

## Media Player Tool Use, Satisfaction with Online Lectures and Examination Performance

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### Abstract

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Media players allow students to pause lectures and to replay portions at will, two capabilities with potentially important pedagogical value that are not available in face-to-face lectures. The first study showed that many students use and value these media player features when watching online introductory psychology lectures. The second study showed that use of the features was correlated with superior exam performance, a learning outcome that was at least partially mediated by increased satisfaction with the learning approach. Together, the findings demonstrate that students who used the features made available by media players were more satisfied with their course, and performed better in it.

### Résumé

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Les lecteurs multimédias permettent aux étudiants d'interrompre les enregistrements de cours en salle et d'en rejouer des parties à volonté, deux fonctions ayant une valeur pédagogique potentiellement importante qui ne sont pas disponibles dans les cours en salle. La première étude montre que plusieurs étudiants d'un cours d'introduction à la psychologie utilisent et apprécient ces fonctions des lecteurs multimédias. La deuxième étude montre qu'il existe une corrélation entre l'utilisation de ces fonctions et une meilleure performance aux examens, un résultat de l'apprentissage qui serait partiellement expliqué par l'augmentation de la satisfaction par rapport à l'approche d'apprentissage. Ensemble, les résultats indiquent que les étudiants qui utilisent ces possibilités inhérentes aux lecteurs multimédias sont plus satisfaits de leur cours et obtiennent de meilleures notes.

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### Introduction

Online instruction is growing in higher education, both in courses offered entirely on the Web and in hybrid courses that involve a mix of online instruction and face-to-face contact (Allen & Seaman, 2004). Despite the appeal of online instruction among many students, instructors, and administrators, concerns have been expressed about a move away from face-to-face lectures in higher education (Young, 2002). Commonly-heard concerns revolve around the danger of creating feelings of isolation,

frustration, anxiety and confusion among students (Brown 1996; Hara & Kling, 2000).

Whether online learning is advantageous or not is, ultimately, a question about learning outcomes. This question echoes similar concerns with other instructional media, concerns that have been long standing and controversial in education. One position, advanced by Clark (1983, 1994), has been that media "are mere vehicles that deliver instruction but do not influence student achievement" (p.445). The body of evidence supporting this conclusion has been substantial enough to become known as the "no-significant-difference phenomenon" (Russell, 1999).

The "no-significant-difference" notion has, however, had its detractors. Some concerns have been methodological in nature. For example, Joy and Garcia (2000) have pointed out that methods of instruction and media are seldom independent, making it difficult to control for a host of possible influences beyond media on outcomes. Other concerns have been conceptual in nature. Kozma (1991, 1994), in particular, has argued that media are important because they rely on distinctive symbol systems that interact with the mental representations and cognitive processes involved in learning. To raise a blanket question about the impact of media on instruction, therefore, misses the complex interactions that can occur between symbolic properties of media and cognitive properties of learners.

Another way that media can influence learning is by influencing the nature of the interaction students experience when learning in various contexts. Moore (1989) has identified three types of interaction that are important in learning: learner-content interaction, learner-instructor interaction and learner-learner interaction. The emergence of computer technologies in the learning process have prompted Hillman, Willis and Gunawardena (1994) to propose that learner-interface interaction is also important to successful learning. We suggest that the media players used by learners to view lectures in streaming video are increasingly important elements of learner-interface interaction because of the opportunities for control they offer learners.

Learner control is an important feature of instructional design that allows students to make decisions about aspects of learning (Williams, 1996). This ability is closely linked to metacognitive activity because the learner needs to dynamically monitor his or her understanding of incoming information in order to exercise control over its flow (Milheim & Martin, 1991; Spiro, Feltovitch, Jacobson & Coulson, 1992). Learner control encompasses a variety of concepts such as student goal selection and content, time management, ordering and pacing of learning tasks, etc. (Niemic, Sikorski & Walberg, 1996). For this reason, Web-based learning environments afford a variety of opportunities for learner

control. For example, the rich interlinking of information in hypertext-assisted learning allows learners to make choices about the path they follow while learning (Niederhauser & Shapiro, 2003). Control over the influx of lecture information is another important aspect of Web-based learning in courses that involve streaming video of lectures. This is where the use of media players can be particularly significant since media players allow students to pause and to "rewind" sections of lectures, capabilities that are very important in the implementation of metacognitive strategies.

