have been underestimated rather than overestimated?

Allowance for Uncollectible A/R

		1,100	12/31/X4
Writeoffs	1,280		
Underestimated	180		
		?	12/31/X5 Adjustment
		2,352	(8% x 29,400)

Bad Debt Expense	2,532	
Allowance for Uncollectible A/R		2,532

Bad Debt Expense should be overstated in 20X5 to compensate for the $180 understatement in 20X4.

31.

Alternative approach to estimating uncollectible accounts receivable.

Aging of Accounts Receivable: (Using different %'s for aged categories)

		Est. % Uncollect.	Amount
Current:	$ 15,000	5%	$750
Past Due:			
0 - 30 days	8,000	8%	640
30-60 days	3,000	10%	300
60-90 days	2,000	15%	300
90 + days	1,400	20%	280
	29,400		2,270

32.

Allowance for Uncollectible A/R

		1,100	12/31/X4
Writeoffs	1,280		
Underestimated	180		
		?	Adjustment
		2,270	12/31/X5

Bad Debt Expense ($2,270 + 180)	2,450	
Allowance for Uncollectible A/R		2,450

33.

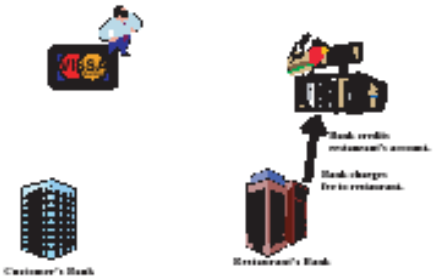
Credit Card Sales

34.

Credit Card Sales

35.

Credit Card Sales



36.

5-6

Appendix D (Sample observation log)

Lesson #13

Location description: Participant #2 — Acc lab - quiet place in basement of library - 20 computers. 2 others in the room - people wear headphones. - There's a sign on the wall "Counting down to the end of Acc lessons to go?" [illegible]

TOM

Lesson #: 13

Time started: 9:34 a.m. March 27, 2004 (Saturday)

he's working ahead of time well in advance

Name	Play	Stop	Pause	Faster	Slower	external
9:34	Starts	(Speed 1.6)				
9:36	takes notes - looks at me out side of eye - aware I'm watching + taking notes.					
9:39	draws point to me - could be boring - he doesn't mind doing					
9:40	takes notes					
9:41	highlights					
9:41 (40)	notes					
9:42	(notes)					
9:44 (34)	yawns					
9:45	more stuff - distract					
9:47	takes notes - circles notes					
9:50	Jumps ahead did problems last night will do another.					
9:51	starts homework					
9:52	gets calculator.					
9:55	talks to me a bit about major not showing, - too busy in pre-MBA.					
9:57	checks answer - nods approvingly!					
* 9:58	recalculates something - maybe got a wrong answer. - he did math wrong on professor assignment					
* 9:59	Starts walkthrough - actually stops walkthrough.					
10:01	takes notes					
10:02	was going fast - doing math					
* 10:02 (45)	Stops video write notes					
* 10:03	Starts again					
10:04	looking down - writing notes					
10:05	writing notes - looking down					
10:08	Prof asks question VC - Ratios					
10:09	lots of writing					
10:11 (30)	Contribution Margin ratios - new maybe complicated terminology					
10:12	sits forward - turns page - new topic in class - looking ahead in notes.					
10:13	has an itch - scratches ribs (side) - discomfort					
10:13 (44)	I cough (in a quiet room)					
10:17	Complicated concepts? - he looks down					
10:19	Writes notes					
10:20	Problems start - he gets out paper. Starts working on probs. - he's using notes, Not replaying any video sections.					
10:29	clicks walkthrough					
10:30	Computer not working right - clicks on video - nothing happens - - clicking everywhere					
10:31	video finally starts - wrong problem (lesson 13 problem #56 walkthrough link not working)					
10:34 (50)						
10:37	talks to me a bit about how this has never happened					

10:40 - gets out calculator to work out problem. - uses + refers back to notes + printed slides

10:43 (30) doesn't get answer right - clicks on walkthrough.

