Exploring Video Projects and Media Literacy in a Computer Networking Course

Dr. William E. Genereux, Kansas State University Polytechnic Campus

William Genereux is a Professor of Computer & Digital Media Technology at Kansas State University Polytechnic Campus. He holds a Ph.D. in curriculum and instruction, and has research interests in computing education, media literacy and the educational use of digital media technology. He has been working with computers and technology for the past 30+ years.

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Abstract

This research paper examines the use of a video project for technical communication in a computer networking course. Communication skills are of critical importance in science, technology, engineering and math (STEM) areas. However, communication is often a topic not directly emphasized by STEM educators in the courses they teach. One form of communication that is increasing in significance due to advances in digital technology is digital video. Video is now a primary source of information, yet most people are only consumers not creators of video. In essence, they are not literate in a common form of communication.

In this study, we explored the impact of requiring a video term-paper project to address the desired educational goals of increasing student ownership of learning, learning course-related concepts, and providing evidence of communication skills and media literacy skills. Study participants came from convenience samples drawn from a computer networking course and from a general education writing course offered on a small branch campus of a large research university. The participants were college students having varying levels of familiarity with the skills examined.

The study design used mixed methodologies, including a quasi-experimental, two-group control/intervention, student surveys, and qualitative interviews. The quasi-experiment consisted of pre- and post-test measurements of media literacy for the two groups, and an intervention of a video term-paper research project completed by the intervention group. Additional data were gathered from student surveys and interviews conducted with the intervention group.

The quasi-experiment did not provide evidence that the video project intervention increased knowledge of media-literacy concepts. However, other data indicated that the video project did demonstrate communication skills and that the project was a relevant challenge that engaged students in active participation in their learning.

Introduction

We now live lives immersed in digital technologies. From mobile smart phones to high-speed Internet connections to video on demand and digital video recorders, the trappings of always-on digital media are ubiquitous in our culture. This affects each of us positively and negatively, but rarely do we stop to consider exactly how we are being affected.[1,2] Neil Postman called for meaning-making to counter the negative effects of media by obtaining a sophisticated understanding of it. He stated that "only through a deep and unfailing awareness of the structure and effects of information, through a demystification of media, is there any hope of our gaining some measure of control over television, or the computer, or any other medium." [3]

College students of today have lived their entire lives immersed in various media technologies. Young people are typically thought to be technologically fluent because of their affinity for using digital tools. They have been described as the "net generation"[4] and "digital natives".[5] However, several studies examining the technological proficiency of college students demonstrated that although some technologies are very popular, the more complex a tool or task is, the less likely it

will be used.[6] In a time of the greatest-ever access to powerful communications technologies,[7] college students, like most people, are still much more likely to be consumers of digital media than they are to be creators of digital media.[8, 9]

Communication and other interpersonal skills can often make or break the career of an engineer. J. Ben O'Neal[10] notes that "most engineers are limited in their career not by a lack of technical knowledge, but by an inability to reason verbally, communicate their ideas to others, and furnish leadership." Communication is a skill that is recognized as important by the field of engineering but is traditionally taught by other faculty instead of directly within engineering courses and curricula.[11] A 2008 survey found that 94% of computer science professors characterized written communication as an important part of computer science education, but fewer than half of them included writing assignments in their own courses.[12] Garvey wrote that some STEM professors may feel inadequate or unqualified to teach writing while others lack interest or willingness to use course time for this purpose.[13]

Media scholars are redefining what should count as literacy and communication. According to Renee Hobbs, "a text doesn't have to be written. A pop song is a text. So is a movie. Text can be defined as symbolic expressions created by humans to share meaning."[14] Elizabeth Daley suggests, "those who are truly literate in the twenty-first century will be those who learn to both read and write the multimedia language of the screen."[15] Therefore, an important aim of this study was to explore an expanded notion of literacy that includes "reading" and "writing" with Daley's "language of the screen" in the form of digital videos.

