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Improving Instructor Presence in an Online Introductory Astronomy Course through Video Demonstrations

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Abstract

We created a series of videos for an online introductory astronomy course at the Pennsylvania State University in part to address the lack of personal presence in online courses. Based on surveys administered to the students during the semester, we found that these videos were effective in creating an instructor presence within the online course. We also found that students who perceived a strong instructor presence had a more positive attitude toward the course. Additionally, there is a correlation between the students' perceptions of how helpful a video is with how enjoyable they rated it, but no correlation between the perceived helpfulness of a video and student performance on video-specific questions, suggesting that students are not good at assessing video helpfulness.

1. INTRODUCTION

In order to meet the growing needs and busy schedules of today's students, more and more universities are offering online versions of their popular courses. During the spring 2008 semester, over 50 courses were being offered in an online format at Penn State (University Park campus), one of them being our version of ASTRO 001, an introductory astronomy course for non-science majors. However, questions remain about the efficacy of online instruction compared to traditional face-to-face lecture courses.

A study of over 1000 students taking online courses at 32 different colleges confirmed that teaching presence is integral in creating a community of learners within an online course (Shea, Li, and Pickett 2006). In a study of four online graduate courses, Swan and Shih (2005) reported that the perceived presence of an instructor in an online course is influential in determining the satisfaction, if not the performance, of students in the course. In order to introduce these equivalent components into our online course, we developed a series of 19 videos, which demonstrated various astronomical concepts throughout the semester. Our primary motivations in creating this series of videos for the online course were threefold: to create the presence of an instructor in an online course, to reproduce any demonstrations normally presented in a traditional face-to-face course within the online environment, and to provide students with a more dynamic presentation. This paper will focus on the first of these motivations: creating an instructor presence—someone with a face, voice, and personality that the student could relate to and feel comfortably approach with questions.

After the initial learning curve of making a video, the amount of time spent on making each video was minimal. Once a script was created, the authors were able to create and edit a video in a matter of an hour or two. The videos were created with the help of Ryan Wetzel and Digital Commons (now Media Commons, http://mediacommons.psu.edu) at Penn State University. Digital Commons is a free service provided for all faculty and students at Penn State. They provided the authors with the cameras and studio space needed to make the videos, along with the expertise and training to edit the videos using FINAL CUT PRO for Macs. A 3–5 minute video typically took half an hour to tape (including practice runs and "bloopers") and an hour

or two to edit. The only cost of making the videos was the cost of the video tapes and any props that were used in the videos. Some of the videos were shot on location, but Penn State University also provides a service that rents video cameras for free to students and faculty. These days, though, with the state of technology, anyone with a good enough video camera and enough storage space on their computer can make a video for minimal cost. Further background on the videos can be found in our companion paper (Miller and Redman 2010, hereafter MR2010). These videos can be accessed on YouTube (www.youtube.com/Astronomy001), Google Videos (www.video.google.com), and iTunes U (www.itunes.psu.edu).

2. EVALUATION OF STUDENT PERCEPTIONS

We conducted a number of surveys in order to evaluate the effectiveness of the videos as well as student perceptions of the course and astronomy in general. Many of the surveys were conducted by and analyzed with the assistance of a number of graduate students in the instructional systems department at Penn State University. Michael Zeilik's Survey of Attitudes Toward Astronomy (Zeilik and Morris 2003) was administered at both the beginning and the end of the course in order to assess student opinions of the online resources and their usefulness within the class, while the Community of Inquiry Instrument (Arbaugh *et al.* 2008) was administered at the end of the semester to evaluate the level of instructor presence, social presence, and cognitive presence within the course. We also administered our own survey, specifically designed to assess the video presentations, which was administered both midsemester and at the end of the course. Students were not required to participate in any of the surveys but were highly recommended to do so. While they did not receive a grade for their participation, they were awarded participation credit for completion of the surveys. All of the information that was gathered was "anonymized" by a professor within the instructional systems department. While the data can only be generalized to students who would grant permission for scores to be used, in comparing results for the classes as a whole to those of the participating students, we found no significant difference in our results. Of the 317 students enrolled in the online course, 204 online students (64%) agreed to participate in this study.

