

IMPROVING STUDENT UNDERSTANDING WITH VIDEO GRADING

Technology in Practice

Walter Schilling, Assistant Professor, Milwaukee School of Engineering,
schilling@msoe.edu

1 Abstract

It is known that students exhibit different learning styles. Good instructors adapt their teaching style to target the appropriate style(s) for their students, and by doing so achieve significant improvements in student outcomes. The same approach, however, does not hold true for submitted assignments. Due to logistics, most submitted assignments are graded in the same fashion: providing numeric feedback (i.e. a grade) and written comments. This article describes a different approach, an approach which is designed to aid visual and audible learners to obtain better feedback from submitted assignments.

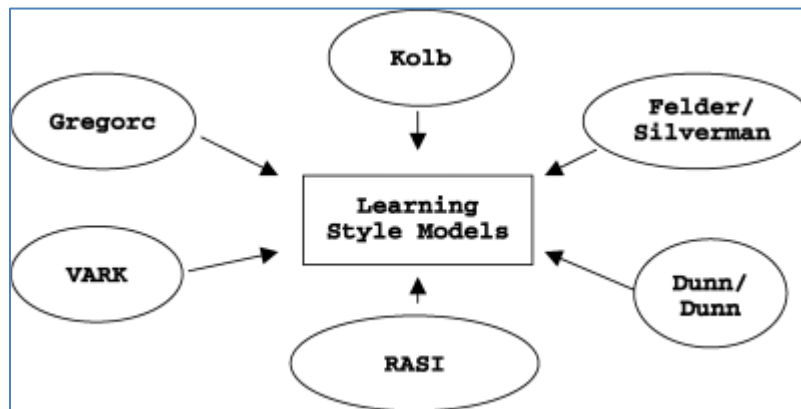


Figure 1 The six prominent learning style models. [1]

2 Problem Statement and Context

It is well known within the educational community that students exhibit different learning styles. Overall, there are six prominent learn style models in the literature [1]. One of the most commonly cited models is the VARK model developed by Neil Flemming [2]. Based upon this model, students are classified as either a visual learner who learns best by seeing pictures or slides, an auditory learner who learns best from through listening, a reading and writing learner who prefers to learn from reading and writing, or a kinaesthetic learner who learns best by touching or doing. The Kolb Experiential Learning Theory model indicates that learning is a set of continuous processes, starting with concrete experience and evolving to active experimentation [3]. The Gregorc model states that individuals have natural predispositions toward learning in four different dimensions, including abstract and concrete perception, sequential and random ordering, deductive and inductive processing, and separative and associative relationships [4]. Felder and Silverman have expanded upon this premise and performed extensive analysis within the engineering field, developing a 5 dimensional model of learning [5] which incorporates student perception, input modality, organization, processing, and understanding. The Dunn

and Dunn learning style model represents the most complex model, in which five stimuli are analyzed across multiple dimensions. Lastly, the Revised Approaches to Studying Inventory model (RASI) uses three dimensional scales to model the interaction between a learner and the learning environment [6].

Effective teachers employ multimodal approaches to ensure that material is both taught and reinforced using different methods. These approaches work well in the traditional classroom. But at some point, every instructor has an assignment that needs to be graded. And while the classroom dynamic is important to ensuring student achievement, providing students with high quality feedback on submitted work is equally important. Hounsell states:

“It has long been recognized, by researchers and practitioners alike, that feedback plays a decisive role in learning and development, within and beyond formal educational settings. We learn faster, and much more effectively, when we have a clear sense of how well we are doing and what we might need to do in order to improve.” [7]

Feedback has been shown to be the single most powerful influence on student success [8]. For feedback to be meaningful, it must meet many criteria, including being applicable to the student, delivered in a timely fashion, engaging to the students, and relevant to the topic at hand. [9]

With all of the importance placed on feedback, student feedback has generally remained unchanged over the years. Written comments make up 79% of feedback received by students, though 45% of students report that they rarely received individual written feedback on assignments [10]. This is clearly a problem, for many students readily admit that they do not read written comments [11].

3 Method Employed

Electronic ink has ushered in a new realm of capabilities for the classroom instructor. In the area of grading, electronic ink has been used to mark up [12] [13] submitted assignments, and has been viewed favorably by both students and faculty. However, like traditional paper based grading, this mechanism suffers from several weaknesses. Due to the medium, feedback is almost entirely in the form of written comments, mirroring traditional feedback from paper submissions. Excluding the improvement in timeliness and accessibility, this form of feedback offers little improvement over traditional paper based feedback.

To improve the effectiveness of feedback, it is imperative that, just like classroom teaching, multiple dimensions be used. For many years, audio commentary has been used to evaluate student performances in the musical and arts forms, as it was convenient for an evaluator to speak into a tape recorder while judging the event. Oral comments have also been used informally in class and in team settings for an instructor to “coach” a team. In research studies, students have shown a preference for audio commentary over written comments [14].