Video Projects in STEM Courses
Digital video-making technologies became available to ordinary consumers in the early 1990s,[16] but most areas of higher education were slow to adopt digital video technology as a valid communications medium.[17] H. Schmidt found that if students have ever made a digital video for a school assignment, they were more likely to have completed such projects in high school than when taking college courses.[11]

Although video project assignments in higher education appear to be uncommon outside of a few majors where media-making is a central theme, some examples of noteworthy STEM course video projects exist. These include a "Solubility Rules" assignment in an introductory chemistry class,[18] an assignment in a neuroscience course about neurotransmission or the scientific method,[19] an assignment in a chemical engineering course on thermodynamics,[20] another introductory thermodynamics assignment,[21] a graduate level course in construction estimating,[22] and an assignment in a structural design course.[23]

Only two of the aforementioned STEM studies directly assessed the impact of the video projects on student learning outcomes. Lichter's optional "Solubility Rules" video assignment was for extra credit in an undergraduate chemistry class. Students who completed that video project outperformed students who did not on an exam that assessed knowledge of the solubility rules.[18] Jarvinen et al.[19] assigned a video project to two different sections of an undergraduate neuroscience course. One section was assigned the topic of "the scientific method" while the other section was assigned the topic of "neurotransmission." Students in both sections scored higher on exam questions related to the video topic assigned to their respective section; the

"scientific method" students outperformed "neurotransmission" students on scientific method questions, while "neurotransmission" students outperformed "scientific method" students on questions pertaining to neurotransmission.

Research Questions

Because creating digital video is not a widely accepted form of communication expected of undergraduate students, the following research questions were proposed for this study:

1. Does learning differ between students who create media while receiving media-literacy instruction and students who receive media-literacy instruction alone without creating any media?
2. Do "video term-paper" projects and lessons in media literacy improve student engagement and ownership of learning in a STEM course?
3. Do "video term-papers" produced by students demonstrate evidence of communication skills and of learning content in a STEM course?

Study Design and Results

The study design used mixed methodologies, including a quasi-experimental, two-group control/intervention, student surveys and qualitative interviews. The quasi-experiment consisted of pre-and post-test measurements of media literacy for the two groups, and an intervention of a video term-paper research project completed by the intervention group. Additional data were gathered from student surveys and interviews conducted with the intervention group. All study procedures and instruments were reviewed and approved by the institutional IRB committee. The following sections provide information about the various methodologies and instruments used in the study.

Media Literacy Quasi-experiment

Study participants in the media literacy quasi-experiment came from convenience samples of undergraduate students drawn from a computer networking course taught by the researcher and from a general education writing course taught by an interested colleague on a small branch campus of a large research university. Most of the classes offered on the campus where this study occurred are small in size, often having only ten or twelve students to a class. However, the computer networking course is one of the larger STEM classes taught on campus, providing a good sample size of 35 students enrolled at the time of the study. The networking course was designated as the intervention group. With no other similarly sized STEM course, a writing course having 25 students offered on the same campus was selected as the control group by convenience, because it was larger than typical campus class sizes, and because it contained some students studying in STEM majors.

The quasi-experiment was designed to measure the media literacy of student participants in the control and intervention groups before and after an intervention of a student-made video term-paper project. The pre- and post-tests consisted of viewing a series of three short videos (a news broadcast, an advertisement, and a public service announcement) and responding to a media literacy instrument before beginning and again after completion of the video term-paper project. Both control and intervention groups received 45 minutes of media literacy instruction after viewing the first set of videos.

The media literacy instrument was developed in a style similar to that of previous work of Hobbs & Frost [24] Arke & Primack, [25] and Ashley, Lyden, & Fasbinder.[26] Using Hobbs' [14] conceptual framework of media literacy of "access, analyze, create, reflect and act" as a guide, the instrument's questions were:

1.) Who is the sender of this message?
2.) Describe the main message of the video using your own interpretation.
3.) Are there other possible interpretations of this video's main message?
4.) Who is the target audience of this video?
5.) What specific techniques are used in this video to attract and hold your attention?
6.) What is the purpose of this video? Check all that apply: ___ inform ___ entertain ___ persuade ___ self-expression ___ make money ___ teach ___ gain power or influence

Quasi-experiment results

The maximum possible pre- and post-test score on the media literacy instrument was 36. Mean scores, standard deviations, and t-test p values for the control and intervention groups are shown in Table 1.