3. DATA AND DISCUSSION

3.1. Video Effectiveness

Twice throughout the semester (once midsemester and once at the end of the semester), we administered a survey specifically designed to measure students' attitudes toward the video series. We asked the students to evaluate the effectiveness of the videos in 1) creating an instructor presence within an online course and 2) explaining the various astronomy concepts demonstrated in each of the videos. The results of our surveys are shown in Figure 1. While we show results from the end-of-the-semester survey, midsemester results were consistent with those shown.

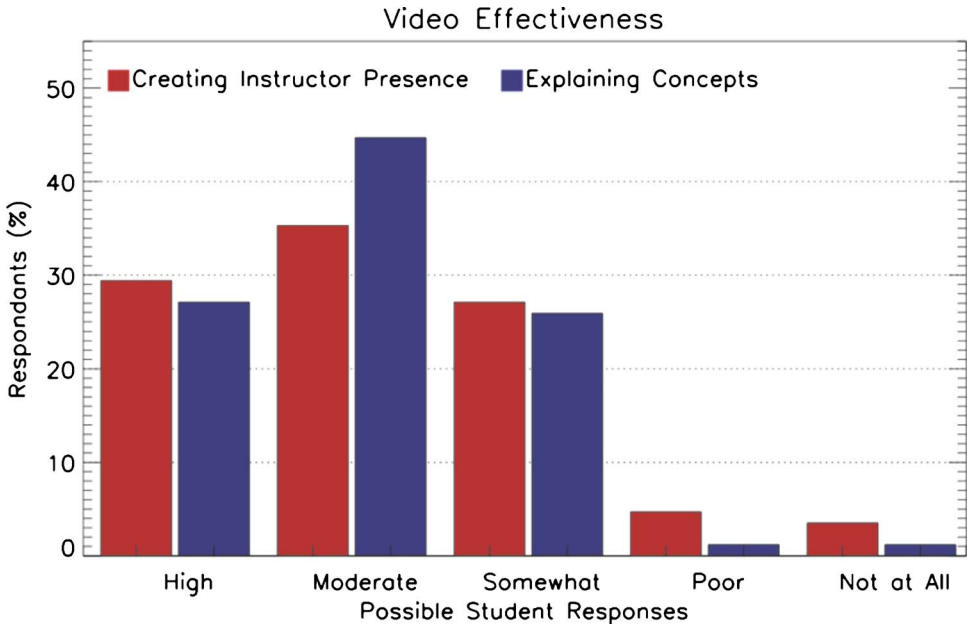

Figure 1. A plot of the perceived effectiveness of the videos in creating an instructor presence within an online course and in explaining astronomy concepts

A five-point Likert scale was used to assess students' attitudes toward the effectiveness of the videos. Based on the results shown above, we can report that a majority of the students found the videos to be effective tools for both the creation of an instructor presence within the online environment as well as demonstrating astronomy concepts. Due to the imprecise nature of the terms used within the Likert scale and the debate over whether or not Likert scales can be considered interval in nature (Hodge and Gillespie 2003) rather than equate the scale terms with numeric values in order to determine an average response value, we simply state that 64.7% of the students found the videos more than somewhat effective at creating an instructor presence, while only 8.2% found them less than somewhat effective. In regard to demonstrating astronomical concepts, 71.8% found the videos more than somewhat effective, while only 2.4% found them less than somewhat effective.

3.2. Correlations with Instructor Presence

Next, we paired students' ratings of the effectiveness of the videos in creating an instructor presence to their attitudes toward astronomy and the course. The students' attitudes toward astronomy were obtained through the use of Zeilik's Survey Toward Attitudes in Astronomy. Composed of 34 questions, the Zeilik survey was designed to survey students' attitudes toward introductory astronomy based on four areas: 1) the students' affects (attitudes) toward astronomy and science, 2) the students' cognitive competence (their perception of their ability to learn, understand, and apply what they have learned) when applied to astronomy and science, 3) the students' attitudes toward the value of astronomy and science in their personal and professional lives, and 4) the students' attitudes toward the level of difficulty of astronomy and science as subjects. The survey uses a five-point Likert scale ranging from strongly agree to strongly disagree, which was converted into rankings of 1 to 5, and used to assess the presence of a correlation.