The purpose of the present research is to investigate whether the use of a media player's pause button and seek bar (slider), while watching lectures through streaming video, is associated with greater satisfaction with online lectures as well as with gains in examination performance. We begin with a brief review of the use of media players for lecture delivery, and then present two studies. The first study explores how much students in a large introductory psychology course used the pause button and seek bar while watching lectures by streaming video, and for what purpose they used these features. The second study explores the relationship between the use of these features and examination performance as well as satisfaction with online lectures.

#### *Media Players in Academic Settings*

Media players have evolved dramatically over the past decade, a development that has significantly bolstered their importance in online instruction (Bassili, 2006). Media players are devices that allow the delivery of audio and video media from a server to client computers for end-users such as students (Galbreath, 1992). The most common media players are RealPlayer, QuickTime and Windows Media Player, all of which are available in versions that can be downloaded freely from the Web.

Audio-visual transmission over the Internet was, in the early days, constrained by important technical limitations. In 1995, for example, engineering students at Stanford University had the ability to watch lectures in graduate-level courses on the Internet, but the viewing experience was impoverished. The QuickTime movies they watched were jagged, with frames changing only about every half-second (Schultz & Rouan, 1998). Another significant hindrance in the viewing experience was that students had to completely download a file before starting to view its contents, such files being so large by the standards of computers of those days, that lectures were segmented into four files, each requiring a full download before it could be viewed.

Fortunately, things quickly improved. By the very next year, streaming technology was implemented in these courses, allowing students to start

watching a lecture soon after requesting it from the server, the rest of the download buffering in the background unobtrusively (Schultz & Rouan, 1998). Even then, however, streaming downloads were constrained by data rates of about 20 KBPS (Latchman, Kim & Tingling, 1999) and constraints imposed by 28.8 KBPS modems that were common in those days. These constraints are effectively nonexistent today with as many as 84% of students in a large introductory course offered online at this university having home access to the Internet by broadband connection (Bassili & Joordens, 2003), and improvements in compression-decompression (codec) technology resulting in audio/visual files that are less memory and bandwidth intensive. Moreover, all students at this campus have the option of watching lectures via high-speed connection at computer facilities on campus.

Of primary importance to the present work is the fact that current versions of media players not only allow students to view lectures, but they also provide students with tools to control the information flow of the lecture. This can be done in two ways: The pause button allows students to stop the lecture temporarily and then to start it again, while the seek bar allows students to move forward or backward to a particular point in the lecture. Given that note taking, external distractions, and lapses in attention and comprehension are ever-present elements in learning, the ability to pause and review sections of lectures has the potential to be extremely pedagogically useful. Yet, while media players are becoming an essential technology for viewing online courses, little is known about the extent to which students pause and seek within lectures while watching them online, or about the consequences of these activities on the learning experience and learning outcomes.

The first study evaluates the interaction of students with the media player interface they used to watch lectures. In particular, the study explores how frequently students used the pause button and seek bar on the media player. In addition, the study examines how useful students found these tools and whether tool use was linked to satisfaction with online lectures.

### Study 1

This study focused on students in an online section of PSYA01, the first half of a large introductory course in psychology. Of specific interest was students' use of the pause button, the seek bar and the clock available in the Real Media player. In addition to assessing whether these features were used by students, we assessed what they were used for, as well as their perceived utility. Finally, student satisfaction with the features was also measured.

### *Method*

*Enrolment and Participants.* Participants in the first phase of the study were enrolled in an online section of PSYA01 in the fall semester of 2002. The course, at the time, comprised three sections where lectures were presented in class, and one where lectures were presented online. A recruitment appeal was made at the beginning of the midterm exam and time was allotted at the end of the exam for students to complete the questionnaire. For ethical reasons, precautions were taken not to publicize whether each student completed it or not. Two hundred and five of the 220 students enrolled in the online section of the course provided data for this study, representing a response rate of 93%.

