Learning Style Preferences for an On-Demand Learning Resource

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Abstract

An on-demand learning resource was evaluated based on students preferred learning styles. During the Spring semester of 2007, I created short video tutorials for various topics in the introductory engineering class, Fundamentals of Engineering Mechanics and Design. The original implementation was highly successful so the concept was expanded for the following term and feedback (both grades and perceptions) was gathered. Learning style preferences (using Felder’s Learning Styles Inventory) of the students in the course were assessed and compared to trends in usage of the on-demand videos. The author hypothesized that it would be more likely to be used by visual, sequential learners. Surprisingly, no specific learning style preference exhibited a greater tendency to make use of the videos. This paper suggests that well-organized, short, instructional videos appeal across the entire spectrum of learning styles. In addition, students at all levels of academic performance utilized the video tutorials. This pedagogically sound on-demand resource potentially helps all students.

Introduction

This paper is part of a larger, continuing study examining the impact of the short tutorial videos. In papers presented at the 2008 American Society of Engineering Education, Bruhl et. al. demonstrated the impact on academic performance seen by students who make use of this resource. In this paper, I examine how likely students are to watch the video tutorials based on their learning style preferences.

The recent increases in computer technology, internet availability and connection speeds are changing the face of education. Until recently, distance education consisted of a student completing course requirements with a textbook, course notes, and perhaps some video tapes of lectures at a location somewhere other than the classroom. Students completed assignments and mailed them to the professor. With the advent of the internet, student access to instructors and course material improved in distance education. Course materials are now accessed through internet portals and conversations take place via e-mail and/or chat rooms. Video-teleconferencing technology further improved capabilities by enabling real-time interaction between student and teacher.

Outside of the classroom, the same technologies that improved distance education have caused a significant shift in the way we access information. We can now get news, watch television shows, and even watch complete movies all through the internet. Individuals have the freedom to get information and entertainment they want, when they want it, and where they want to be when they get it.
Harnessing the capability of these technological changes in traditional courses has been a bit slower than in distance education and much slower than in other aspects of our lives. Yet, today’s generation of students wants to have more control over their education, much as they do over information in other aspects of their lives. Prensky refers to students today as “digital natives” – they have literally grown up with ubiquitous technological devices. These “natives” use the internet regularly to maintain social contact, obtain news, and for entertainment. They carry iPods® for music, handheld video devices for gaming and movie watching, and cellular phones often for more than simply making a phone call. Because of this, many students desire more use of technology in other aspects of their lives – such as education.

Most teachers, Prensky states, are “digital immigrants,” having to gradually integrate the technology that their students take for granted. Students today are increasingly “bewildered”, “disappointed”, and even “disillusioned and dispirited” in the way that these digital immigrant teachers attempt (or, in many cases, do not attempt) to integrate technology into coursework. This finding is strongly corroborated by recent research by the Pew Internet and American Life Project. The question all teachers should be asking, however, is: Can we make use of technological advances to improve our courses? A secondary question is: How can we ensure that the technological advances appeal to our students and improve their learning?

Background

In Fundamentals of Engineering Mechanics and Design (CE300), we recently created a “pull” resource: short (5-10 minutes), instructor-made, instructional videos (each on a specific topic). We used a Tablet PC and Camtasia screen capture software to create these videos and call this resource “Video AI” since they provide another avenue of “additional instruction” for our students. The videos are not intended to replace any of the classroom instruction; the intent is to augment instruction. The videos are posted on the course Blackboard page for access by students at a time and place of their choosing. Unlike copies of problem solutions, these videos allow the student to see the solution unfold bit-by-bit similar to what they see in class. By making the problems in these videos different from those worked in class and providing some videos focused on concepts rather than direct application, the students have a resource at their fingertips to augment their traditional preparation for class and study for exams and which supplements what they get during class without replacing the need for classroom instruction. In addition to their textbook and course notes they can now supplement their studying with a few videos. Over the course of the last three semesters, the number of videos available for cadets enrolled in CE300 has grown from four to eleven with plans to continue creating videos on problem areas as they arise in the midst of the semester.

Choi and Johnson concluded in a recent study that “video-based instruction can effectively be used to motivate learners by attracting their attention” when the instruction is well-organized and prepared based on effective pedagogy. We created videos that would maintain their attention by keeping each video less than ten-minutes in length. This ensured the video remained focused on important details and was accessible by our students without being burdensome. By having different videos available on a variety of topics and organized by major topics, students are able to quickly find a video to address a concept with which they need assistance. Baggett suggests that videos are effective for learning because they contain both auditory and visual information.
When used as a supplemental study resource, videos clearly have some potential benefits over the “old standards” of a textbook and handwritten notes – the student can hear and see the information rather than simply see it.

Determining the benefit of this new resource on our students' learning is critically important. In order to decide if it is worth the time required to create new resources, the impact on academic performance (i.e. grades) as well as student attitudes towards it was assessed. We showed that not only do students appreciate having Video AI available\textsuperscript{10}, but those that used the videos when studying performed better than those who did not use the resource\textsuperscript{11,12}.

