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Use of Lightboard Video Technology to Address Medical Dosimetry Concepts: Field Notes

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USE OF LIGHTBOARD VIDEO TECHNOLOGY TO ADDRESS MEDICAL DOSIMETRY CONCEPTS: FIELD NOTES

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INTRODUCTION

Web-based lecture technologies are being used more frequently in higher education. Routinely, these video and audio recordings are subsequently made available to students online and have been referred to as lecture capture (O'Callaghan, Neumann, Jones, & Creed, 2017). Increasingly, educators suggest that the delivery of video lectures through diverse forms of media is a useful pedagogical approach, which may have a positive effects on student learning, satisfaction, engagement and interest (LSEI) (Costley, & Lange, 2017). As more and more instructors flip their classrooms or teach online courses, the importance of communicating effectively and creating an engaging online class that can hold a student's focus becomes increasingly essential. Communication is an integral part of our lives and different faculty members communicate in different ways to express thoughts, feelings, knowledge, skills, and ideas, all of which makes alternative approaches an important part of the process of effective teaching (Haneef, Faisal, Alvi & Zulfiqar, 2014).

LITERATURE REVIEW

The use of video technology as a communication tool for content can create authentic learning opportunities such as: facilitating problem-solving, assisting in the mastery of learning, and inspiring and engaging students (Alpay et al. (2017). Globally, instructors have experimented with new ways to make videos more interactive and engaging. In some cases this has been achieved by using a webcam to provide a brief recording of lecture related to teaching materials also provided within the video (Kaltura, 2015). Recent research suggests that including video presentations in lecture sessions allows instructors to communicate more clearly and supports nuanced engagement in part because the media supports the ability to display non-verbal communications (Borup et al., 2014).

LIGHTBOARD TECHNOLOGY

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At Grand Valley State University faculty members who incorporated video presentations in their classrooms perceived a problem with standard technologies related to communication clearly and engaging with learners in nuanced ways. Specifically, the standard video presentation technologies forced instructors to turn their backs on their students to see and to manipulate the video content these instructors were projecting to the front of a classroom.

Our home-grown solution has been to build instructional Lightboards using the "Lightboard" open source hardware design developed by Michael Peshkin from Northwestern University and adapting these designs to better fit our needs (Peshkin, 2017).

The Lightboard is a custom-built 4x6 foot piece of glass, attached to an aluminum frame, with high-intensity LEDs mounted to the top and bottom of the glass. The materials we used to create our Lightboard frame cost roughly $900. We sourced the glass sourced from a local vendor for $350. The electronics we used are priced at around $100. Beyond these materials, we also used 3D printed pieces to mount the glass to the frame, though these 3D printings were provide to the university at no cost. To reduce glare when recording our Lightboard videos, faculty members use a typical studio lighting kit and a camcorder with a polarizing filter. Once a recording is finished we use video-editing software to clean up the footage and add institutional branding.

PRODUCTION RECOMMENDATIONS:
The authors recommend that practitioners and researchers review the following tips prior to filming a Lightboard video. We recommend that instructors do not wear clothing with prints, logos or words. Avoid wearing jewelry and shiny objects during filming, as these can reflect the lights and create artifacts in the final video. It is also essential to be aware of the space of the Lightboard and to leave borders on the glass wall. Video segments should be concise (5-7 minutes in duration, at most) and lecturers should plan in advance to avoid the need to erase during the filming. PowerPoints can be superimposed on the recording to assist in time management and to minimize the amount of time required for hand writing. Finally, have a script in mind regarding is to be covered in the video since stopping and starting is difficult and optimally videos should be recorded as one continuous segment

What makes use of the Lightboard different from use of all other classroom board work is that the Lightboard enables instructors to face "toward" students when writing on the board. When using the Lightboard, instructors write text on a glass that is brightly illuminated such that text is highly visible on the board (Figure 1).