*Materials.* Different institutions utilize streaming media in different ways. As instructors of a large psychology course, our goal was to create a Web option for a course that was also offered face-to-face. For this reason, the online lectures reproduced the face-to-face lectures closely, both in terms of what the professor did and said in class and in terms of the audiovisual materials shown there. Lectures were made available online by capturing them in class on videotape and by uploading a compressed digital video file to a server on the Web where they could be accessed by means of streaming video in Real Player format. The PowerPoint slides shown in class were presented side by side with the video window during viewing.

The streaming media versions of lectures were presented in Real Media format in a 320 X 213 pixel window at a rate of 12 frames per second for students with a high speed connection, and at a rate of 6 frames per second, with stronger compression, for students with a modem connection. Pilot research with students in this course has demonstrated that they find the quality of the video image and of the sound satisfactory, even when they access lectures by modem (Bassili & Joordens, 2003).

*Procedure.* Real Player, like most contemporary media players, provides two important means of controlling the influx of information. The first is the pause button that students can use to interrupt the lecture and then resume playing it, while the second is the seek bar, or slider, that allows shuttling forward and backward in the lecture.

Our goal was to measure use and perceived utility of the tools provided by the media player. These measures were collected by means of a questionnaire distributed after the midterm exam. Students were given extra time at the end of the exam to complete the questionnaire if they chose to do so.

*Measures.* The omnibus questionnaire used in this study contained 99 questions, many of which not relevant to the present focus on media

player use. Of the eight questions pertinent to the focus of this paper, one asked "The video player contains a seek bar (a slider) that allows you to find a place in the video. How often did you use the seek bar?" The response options varied from "Almost never" to "More than three times every hour." This question was followed by this question "Assuming that you used the seek bar at least some times, what did you use it most often for?" The response options, which were selected because they were often mentioned by students in prior informal discussions, were: "Finding my place when coming back to a lecture"; "Going back over material that was not clear"; "Skipping material that I did not find useful" and; "For some other purpose." The last question on the seek bar asked "Assuming that you used the seek bar at least some times, how useful did you find this feature?" A five-point response scale defined at one end by "Useless" and at the other by "Extremely Useful" was provided for this question.

The next three questions were identical in format but pertained to the pause button rather than the seek bar. The only difference in this set of three questions was the set of response options for the question asking what the pause button was used for. The options, which were selected on the basis of prior informal discussions with students, were: "To allow me to write notes"; "To interact with someone"; "To go to the bathroom"; "To get something to eat"; and "For some other purpose."

Satisfaction with online lectures was assessed with two items. The first asked students to rate their agreement with the following statement "All things considered, I am very happy with online lectures in PSYA01 this year", and the second with the following statement "It is really good to be able to take some courses, like PSYA01, online and others in class". Ratings were made on a five-point scale labelled "Strongly Disagree" at one end, and "Strongly Agree" at the other.

### *Results*

Close to 60% of the students reported using the pause button at least once every hour of lecture (see Table 1). In about 47% of the cases, this was done for the purpose of taking notes. The ability to pause lectures was rated extremely useful by 54% of the students, with nearly 80% rating it from the midpoint to the positive end of the scale.

The seek bar was used at least once every hour of lecture by 42% of the students. In 63% of the cases, this was done to go over material that was not clear. The feature was found extremely useful by 38% of the students, with about 70% rating it from the midpoint to the positive end of the scale.

Table 1  
 Percentage of Students Reporting Using the Pause Button and Seek Bar Most Often for a Particular Reason

Reasons for Using the Pause Button		
To allow me to write notes	46.7	(77)
To interact with someone	13.3	(22)
To go to the bathroom	20.6	(34)
To get something to eat	9.1	(15)
For some other purpose	10.3	(17)
Reasons for Using the Seek Bar		
Finding my place when coming back to a lecture	19.2	(32)
Going back over material that was not clear	62.9	(105)
Skipping material that I did not find useful	10.8	(18)
For some other purpose	7.2	(12)

*Note:* Values presented in parentheses represent the number of students who selected a response option.

The correlation between use of the pause button and use of the seek bar was  $r = .28$  ( $p = .000$ ). While this correlation is suggestive of a tendency for some students to use both tools more than other students, the modest size of the correlations also suggests that different people tend to use different tools.