The Community of Inquiry Instrument is composed of 32 questions designed to survey students' attitudes in regard to 1) the level of interactivity of the instructor within the course in communicating important information and providing feedback, 2) the ability of students to interact with their peers within a social environment

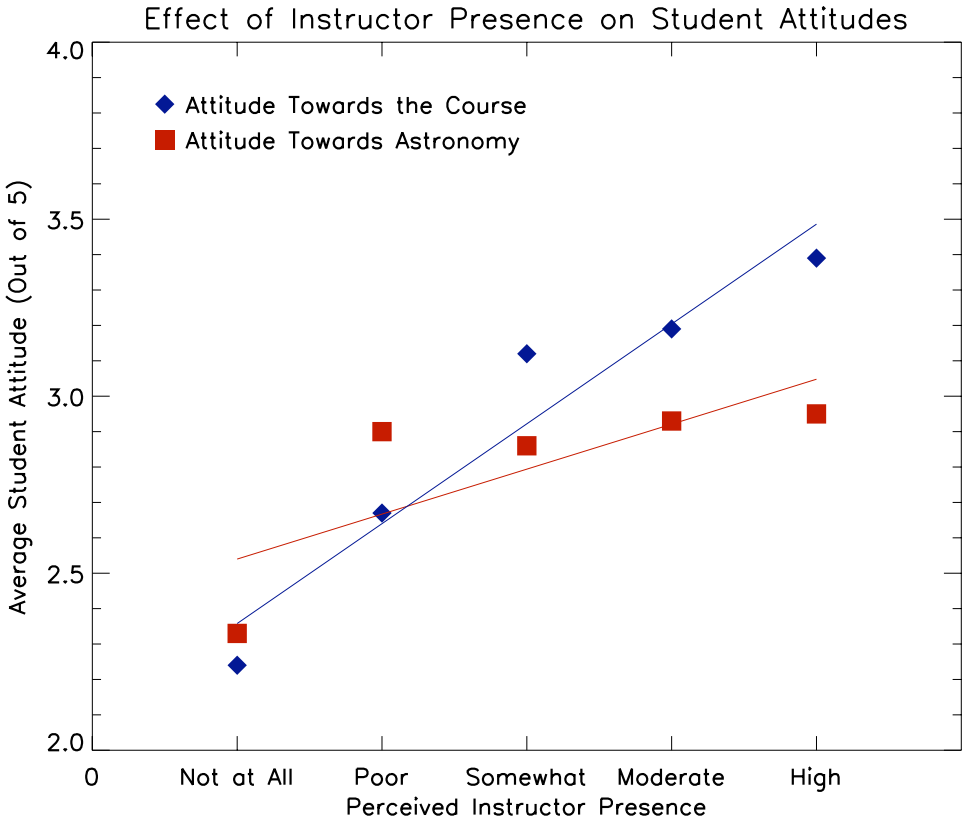

Figure 2. Correlation between the perceived level of instructor presence versus student attitudes toward the course (diamonds) and student attitudes toward the subject of astronomy (squares). While the Likert scale cannot be used to quantify these correlations (since there is no value assignment to these student perceptions), we can comment on the relative correlations of these quantities. This plot shows that student attitudes toward the course are more strongly correlated with student perceptions of the instructor presence that the videos provided

and develop levels of communication with them, and 3) the ability of the course to encourage students to develop critical thinking skills and reflect upon their learning aptitude. As with Zeilik's survey, we converted the Community of Inquiry Instrument's five-point Likert scale to integer values so that we could calculate average student ratings for the purpose of looking for correlations.