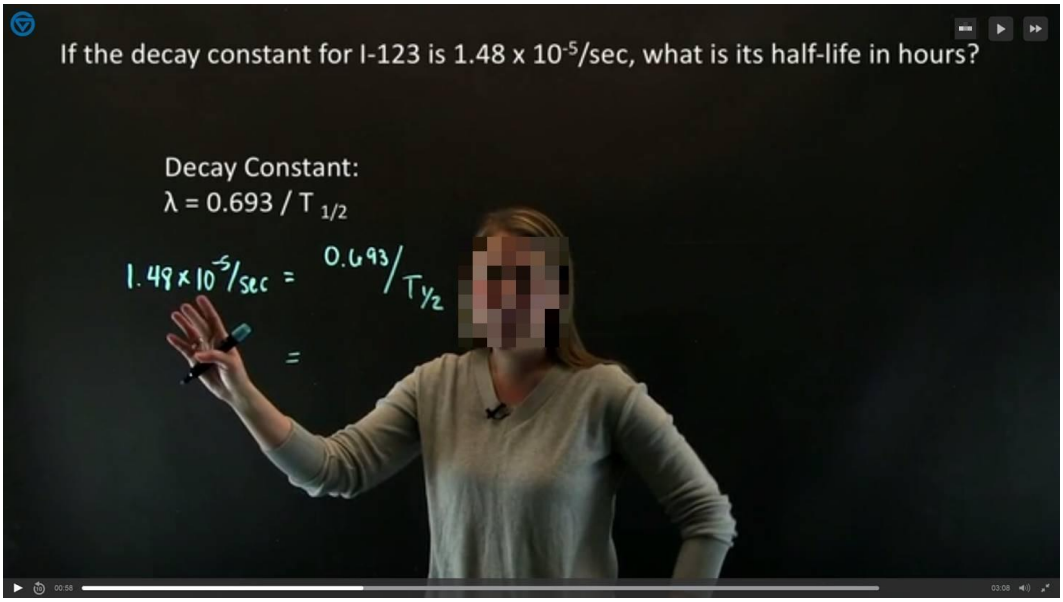

FIGURE 1. Lightboard example demonstrating brachytherapy equations.

In the raw footage of the recorded lecture, the writing on the Lightboard is reversed, but the image is digitally flipped during the post-production editing process. The edited lecture capture recording is then published to a video host server. Learners access the video via links embedded in a course shell within a learning management system.

Instructors who lecture using a Lightboard face the learners who attend the live lecture being captured for later playback. Instructors and students involved in these live lectures indicate feeling a sense of engagement and connection. Moreover, when using the Lightboard, an instructor is filmed "facing" the camera and therefore appears to be facing the remote, asynchronous learners who access the lesson as a lecture captured video, after the fact. Our preliminary findings suggest this learning situation provides learners with a strong sense of student-to-content and student-to-faculty engagement.

The aim of our modest field notes study has been to assess the use of Lightboards built using Michael Peshkin's hardware design (Pesking, nd) as a modality to address key complex concepts pertaining to medical dosimetry such as brachytherapy. Medical dosimetry is a highly sophisticated radiation oncology discipline, which uses advanced technology (CT, MRI, PET & radiation treatment planning systems) to create 3D, 4D radiation treatment plans. The goal of such treatment plans is to ensure a physician-prescribed radiation dose will be

delivered in the best way possible to maximize tumor effect and to minimize dose to surrounding organs and tissues.

For this preliminary study, we gathered data regarding students' perceptions of the impact of the use of a hybrid video technology (the Lightboard) on students' interest levels and understanding of brachytherapy equations. We are sharing these field notes because we suspect that the insights we obtained from our survey results could be used by other educators to improve their own delivery of similar content, and should be built upon by researchers exploring this technology more systematically and comprehensively.

METHODS

CREATION OF LIGHTBOARD

The concept of a Lightboard video technology was developed by Michael Peshkin at Northwestern University (Grand Valley State University, 2017). Our Lightboard is largely based upon Peshkin's concepts with a few alterations made to fit our needs. The university's eLearning and Emerging Technologies Department has a dedicated web presence with documentation regarding how to construct a Lightboard, which information can be accessed readily at https://www.gvsu.edu/elearn/digital-studio-gvsu-lightboard-8.htm.

POPULATION

At Grand Valley State University, Medical Dosimetry is a graduate level program. Our study participants comprised one graduate level cohort of Medical Dosimetry students. The students were enrolled in a required Medical Dosimetry II course. The ten students in the course, all of whom were over 18 years of age, were sent a survey provided below as "Table 1."

PROCEDURES

Following institutional review board approval, data were collected using an online survey instrument administered through SurveyMonkey. The survey was distributed by email through SurveyMonkey in the summer of 2017. Included were a study cover letter and the online link to the survey. The subject line of the email referenced *Use of Lightboard Technology to address Medical Dosimetry Concepts*. One email reminder was sent to the students, to improve response rate. The results were downloaded from the survey site and analyzed with assistance from the University's Statistical Consulting Center. A total of eight questions were analyzed (six quantitative and two qualitative).