Next we looked at whether use of the media player tools correlated with satisfaction with online lectures. Because the two questions assessing satisfaction with online lectures were highly correlated ( $r = .749$ ,  $p < .001$ ) an average score was computed. The frequency of use of the pause button was correlated with satisfaction with online lectures ( $r = .439$ ,  $p = .000$ ), but

use of the seek bar was not ( $r = .066, p > .25$ ). The rated utility of the pause button and the seek bar were significantly correlated with satisfaction with online lectures ( $r = .518, p < .001$  and  $r = .439, p < .001$  respectively).

### *Discussion*

The preceding results illustrate that students often use the pause button and the seek bar when watching lectures online, that they find these features very useful, and that their feelings towards these features is related to their satisfaction with online lectures. The next study focused on the relationship between use of the pause button and seek bar, performance in the course, and feelings towards online lectures.

### Study 2

The results of the first study suggest that the features available in media players are used by many students, and that the students who used them tend to be satisfied with online lectures. While this finding is heartening, it leaves a number of questions unanswered. Study 2 explores three questions: (1) does use of the pause button and seek bar correlate with satisfaction with online lectures; (2) does use of the pause button and seek bar correlate with enhanced performance on exams?; And (3) To the extent that use of the features is correlated with examination performance, what factors mediate this relationship?

Chou and Liu (2005) report that learner control is related to learning effectiveness and general satisfaction with a high-school computer course, suggesting an affirmative answer to the first two questions raised above. The third question is of particular theoretical significance. To the extent that the use of control-features of the media player is related to examination performance, one can hypothesize possible mediators of this relation. One possibility is that some students are generally keen about participating in the course, and their heightened participation leads them to use the media player features more as well as to perform better in the course. Alternatively, generalized keenness or participation may have little to do with the use of features of the media player, any relation between use and performance in the course being mediated by other factors, such as enjoyment of the learning environment created by the availability of media player features. While the correlational nature of the present study does not allow us to identify causal relations between variables, the approach does allow the exploration of mediational relations of this type.

### *Method*

*Enrolment and Participants.* The participants in this study were a different cohort of students enrolled in PSYA02, the second part of the introductory course offered a year later. That year, the course was reorganised into one section that met in class and another, much larger one, where lectures were presented online. At the time of the study, 1027 students were enrolled in the course, with 414 and 613 registered in the class and online sections respectively. A recruitment appeal was made at the beginning of the final exam and time was allotted at the end of the exam for students to complete the questionnaire, precautions being taken not to publicize whether each student completed it or not. In total, 673 students completed at least part of a questionnaire pertinent to the present study. The effect of registration in one section or another was more administrative than real because an open invitation was extended to students registered in either section to attend any lecture they wished or to watch it online.

*Materials.* The streaming media versions of lectures were presented in the manner described in Study 1.

*Procedure.* As in Study 1, measures were collected by means of a questionnaire distributed after the midterm exam. Students were given extra time at the end of the exam to complete the questionnaire if they chose to do so.

*Measures.* The two questions assessing the frequency of use of the pause button and the seek bar were also asked in this study. Students' grades on the 50 multiple-choice questions of the midterm exam they took prior to completing the questionnaire served to assess performance in the course. Satisfaction with online lectures was assessed with three questions (e.g.: "I think that the presentation of lectures online is a great idea and that it should be used in more courses.") Responses to the three questions were highly intercorrelated ( $\text{Alpha} = .808$ ) and were averaged. General participation in the course was assessed with five questions asking about the extent to which students kept up with announcements on the home page for the course, read and posted messages in the discussion forum for the course, e-mailed the professor and T.A., and watched lectures more than once. Responses to these questions were highly intercorrelated ( $\text{Alpha} = .701$ ) and were averaged to yield an index of participation.

### *Results*

The correlation between use of the pause button and use of the seek bar in this study was  $r = .45$  ( $p < .001$ ). Thus, while we expected similarities in the use of these two features, the correlation between the

use of the pause and seek features was not high enough to warrant combining these measures for the purpose of analysis.

Zero-order correlations between the frequency of use of the pause button, the seek bar, grade on the midterm exam and satisfaction with online lectures were computed (see Table 2).