While beneficial, audio commentary does not aid the visual learner. A visual learner needs to see things in context in order to understand their meaning. Thus, while audio commentary is an improvement over written feedback, it still is not optimal. To truly reach all student learning styles, feedback to the students must also incorporate visual feedback. Thus, the concept of video grading.

Video grading starts in much the same manner as any other form of electronic grading. A student submits to an instructor an electronic document. While in this particular process a pdf document format was chosen for portability purposes, any electronic format could be employed. Prior to the instructor grading

the assignment, the instructor runs a screen capture program¹ and dons a headset microphone. As the instructor reads and interprets the document, a stream of consciousness capture of their instructor's thoughts is captured on the audio track. As the instructor marks up the document, the student can see exactly the progression of markups in the document as well as hear the instructor's verbal comments. If written comments are made on the document, the instructor can either verbally repeat the comments or provide more rationale for their inclusion. Overall the process is shown in Figure 2.

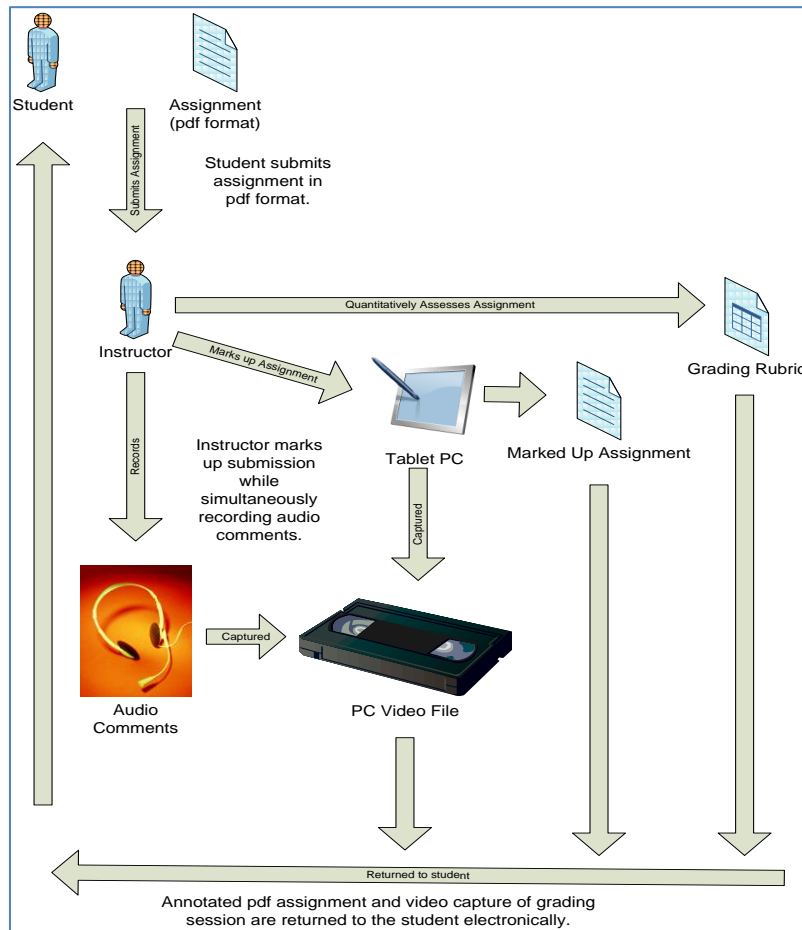


Figure 2 A workflow diagram for video grading.

One distinct advantage of this process is that in addition to aiding visual learners, it really helps the students to see the non-linear process of assessing a submission. For example, when an instructor grades an assignment, they may refer back to a previous page if something contradictory is found later on or if a duplicated point is found. With this approach, since the student is visualizing exactly what the instructor saw when the assignment was graded, the student sees the instructor returning to the previous location and clearly can follow the reference.

4 Results and Evaluation

The described method was employed in a software requirements and specification course during the Fall of 2012. In this course, students work in teams to develop a requirements specification for a software

¹ In this particular instance, Microsoft Expression Screen Capture utility was used, but any program which does screen capturing could be used.

product. Activities that the students conduct include preliminary research, stakeholder identification, interviewing stakeholders, drafting a requirements document, and developing storyboards. While the students do give oral presentations, a significant amount of their grade involves effective written communication, which has always been evaluated in a traditional manner using written comments as well as standardized grading rubrics. Overall, there were 3 major assignment submissions which were graded using video grading techniques, resulting in the average video lengths shown in Figure 3.

| Assignment | Average Video Length |
|--------------|----------------------|
| Assignment 1 | 0:22:08 |
| Assignment 2 | 0:11:44 |
| Assignment 3 | 0:20:41 |

Figure 3 Average Video lengths for graded assignments.