With the impact established – these videos definitely help students learn – this paper examines the likelihood of students to use a “pull” resource in an otherwise traditional course. We found that while students with lower incoming GPAs were more likely to use the resource, even those with high academic records made use of and benefited from it\textsuperscript{13}. The question addressed in this paper is: Are students more likely to make use of the instructional videos based on their learning style preferences?

Researchers have investigated the influence of learning styles on preferences of instructional material organization and delivery mode. The focus of the majority of this research is on-line courses (i.e. distance education). A 2002 study found students enrolled in a traditional course and those enrolled in an on-line version of the course performed equally and that no specific learning style exhibited a strong preference for either form of instruction\textsuperscript{14}. The researchers concluded that their results are due in large measure to the quality of instruction presented online and the way in which it was organized.

A 1992 study conducted in the United Kingdom examined the impact of the organization and presentation of online instruction. The researchers prepared three versions of a lesson with varying structure, organization, verbal emphasis and use of diagrams and other images. Results showed that students with an Analytic-Imager learning style (that is, they tend to think in parts rather than the whole and they prefer visual to verbal learning) performed poorest on the version in which the information was presented primarily verbally with simple line diagrams. Not surprisingly, Analytic-Verbalisers performed least well when the information was presented in small chunks of verbal content with a reliance on diagrams and pictures. However, when the lesson was presented with a quick overview, small summaries throughout, and a combination of diagrams and verbal presentation all students performed equally well regardless of learning style\textsuperscript{15}. This version of presentation was effective across learning styles by appealing to all learning styles.

The study reported in this paper used the learning styles described by Felder and Solomon\textsuperscript{16} and examines the influence of learning styles on preferences using an on-line resource in an otherwise traditionally presented course. Felder and Solomon identify four learning style dimensions: Sensing/Intuitive, Visual/Verbal, Active/Reflective, and Global/Sequential.

The Sensing/Intuitive dimension describes the student’s preferred way to perceive information. Sensing people exhibit a preference to learn through observation and gathering of data while an Intuitive student uses more indirect perceptions such as speculation.
The Visual/Verbal dimension describes how the student prefers to receive information. As the terms imply, Visual learners learn most effectively through what they see – diagrams, images, demonstrations – while Verbal learners remember more of what they hear and say.

The Active/Reflective dimension describes how a student tends to process information. Reflective learners tend to work best by themselves and do best after they have had some time to think about what they have recently learned. Active learners tend to be more effective when they are able to experiment and do not perform as well in passive classroom environments.

The Sequential/Global dimension describes the student’s preferred way to understand information. Global learners do best when they have been exposed to the “big picture” before learning details. Sequential learners, on the other hand, tend to prefer to learn details (or “pieces”) first and then see how it all connects.

It is important to note that most people are not clearly at one end or the other of each dimensional spectrum but, may exhibit a preference (moderately or strongly) for one end of each dimension. Many people are “balanced”; that is, they do not exhibit a strong preference but can effectively perceive, receive, process, and understand information in a variety of ways.

Method

**Procedure.** For each student enrolled in CE300 during the Fall 2008 semester, I compiled their learning style preferences (gathered as part of a homework assignment) and Video AI use history (using tracking statistics in Blackboard). Learning style preferences were compared to Video AI use. The two populations compared were: “Used Video AI” – these students watched at least one Video AI during the semester – and “Did not use Video AI”. Comparisons were also conducted based on the regularity of Video AI use. Using the learning styles data I determined the distribution of learning style preferences for each of the two populations. This enabled observations to be made and conclusions drawn.

**Sample.** This study was conducted in a course with an enrollment of 183 students during the Fall 2008 semester. I chose not to create control groups since it was hypothesized that the videos would only improve performance, not harm it, and we wanted all student to be afforded the opportunity to use the resource. In practice, the students created two groups: 113 students (62%) used the videos to supplement their study at least once during the semester, 70 students (38%) did not once make use of the resource during the semester.

Of the students who watched the videos, most watched five or six of the eleven videos available (see Figure 1), many of them watching the videos multiple times (see Figure 2). As seen in Figure 3, the most popular videos were those covering course content that was applied throughout the semester (forces, moments, and 2-dimensional equilibrium).
Figure 1 Distribution of Number of Different Video AIs Watched

Figure 2 Distribution of Number of Total Number of Video AIs Watched
The students in the course spanned the range of learning style preferences (as shown in Table 1) but the majority of our students were: Sensing, Visual, Active, and Sequential learners. These preferences mirror what Felder discovered: “most engineering students are visual, sensing, active, and sequential learners.” As seen in Figure 4 through Figure 7, many of the students in our sample exhibited balanced learning styles. Eight (4%) students were balanced in all four dimensions, 30 (17%) were balanced in three dimensions, and 65 (36%) were balanced in two. The dimensions in which our students were most likely to be balanced were Sequential/Global and Active/Reflective. Interestingly, 74 students (41%) were strong Visual learners, while only one student exhibited a strong Verbal preference.