Table 2  
Zero-Order Correlations Between Frequency of Use of Pause Button, Seek Bar, Midterm Grade and Satisfaction with Online Lectures

	Pause	Seek	Part.	Grade	Satisfaction with Online
Pause	1.00				
Seek	.45**	1.00			
Participation	.13**	.13**	1.00		
Grade	.11*	.13**	.09	1.00	
Like Online	.18**	.10*	.01	.16**	1.00

Note: \*  $p < .05$ . \*\*  $p < .01$  (all tests two-tailed).

The four variables were significantly related to each other, the highest correlation being between use of the pause button and use of the seek bar. As might be expected, students who use one of these media tools tend to also use the other. More to the point are the correlations between the use of either of the media tools, general participation in the course, and grades on the midterm exam, as well as satisfaction with the online option. Those students who used the tools provided within the media player environment scored better on the exam. While these correlations are modest, they suggest a mediational sequence in the processes that link the use of media tools to performance in the course as indexed by grades on the midterm exam.

We posited at the outset that one possibility for such a relation is that students who are generally keen about the course, participating in all its aspects, also did better on the exam. The correlation between the participation index and examination performance ( $r = .090$ ,  $p > .05$ ), however, was not significant, indicating that general participation is not a central factor in the relationship between use of the pause button and seek bar and examination performance.

Other mediational processes can account for the observed relation between use of the seek bar and pause button and examination performance. One possibility is that students who like online lectures use the pause button and seek bar more, and this enhances their performance in the course. Another possibility is that the use of the seek bar and pause

button enhance a student's satisfaction with online lectures, and this increased sympathy results in better performance in the course.

The procedure suggested by Baron and Kenny (1986) was used to elucidate the mediational relation between use of the pause button,

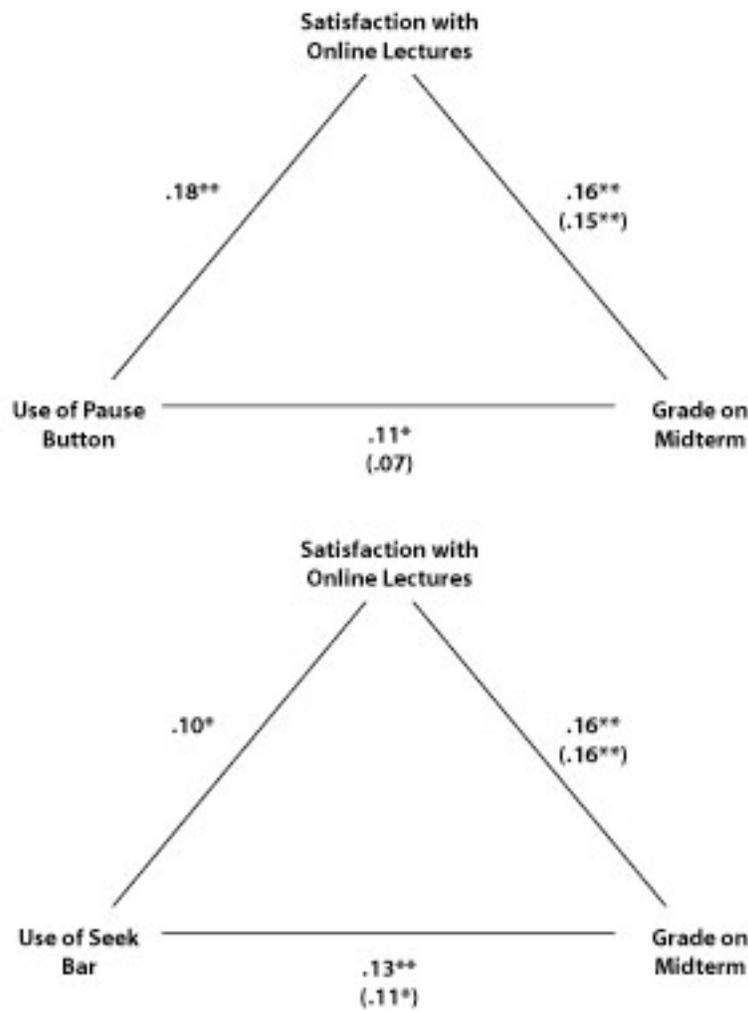


Figure 1. Mediational analysis of the relation between the frequency of use of the pause button (top panel) seek bar (bottom panel), satisfaction with online lectures and performance on the midterm exam (\*  $p < .05$ . \*\*  $p < .01$ ). Path coefficients shown in brackets are from the model where midterm grades are regressed on both satisfaction with online lectures and frequency of use of the pause button (top panel) or seek bar (bottom panel).