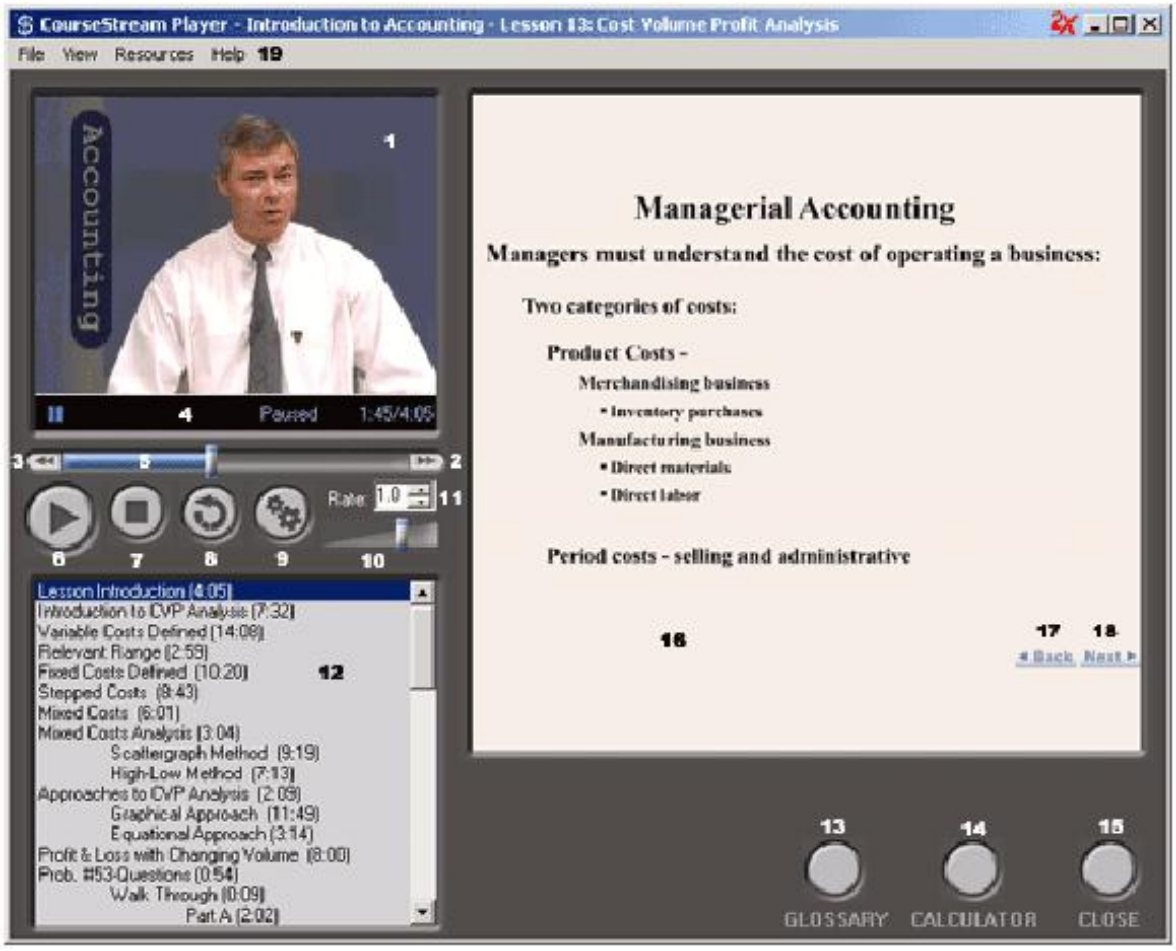
10:46 - laughs at something instructor says

* 10:46 - Jump back 10

10:49 - stops video - writing notes - works out problem.

10:50 (I stop him to ask questions)

Appendix E (accounting course and VSP interface)



1. **Video Window** — This is the video portion of the lesson. This window now has the ability to double in size. To change the video to double size, Click "View" and then click "Double size video."
2. **Fast Forward —** This button fast-forwards the video at about 10 times the original speed (NO audio).
3. **Fast Rewind —** This button fast rewinds the video at about 10 times the original speed. (NO audio)
4. **Video Status Window** — This section now provides better video information. The status window tells the user the present state of the video and the video now counts in real-time.
5. **Time Bar** — The time bar is now much more advanced and responsive over the previous version. The time bar now moves in real-time as the video plays. The user can also manipulate the time bar with greater ease.
6. **Play/Pause Button —** The play and pause button are now combined.
7. **Stop Button —** This button stops the video and returns the time bar to the beginning of the video segment.

8. **Ten Seconds Back button** — This button moves the video back ten seconds. We changed this button from five seconds to ten seconds because most students move through the material at 2X the original speed and five seconds was simply not enough time.
9. **Synch Button —** This button synchronizes the video with the current slide
10. **Volume Control Slider —** This slider controls the volume of the presentation.
11. **VSP (Variable Speed Playback) Module** — This integrated module allows the user to increase or decrease the presenter's rate of speech without distorting the pitch of the voice. This module only works properly in Windows XP and functions much like the Enounce 2xAV plug-in. This integrated module and the Enounce plug-in can be used simultaneously to achieve combined playback rates faster than four times the original speed. This integrated module can be turned off in the Settings menu causing the Enounce 2xAV plug-in to be the sole VSP engine. We strongly suggest that when a student watches the lessons for the first time they do so at rates lower than or equal to 2.5X the speed. If a student chooses to review the material for a test or exam then it may be appropriate to watch the lessons at a faster rate.
12. **Table of Contents —** This is an outline of the content in the lesson.
13. **Glossary Button** — (see below for more information about the glossary).
14. **Calculator** — This button loads the internal program calculator. If you desire, you can set the program to load the default Windows calculator in the settings menu when you click this button.
15. **Close** — This button shuts down the program.
16. **Slide Window** — This is the flash animation window.
17. **Back Button** — This button causes the slide window to show the previous slide.
18. **Next Button** — This button advances the slide window to the next slide.
19. **Menu System** — Please refer to "Menu System" below for an explanation.