Figure 2 illustrates the correlation between the level of instructor presence as indicated by the students on our video survey versus their attitude toward astronomy (squares) and their attitude toward the course (diamonds). A linear best fit for the data is included. As is illustrated, students' attitudes toward the course are highly correlated with their perception of an instructor presence: students who felt a stronger instructor presence within the course also had more favorable attitudes toward the course. This is consistent with the results that Swan and Shih (2005) found in their study of online graduate courses. While it may appear that there is no large separation in value between the average student attitudes between degrees of perceived instructor presence, this could be in part due to the imprecise nature of Likert scales and their difficulty in converting from an interval scale to an integral scale.

A lower correlation was found between the level of perceived instructor presence and students' attitudes toward astronomy. In fact, if the data from the few students who indicated that they perceived no level of instructor presence is omitted, then the students' attitude toward astronomy is near constant (2.91 ± 0.05 out of 5). In other words, for most of the students, the perceived level of presence of an instructor within the course had no effect on their attitude toward astronomy as a subject. On average, students had neutral (a ranking of 3 out of 5) attitudes toward astronomy.

In both cases, we also looked for correlations between subsets of each survey. In terms of the survey of astronomy attitudes, no greater correlation was found among the subset of topics (affect, cognitive competence, value, and difficulty). In terms of the survey of course attitudes, a slightly higher correlation ($R=0.97$) was found for the questions pertaining to the level of instructor presence. A summary of the correlations between the various factors and instructor presence can be found in Table 1. While our survey applied specifically to the students' perception of the level of connectedness they felt with the instructor after watching the videos and the Community of Inquiry surveyed a much broader level of teacher presence (communication of goals, objectives and deadlines, level of feedback provided, etc.), the high correlation between the two serves to strengthen the validity of our survey as an effective tool for measuring the overall perceived level of instructor presence within the online course. The correlation between perceived instructor presence and students attitudes toward social presence and cognitive presence were also relatively high ($R=0.94$ and 0.91, respectively).

Table 1. Correlation (R) values between the perceived level of instructor presences versus various components of student attitudes

	Correlation (R)
Attitude toward course	0.96
Instructor presence	0.97
Social presence	0.94
Cognitive presence	0.91
Attitude toward astronomy	0.77
Affect	0.89
Cognitive competence	0.81
Value	0.62
Difficulty	0.83

3.3. Student Perception of Educational Benefit

In addition to asking students to indicate the level of instructor presence within the course, we also included in our survey questions that asked the students to indicate which videos they thought were 1) most helpful and 2) most enjoyable. Students were allowed to indicate as many videos as they wanted in both cases. Using these data, we investigated whether there was any correlation between the perceived helpfulness of the videos and their perceived enjoyment, as well as student performance on exam questions. To determine the latter,

we looked at exam questions that specifically related to topics covered in the video and compared results from students who indicated they had watched the associated video to those who indicated that they had not.

Figures 3(a) and 3(b) show the data described above for all 18 videos (the first video was simply an introduction video to the course and therefore did not cover any astronomical topics). In each graph, the x-axis is a measurement of the perceived helpfulness of the videos, as determined by the percentage of students who watched a given video and marked it as one of the most helpful. In Figure 3(a), the y-axis is a measurement of the perceived enjoyment of the videos, as determined by the percentage of students who watched a given video and marked it as one of the most enjoyable. In Figure 3(b), the y-axis is a measurement of the increase in student performance from watching a given video, quantified by the odds ratio. (See MR2010 for details.) A higher odds ratio indicates that students who watched video X were more likely to answer exam questions related to the video correctly, while students who did not watch the video were more likely to answer the same questions incorrectly.