At the end of the course, students were given a brief, 10 question survey which assessed their perceptions of video grading. In particular, there was a strong desire to determine if the students watched the videos and if they found the videos to be helpful. If the students did not watch the videos, then the videos would clearly be no more effective than written comments which are ignored. If the students watched the videos but did not feel the feedback was worthwhile, then again the video system would not be effective. Results of the survey are provided in Table 1. On all questions, the majority of the students either agreed or strongly agreed with the statements, and the majority of students watched all of the videos. Reaction was mixed to the length of the videos, as half of the students felt that they were too long.²

Table 1 Student survey results.

| | | MSOE SE3821 Software Requirements and Specification | | | | |
|---|---|---|-------------|-----------|-------------------|--|
| | | All | 2 | 1 | 0 | |
| How many of the videos did you watch? | | 57% | 29% | 14% | 0% | |
| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | |
| I found the video format more helpful than traditional paper-based assignment feedback. | 29% | 43% | 29% | 0% | 0% | <i>The only downside is the time it takes to listen to the videos, unavoidable but still nice to hear what you're thinking.</i> <i>It was nice to see the thought process of your grading, as you're grading.</i> |
| I found the audio commentary more helpful than traditional written comments. | 43% | 43% | 14% | 0% | 0% | <i>Audio comments, while taking longer, provide much more in-depth feedback as well as including feedback that is not easily included in written feedback. I believe that the rubric and summary are important parts of the feedback process, however.</i> |
| I was able to read the text on the video. | 71% | 14% | 14% | 0% | 0% | <i>The length was long, but less time would make the video feedback far less useful</i> |
| I was able to clearly see what was being described in the video. | 67% | 17% | 17% | 0% | 0% | |
| I prefer video feedback to traditional feedback in computer courses. | 20% | 40% | 20% | 20% | 0% | <i>Easier to reread paper than go back in video.</i> |
| | Way Too Long | Too Long | About Right | Too Short | Way too short | |
| I felt that the length of the videos were: | 0% | 50% | 50% | 0% | 0% | Perhaps a 5 minute limit |
| In what way(s) could video grading be improved to make it more useful for you? | If different professors were involved in the video grading process collaboration for improving the process might help; I have no suggestions at this time. | | | | | |
| Please enter any other thoughts or comments that you may have about video grading. | In a course like Software Req+Specs, video grading is nice to have, but actually seems it might be more trouble than it's worth. There's no product after labs that we need to demonstrate, just a report, so there's not much to talk about - either we reported something correctly, or we didn't. In order to keep the video short, you had to skip over a lot of content of reports, only taking samples of the overall work. I don't think this helps overall - what if you skip over a really big mistake? Then you'll have to resort to looking through the report and handwriting the comments anyway, which seems to defeat the purpose of doing video grading in the first place. Should be continued Good idea, takes a little long but insightful comments make the value about the same as written. | | | | | |

² This was a somewhat expected response, as even the instructor felt the videos were a bit too long. However, the assignments had 25 or more pages in the report that was to be reviewed, and significantly reducing this time was not deemed feasible for the assignments.

Overall, students viewed the videos very positively, and a slight majority indicated a preference for video grading versus traditional grading.

5 Future Work

There is obviously much more research to be done to assess the effectiveness of video grading. The scope of this project was small and the sample size was very limited. However, it is believed that this is an acceptable way for assessing student work that offers unique advantages in the digital age.

To be more effective, it is important that some of the technical issues with this approach be resolved. While the actual time spent grading was very comparable to that spent grading in a traditional manner, there was a significant amount of overhead associated with assignment return. While the output of the tablet was an annotated pdf file, the initial output of the Expression Screen capture utility needed to be encoded using Microsoft Expression. This added approximately 15 minutes of processing after grading was completed in order to create a video format which could be distributed to the students. The files themselves were also very large. Some of the videos approached 35 MB in size, too large to return by e-mail. Thus, a dedicated website was setup to allow the students to log on and view their videos. While these techniques were not insurmountable, they may preclude less technically savvy instructors from adopting the procedure.

Technical issues aside, there is still much to learn about this method. The assignments given in this class were very static in nature, and grading on paper would probably convey most of the relevant information. But, could this technique be applied to other aspects of the software and computer engineering curriculum? An area of exploration is in the design and execution of computer programs. With this technique, and an appropriate split-screen approach, an instructor could markup a design while simultaneously executing the program. Preliminary work has already started in this area in another programming course.

Further research needs to be done on the length of the videos as well. It is known that humans have limited attention spans. Clearly the 20 minute videos used may have been too long, just as a 50 minute lecture without appropriate active learning exercises can be too long. But, what is the appropriate length for a custom video which will retain the student's interest as well as appropriately convey feedback to the student? This length may be highly variable based on the assignment context.

Lastly, it is important that this approach be tried in different disciplines. The field of software engineering, by its technical nature, often applies technology in advance of other disciplines. Certainly there are other areas where such an approach might prove prudent. Mathematicians could verbally explain mistakes in a mathematical proof or numerical computation. Chemists could easily show mistakes in a chemical equation. And other disciplines of engineering could easily perform a design review of a product and capture the thoughts of the reviewers.

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