Table 1 - Video Viewing Media Literacy Scores

		Pre-Test		Post-Test		
Group	Participants	Mean	SD	Mean	SD	t-test
Control	n = 16	25.00	3.59	24.00	2.42	$p = 0.20$
Intervention	n = 22	23.45	2.98	23.55	2.82	$p = 0.45$

The time between conducting pre- and post-tests was approximately one month. The number of intervention group participants appearing here in the quasi-experiment (n=22) differs from the total number of videos created (n=29) because study participants who completed videos but did not complete both the pre-test and post-test were excluded from this analysis. Mean score comparisons of the pre- and post-tests showed a decrease for the control group (25.00 to 24.00) and an increase for the intervention group (23.45 to 23.55). T-tests were used to measure the difference in scores between pre- and post-testing for each group. A one-tailed, paired t-test was computed on the pre- and post-test results for both the control and intervention group. Neither group indicated a statistically significant ($p < 0.05$) improvement in media literacy scores from the pre- to post-test (Control, $p = 0.20$; Intervention, $p = 0.45$).

Video Term-paper Project Intervention

The intervention part of the quasi-experiment design was the video term-paper project assigned as a research project to students in the intervention group. The project required researching a topic related to computer networks or the Internet and creating a video "term-paper" that shared what they had learned with classmates and other viewers on YouTube. Two weeks of a 16-week computer networking course were allocated to work on this video project. Students in the intervention group received instruction on critical viewing of videos as well as guidance on techniques related to making and editing videos for communication with a broad audience. Control group students only received instruction on critical viewing of videos. This design was used to determine the impact of assigning the video term-paper on student media literacy.

Requirements of the video project included:

- Create an original video essay that informs the viewing audience about a particular topic related to digital computer networks and/or the Internet.
- Length of video is between 2 - 4 minutes, including credits. No more, no less.
- The video must be uploaded and made available for public viewing on YouTube. You may publish under an anonymous pseudonym that does not identify you.
- Like a well-written research paper or informative speech, the video should have a clear and logical structure with an introduction, body and conclusion.
- The video should not be an opinion piece, but rather be the result of research you have conducted about your topic, with arguments supported by credible, authoritative sources.
- All sources used must be cited in the video credits or in the video description on YouTube.

Video Project Assessment

Worsnop suggested that media assessment can be accomplished by modifying accepted means of assessment for written communication.[27] Following this recommendation, a rubric for assessing the student videos was created by using the Association of American Colleges and Universities VALUE (Valid Assessment of Learning in Undergraduate Education) rubric for written communication as a guide.[28] The language of the new video assessment rubric was modified to suit a video project, but the assessment aims remained largely unchanged, using the same four point scale as the VALUE rubric format.

A three-person assessment team consisting of a writing professor, a communication professor, and a computer technology professor evaluated 29 videos created by participants in this study using the video assessment rubric. The rubric included five categories: 1) Ideas, Content & Purpose, 2) Organization & Structure, 3) Voice & Creativity, 4) Delivery, Visuals and Aesthetics, and 5) Technical Requirements. Individual raters on the assessment team assigned scores for each category on a Likert scale ranging from 1 (beginning) to 4 (exceptional). With 4 points possible in each of the five video assessment categories, the maximum possible rubric score was 20. The three raters individually calculated a score using the rubric for each of the 29 video projects. These three scores were then averaged to determine a final score for each video. These final video assessment scores ranged from a low of 9.83 (49%) to a high of 19.50 (95%). The mean score for all 29 videos was 16.36 (82% of the maximum 20 points) with a standard deviation of 2.66. A breakdown of this assessment by the five rubric categories is shown in Table 2.