grades and satisfaction with online lectures. This procedure involves computing coefficients based on the relation between two variables at a time, and then determining if the value of the coefficient drops when the possible mediator is added to the regression model. A drop in the coefficient suggests that some of the variance in the relation between the initial two variables is mediated by the third variable. The familiar triangular set of relations used in this analysis is shown in Figure 1. The figure reveals that the relation between grades and the use of the pause button (Beta = .11,  $p = .02$ ) weakened when satisfaction with online lectures was added to the regression equation (Beta = .07,  $p = .16$ ) whereas the relation between grades and satisfaction with online lectures remains substantially the same (Beta = .16,  $p = .001$  and Beta = .15,  $p = .003$ , respectively). This finding suggests that the relation between grades and use of the pause button is mediated by the level of satisfaction with online lectures.

The mediational analysis of the use of the seek bar yielded similar results. The relation between grades and the use of the seek bar (Beta = .13,  $p = .006$ ) weakened, but remained significant, when satisfaction with online lectures was added to the regression equation (Beta = .11,  $p = .031$ ) whereas the relation between grades and satisfaction with online lectures remained substantially the same (Beta = .16,  $p = .001$  and Beta = .16,  $p = .002$  respectively). This finding suggests that the relation between grades and frequency of use of the seek bar is mediated, at least in part, by the level of satisfaction with online lectures.

### *Discussion*

The results of Study 2 paint an interesting picture of the use of the pause button and seek bar while watching lectures in streaming video. Students who used the pause button and the seek bar performed better on the exam. One obvious possibility for this relation is that these students participated more in all aspects of the course, an involvement that favoured their good performance. This, however, was not the case because while general participation in the course was related to the use of the pause button and seek bar, it was not related to examination performance. Instead, our mediational analysis demonstrated that use of the pause button and seek bar increased satisfaction with online lectures and this increased sympathy promoted performance in the course. One particularly interesting aspect of this finding is that it suggests that learner control over the flow of instruction does not necessarily have a direct impact on learning. The impact appears, instead, to be mediated by increased enjoyment of the learning environment.

### *General Discussion*

We said at the beginning of this paper that concern has been expressed about the transition from face-to-face to online instruction. The assumption behind this concern is that there is only loss in this transition, online presentation of lectures never amounting to more than a second-rate facsimile of live lectures. The research presented in this paper has a more positive outlook on online lecture presentation since it focuses on features of media players that provide students with important capabilities that they do not have in class, namely the capability to pause the lecture and to shuttle backward and forward in it. Given that it would be extremely impractical to make these capabilities available in a face-to-face context, this is one aspect of lectures presented by streaming video that offer special advantages to students.

Perhaps of most significance is the fact that the use of the pause button and seek bar was related both to satisfaction with online instruction and to improved examination performance. The fact that satisfaction with online lectures mediated the relation between use of these features and examination performance suggests that learner control in the context of Web-based learning can have as much to do with promoting motivation as it does with cognitive aspects of learning. This finding is not only consistent with past findings on the relationship between learner control and satisfaction (Chou & Liu, 2005; Merrill, 1983; Williams, 1996) but also demonstrates that increased satisfaction can be responsible for the improved academic performance documented here and elsewhere (Chou & Lui, 2005).

The present results are a testament to the importance of student-interface interaction and of learner control in the context of online lectures that rely on streaming video technology. Students in the courses we have studied mastered the use of the streaming video interface without special training. Moreover, these students used the pause button and seek bar for pedagogically meaningful purposes such as taking notes and reviewing parts of lectures that were not clear, and this use was linked to higher levels of satisfaction with online lectures and to improved examination performance. Together, these outcomes mitigate the concerns that have been expressed about the transition to online instruction in higher education and, in fact, suggest there may be positive impacts if appropriate technologies are used.

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