<table>
<thead>
<tr>
<th>Table 1 Learning Style Preferences of Sample</th>
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<tr>
<td>Percentage of students exhibiting a preference in each category (n=179)</td>
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<tr>
<td>Sensing/Intuitive</td>
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<tr>
<td>Visual/Verbal</td>
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<tr>
<td>Active/Reflective</td>
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<tr>
<td>Global/Sequential</td>
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Figure 4 Distribution of Strength of Learning Style Preference (Sensing / Intuitive)

Figure 5 Distribution of Strength of Learning Style Preference (Verbal / Visual)

Figure 6 Distribution of Strength of Learning Style Preference (Reflective / Active)
Materials. All course materials were made available to all students enrolled. Felder and Solomon’s Learning Style Inventory (LSI) was completed online by 179 of the 183 students as part of a homework assignment.

Findings

Students across the learning style spectrum made use of Video AI. Examining each learning style individually (Figure 8 through Figure 11) shows that there was reasonably close usage of the on-demand learning resource across the spectrum.

Figure 7 Distribution of Strength of Learning Style Preference (Global / Sequential)

Figure 8 Distribution of Learning Style Preference for Video AI Usage (Sensing / Intuitive)
Figure 9 Distribution of Learning Style Preference for Video AI Usage (Visual / Verbal)

Figure 10 Distribution of Learning Style Preference for Video AI Usage (Active / Reflective)
Since students exhibit learning style preferences in varying degrees (balanced, moderate, and strong using the computer-based learning styles inventory), it is important to consider the impact of the strength of their preference on the likelihood that they made use of the on-demand resource. This comparison is accomplished by examining the use of Video AI by those exhibiting a moderate or strong preference for each learning style (Figure 12 through Figure 15).

From Figure 12 we see that those exhibiting a strong preference for Intuitive learning were more likely to use the videos. Data in Figure 13 shows that visual and verbal learners were essentially equally likely to make use of the videos regardless of the degree of preference. As shown in Figure 14, those with moderate or strong preference for active or reflective are equally likely to make use of the videos, although when those with balanced preferences are included (as in Figure 10), active learners in aggregate appear to be more likely to use Video AI. Finally, students with a strong preference for sequential learning appear to be more likely to use Video AI as seen in the data in Figure 15.
Figure 12 Impact of Degree of Sensing / Intuitive Preference on Likelihood of Using Video AI

Figure 13 Impact of Degree of Visual / Verbal Preference on Likelihood of Using Video AI
Figure 14 Impact of Degree of Active / Reflective Preference on Likelihood of Using Video AI

Figure 15 Impact of Degree of Global / Sequential Preference on Likelihood of Using Video AI
It is also worth considering the influence of combinations of learning styles. Since Visual and Sequential learners were the most likely to watch the videos when considered individually, I examined how likely those who were both Visual and Sequential were to watch the videos. As seen in Figure 16, when considered in aggregate, those students who exhibited preferences for both Visual and Sequential learning appear to be slightly more likely to access the on-demand resource. Conversely, we see that those who are the opposite (exhibiting a preference for both Verbal and Global learning) were less likely to use the videos. From Figure 16, several other observations can be made. When considering the strength of a student’s preference for Visual and Sequential learning, we see a slight increase in the likelihood of accessing the videos. When a preference for Active learning is included along with a preference for Visual and Sequential learning, we again observe a slight increase in likelihood. Students with a strong or moderate preference for all three learning styles have an even greater likelihood of using the video resource.

![Figure 16 Influence of Combination of Learning Styles on Likelihood of Using Video AI](image)

Those students who were balanced in three or four of the learning style dimensions appear to be slightly more likely to use the videos to supplement their studying (see Figure 17). Those balanced in only two, however, were neither more nor less likely. This is most likely due to the fact that a large number of students balanced in two dimensions and those who were represented the full spectrum of other learning styles.
Conclusion

Today’s students use technology to “pull” information in most aspects of their lives yet traditional courses, in general, have not integrated “pull” type of resources. In education, we owe it to our students to develop ways to appeal to all learning styles – since all types are represented in our courses – both in our traditional instruction in the classroom and in additional resources we provide. This led us to the idea of Video AI and this paper examined this resource and its appeal to various learning styles.

These videos appealed across the spectrum of learning styles. Verbal learners made use of them as did Global learners. Similarly, Reflective and Intuitive learners watched the videos to supplement their learning. While students exhibiting preference for visual, active, and sequential learning were slightly more likely to use an on-demand resource the increase in likelihood was most evident for those students who exhibited a strong preference. Because of the rather small size of the samples, none of these variations in use are statistically significant. I have been gathering the same data for this current semester (168 students) and the same trends appear to be continuing. At the conclusion of this semester, I will combine the data from 08-1 and 08-2 and again conduct a statistical analysis to determine if, with a larger sample, the likelihood of various learning styles to use the video resource is statistically significant.

As long as the resources are designed using proven pedagogy (for example: focused, well-organized, and clearly explained instruction) the on-demand video resource appeals to most students regardless of learning style preference.
Bibliography