Table 2 - Video Project Assessment

Video Assessment Categories	Mean Score	SD	Ratings			
			1 (Beginning)	2 (Developing - low)	3 (Developing - adequate)	4 (Exceptional)
Ideas, Content & Purpose	3.38	0.55	0	2	10	17
Organization & Structure	3.29	0.58	0	2	11	16
Voice & Creativity	3.14	0.69	1	3	12	13
Delivery, Visuals and Aesthetics	3.19	0.57	0	3	14	12
Technical Requirements	3.36	0.67	0	4	8	17

Survey - Student Perceptions of the Video Project

After completing the video term-paper project, students in the intervention group responded to a survey of their perceptions of the assignment. Of the 29 students who submitted a video project for evaluation in the study, 25 students completed the survey, for an 86% response rate. Students responded to each statement of the survey using a Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). An overview of the results of the survey is shown in Table 3. The mean scores for the statements ranged from a low of 3.76 to a high of 4.08, with most of the statement averages located in close proximity to 4.00, indicating general agreement with the statement.

Table 3 - Student Perceptions Survey (n=25)

Item	Mean	SD
Consider video to be a valid form of professional communication	3.92	0.84
Understand how professional TV & film are created	3.92	1.09
Be a better communicator in my life and career	3.76	1.11
Increase my interest in learning about computer networking	4.04	0.92
Enjoy the networking class more	3.80	0.94
Work hard at being knowledgeable on my topic of research	4.08	0.84
Recommend this project for future students	3.88	1.11

Student Interviews
The researcher/course instructor developed the interview protocol that was later reviewed for validity by two expert faculty members in communication and in computer technology. The researcher conducted and recorded qualitative interviews with nine students who completed the video project and who were volunteers recruited in class and by e-mail. Of the nine volunteers, two were female students, and seven were male students. The video-making ability of the nine interviewees was varied and somewhat representative of the entire class. The video assessment mean for the class was 16.36 out of 20.00 (SD=2.66) while the mean for the interviewees was 14.88 (SD=2.69).

Although nearly a third of the students were interviewed, because the interview sample came from volunteers and not randomly selected, the interview results should be viewed with caution. The volunteers would likely view the assignment more positively than a random sample would have. It should be noted that not everyone liked the assignment. Two students in the class decided not to even make a video and received a zero for the required assignment. This decision effectively lowered their semester grade in the course by one letter grade. Unfortunately, it was not possible to interview those two students to learn more about their opt-out decision.

Upon completion of the interviews, the researcher transcribed and coded them using a coding system he developed to document the themes that emerged within the question categories. Interviewees each were asked 20 questions from three general categories: 1) technology, 2) communication, and 3) learning. Questions in the technology category inquired about how

students dealt with technological issues that arose while making their videos. Questions in the communication category investigated how the video project affected the students' ability to communicate and interpret media effectively. Questions in the learning category explored how students felt the video project helped with their learning of the networking course material, their engagement in the course, and of the usefulness of video communication in the future.

Regarding technological issues, two themes emerged in the interviews: one concerning the loss of project data and a second relating to the need to improve computer and video-editing skills. Of the nine interviewees, three mentioned having some sort of technical glitch that caused a loss of project data, and six mentioned needing to improve their skills with using a computer and/or the editing software. One student offered:

> *I spent eight hours on my project, and I lost my flash drive. So I learned to back it up. I have an external hard drive now so I can back up to it. When you said to make a backup in the lab, I just made a copy on the same flash drive. I never thought of losing my flash-drive.*

In terms of demonstrating communication skills, seven of the nine students interviewed had developed a planning document to assist with the organization and planning of the video project. While such a document was recommended for completing the project, there was no required template or format assigned. Two of these students made simple outlines, while five others developed a more complex planning document, such as an essay, script, or storyboard. Those who lacked planning documents and those who worked from simple outlines seemed to have more difficulty keeping their thoughts organized than did those who had developed the more complex documents. One student developed a script:

> *I wrote it out, it was a script. I turned it into an essay format, then I changed it around so it would flow better with video. Sometimes essays don't really translate. Every sentence is followed by a pause and a picture. It would lead into the next sentence. I tried keeping everything connected.*