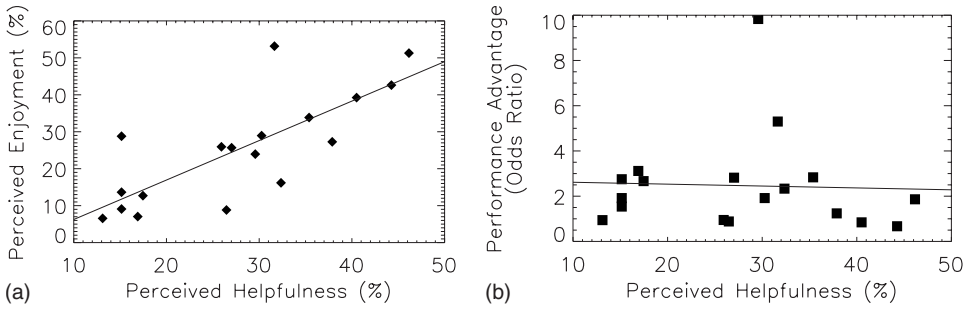

Figure 3. (a) The correlation between the perceived helpfulness of each of the 18 videos (neglecting the introductory video) versus the perceived enjoyment (diamonds). (b) The correlation between the performance advantage (odds ratio) provided by each video versus perceived helpfulness (squares). These figures strongly suggest both that students are not very good at assessing how useful videos are (b) and that their opinions are swayed by those videos they find most enjoyable (a)

As can be seen in the figures above, there is little correlation ($R=-0.041$) between the students' perceived helpfulness and their actual performance improvement on exam questions related to the videos. There is a stronger correlation ($R=0.771$) between the students' level of enjoyment and the perceived level of helpfulness of the videos. In other words, whether the video was truly helpful or not, students believe videos to be more helpful if they enjoyed them more.

3.4. Student Feedback

Students were allowed to leave written comments on the survey that we administered. Some of these comments supported our goals for the videos.

"I think the videos are great. I have a hard time getting the concepts just reading the slides, but when I see the concepts in motion it makes it easier to understand."

"I think the videos are very helpful… they are entertaining and I actually get to see my professor teaching, and they help me better understand confusing topics."

"I thought the videos were very helpful! I am a visual learner and seeing many of the concepts we learned about in the lessons in the videos helped me to better understand those concepts."

"I enjoy the use of the videos to create the instructor presence. Also the humor associated in the videos helps to make the concepts more interesting and easier to remember."

"I think the videos are very helpful in reinforcing the material that we have to read over for the class. It is beneficial to see something in action and be able to see you and hear you. It does make me seem like I know you better and could approach you whenever. It's also good that you include humor in both your messages and videos. It makes us want to be a part of this class."

"I personally enjoyed them. It was nice to be able to recognize the instructor better than any other online class I have taken. To be honest, I often forget that this was an online course."

4. CONCLUSIONS

We have successfully demonstrated how the inclusion of video demonstrations in an online course created a positive learning experience for our students. Our results show that in addition to other forms of teacher interaction (such as the communication of goals and deadlines, feedback on assignments and exams, as well as answering student questions), creating a visual and interactive presence within an online setting improves student attitudes toward the course and aids the students in their efforts to succeed in learning the material. By associating a face, voice, and personality with the online instructor, students felt more connected to the course and felt more comfortable interacting with the instructor and asking questions.

We have determined that video demonstrations are an effective means of creating an instructor presence within an online course. On average, students who perceived an instructor presence from the videos rated the course favorably. While Likert scales can be imprecise in determining how favorable a student may rank various qualities, the majority of students either moderately agreed or strongly agreed that the videos contributed to a greater connection between teacher and student. In addition, correlating students' perceptions of instructor presence and attitudes toward the course shows that students who perceive a stronger instructor presence are more likely to have a positive attitude toward the course. Simply having a more favorable attitude toward a course can go a long way in keeping students motivated and focused, which aids in their understanding of the material.

Students who perceived the videos as enjoyable also found them to be helpful whether or not they provided any measurable educational benefit. No correlation was found between how students rated videos in terms of their usefulness in explaining various concepts and how well they did on exam questions relating to those topics. Videos that were highly rated as being helpful did not necessarily produce increased levels of learning compared to videos that were not as highly rated as being helpful. Instead, videos that were highly rated as being helpful were also highly rated as being enjoyable to watch. Therefore, students may not be good discriminators between what learning tools are effective instruments at explaining astronomical concepts.

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