RESULTS

Two email messages inviting survey participating were sent to each of the10 participants in a Medical Dosimetry II course. Eight out of the 10 students completed the survey for an 80% return rate. A majority of the students either strongly agreed (n=1; 12.5 %) or agreed (n=5; 62.5%) and no students disagreed (n=0; 0%) that the use of Lightboard videos provided them with the necessary information to understand the concepts of brachytherapy. Additionally, students either strongly agreed (n=1; 12.5%) or agreed (n=7; 87.5%) that the use of Lightboard videos provided them with the necessary information to complete the brachytherapy homework problems assigned. While the sample size of our study precludes generalizable statistical significant we were encouraged that those surveyed were so predominantly satisfied with the learning they achieved using the Lightboard technology. Table 1 provides a complete summary of the response completed by the eight students.

Table 1. Use of Lightboard Technology to address Medical Dosimetry Concepts: Survey Responses.

Survey Question	# of Responses	Percentage
I found the Lightboard videos engaging and easy to understand.	Strongly Agree *n*=2 Agree *n*=6	Strongly Agree 25.00% Agree 75.00%
By being able to watch a Lightboard video of the brachytherapy problem prior to performing the homework, I felt prepared for the exercise.	Strongly Agree *n*=1 Agree *n*=7	Strongly Agree 12.50% Agree 87.50%
I have more confidence in my ability to perform brachytherapy problems now that I have the Lightboard videos.	Strongly Agree *n*=1 Agree *n*=5	Strongly Agree 12.50% Agree 62.50%
I understand the brachytherapy concepts better by watching the	Strongly Agree *n*=1	Strongly Agree 12.50%

Lightboard videos.	Agree *n*=5	Agree 62.50%
Would you like to see more Lightboard style videos in future courses?	Yes *n*=8 No *n*=0	Yes 100% No 0%
Disagree	n=1	12.50%
Neither Disagree or Agree	n=1	12.50%

Students were also asked to provide responses to two open-ended questions regarding the Lightboard videos. Students were asked what features regarding the Lightboard videos they liked and did not like. A majority (n=8) indicated as positive the ability to see the instructor perform the calculations pertaining to brachytherapy. Two of the eight students who responded to the survey provided qualitative comments, which read as follows:

> *Student 1:* I liked being able to work step by step along with the teacher which is extremely helpful when doing math problems.
>
> *Students 2:* I liked how I was able to see the professor writing out problems. It made for a more engaging experience compared to watching a PowerPoint lecture

DISCUSSION

Limited data from our field notes study suggests that Lightboard video technology meets the students' need for clear and informative video lecture. The technology seems especially valuable for instructors in health, science, math or technology fields who often must explain complex processes using illustrations. In this course the instructor used multiple video formats, such as recorded PowerPoint lectures explaining the concepts and for the brachytherapy problems both Elmo document camera recordings and Lightboard videos. Both recording techniques were effective in that the students learned and retained the material, as shown through the final exam.

The Lightboard videos help increase instructor presence, which is important when teaching online courses since the personal interaction in an online class is reduced compared to in seat courses. All the students responded positively

to wanting more Lightboard videos in the future and the qualitative comments lead us to believe that seeing the professor is beneficial to the students.

Lightboard videos can also be useful in flipped classrooms. Making lecture materials available for students to review prior to attending class, class time is freed up to engage students in experimentation, as well as in dialog regarding best practices and metadiscourse on the learning process of students. The videos can be useful for students who need the complicated problems explained more than once, those students are able to view the video as many times as needed and pause them as necessary.

CONCLUSIONS AND FUTURE STUDY

Overall, at Grand Valley State University, we have found the use of Lightboard Video Technology provides a stable pedagogical framework to convey complex concepts pertaining to Medical Dosimetry such as brachytherapy equations. The use of Lightboard Video Technology is a useful tool in explaining course content, specifically in complicated math problems that require multiple steps. Our limited study of student survey responses indicates that our students respond well to and learn efficiently from Lightboard Video Technology recordings. We therefore intend to continue to use the Lightboard in online courses. Lightboard Video Technology is a novel way to present material in that it allows faculty to face the viewer while draw diagrams, equations, or formulas such as the equations for brachytherapy. We believe that Lightboard Video Technology warrants further research and expanded use in the educational professional as an emerging educational technology that holds promise for effective delivery of a range of complex medical concepts. We would suggest as future study designs the following:

- a control study that compares traditional (back to learner) video capture technologies to Lightboard (front facing) video instruction on particular (apples to apples) learners.
- a study (survey study) of instructors as well as learners' perceptions. Ease of use, time comparison, frequency of questions from students, test results
- a control study that compares screen capture only video technologies (Elmo, PowerPoint) to Lightboard (front facing) video instruction on particular (apples to apples) learners.

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Justin Melick is a Digital Media Developer at Grand Valley where he works with faculty to create a variety of digital content for their courses. Specifically Justin works with faculty to increase instructor presence in online and hybrid courses and is responsible for building and pioneering the use of GVSU's Lightboard.

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