With regard to learning the course concepts, the responses of the interviewed students were mixed. Six respondents were able to describe at least one way in which the project helped them learn about some content component of the networking course, while three were not able to make a connection between their work on the video project and learning in the course. However, when asked if they could explain their topic to a friend who had limited knowledge in the area, all of those interviewed agreed that they could, and one student stated that such conversations had already happened. He said:

> *Yes, I think I could do that very comfortably. When I was talking to some of my friends, they were like what is W3C? So I kind of had to explain it to them a little bit.*

Another student stated:

> *I now have a much stronger connection between this class and my chosen subject so I can see how it's applied in different areas. But this has definitely given me a new way to think about it and applying these concepts.*

Discussion of the Research Questions

In this study, we explored the impact of requiring a video term-paper project to address the desired educational goals of increasing student ownership of learning, learning course-related concepts, and providing evidence of communication skills and media literacy skills. The study occurred on a small branch campus of a large research university and is intended to report what happened on that campus. Although reporting the results of the study may be helpful to others interested in doing video assignments similar to the one described here, the mixed methodologies used in the study are not appropriate for generalization of results beyond the population of the campus where the study occurred.

Research Question 1. Does learning differ between students who create media while receiving media-literacy instruction and students who receive media-literacy instruction alone without creating any media?

The quasi-experiment did not provide evidence that the video project intervention increased knowledge of media-literacy concepts. While both control and intervention groups received 45 minutes of media literacy instruction after the pre-test, the control group score decreased from pre- to post-test and the intervention group score increased only slightly. This is perhaps due to a single media project being insufficient to greatly alter or enhance student understanding of media literacy. In this study, the control group only passively viewed videos while the intervention group actively participated in creating video in addition to viewing videos. Future studies could examine how repeated opportunities for making video compares with passive video viewing for developing media literacy skills.

Research Question 2. Do "video term-paper" projects and lessons in media literacy improve student engagement and ownership of learning in a STEM course?

Three statements on the student perceptions survey were designed to measure the level of student engagement and ownership of learning in the course. These were "*Increase my interest in learning about computer networking*" (M=4.04, SD=0.92), "*Enjoy the networking class more*" (M=3.80, SD=0.94), and "*Work hard at being knowledgeable on my topic of research*" (M=4.08, SD=0.84). Each of these survey questions scored above the neutral score of 3.0 on the 5.0 scale, indicating an overall positive outcome of student engagement and ownership of learning. Some of the interview questions helped to establish engagement and ownership of learning as well. Students discussed the class and the video project with friends and family members. Some students described how little they initially knew about computers and technology and how the project caused them to dig more deeply into the subject.

Research Question 3. Do "video term-papers" produced by students demonstrate evidence of communication skills and of learning content in a STEM course?

Direct assessment of the student-made videos provided evidence of students using the video medium as an effective communication tool, with the majority of the projects assessed scoring a 3 or 4 out of 4 possible on all dimensions examined in the video project. The student perceptions survey also provided some additional evidence for communication skills. "*Consider video to be a valid form of professional communication*" (M=3.92, SD=0.84), "*Understand how professional*

TV & film are created" (M=3.92, SD=1.09), "*Be a better communicator in my life and career*" (M=3.76, SD=1.11). Each of these student survey questions scored above the neutral score of 3.0 on the 5.0 scale, indicating a positive outcome in the communication area.

The results of the interview data were mixed with regard to learning course related content in the video project. Six of the interviewees were able to relate at least one idea of how the assignment helped them to learn material in the course, while three were not. However, the direct video assessment category for "Ideas, Content & Purpose" was the highest scoring category (M=3.38, SD=0.55), suggesting that the learning of course-related material was actually happening with the video assignment.

If possible, future explorations of video assignments should attempt to include the perspective of students who are resistant to video assignments in STEM courses. It is understandable that some students would be hesitant to participate in a video assignment, given that most college students are not media creators.[8, 9] However, hearing these reluctant voices may give insight on improving these kinds of assignments so they are relevant to a wider range of students.

Overall, the data from this study suggest that including the video project in the course was a worthwhile endeavor that promoted student engagement and learning. To view a current playlist of the networking student video projects described in this paper, please visit https://goo.gl/swt8yn or use the following QR code:

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