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Science teachers as video content producers: An Analysis of Science Videos on TeacherTube

Introduction

The growth and penetration of the Internet has touched every sector commerce and culture across the globe. Education is, of course, not untouched by these radical changes in information dissemination. Although the extent to which the Internet has, and ought to, impact traditional K-12 education is a matter that is currently up for great debate (Bonk, 2009; Cuban, 2003), there can be no question that technology has made an indelible mark on how the students learn, think, and communicate (Gee, 2007; Lenhart, Purcell, Smith, & Zickuhr, 2010; Livingstone& Bober ,2004; Wolf, 2007). Several scholars have voiced concern that teachers at the K12 level might be "digital immigrants", struggling to effectively integrate technology into their teaching practice. (Bennett, Maton,& Kervin 2008; Jones, Ramanau,Cross, & Healing,2010; Prensky, 2001). As a former teacher, educational media producer, and now a school-based technology specialist, I find myself in a lot of online communication with other educators who make great use of Web 2.0 technologies such as Youtube, Twitter, and Facebook to enhance their professional lives. While these educators are by not necessarily representative of the majority of K12 educators, their numbers grow greater every year, but there has been little work investigating them or their digital products by the educational research community. To be sure, as social networking and video sharing become more popular over time (Jenkins,2009), it is reasonable for us to expect to see an increased presence of user-generated media in the classroom or as part of teacher development. However, considering the decades of scrutiny all manner of curricular material has recieved from scholars over the decades (Provenzo, et al., 2010; Strickland, 1962), very little research has been done to characterize the nature of user-generated educational content at the K12 level. In what follows, I illuminate my professional interest in teacher-generated web content in general, and the nature of the science content found a specific user-generated site in particular. My hope is that in defining the scholarly problems that exist in this new space, I can generate interest and awareness in the educational research community in this new frontier of curricular material.

My interest in teacher-created media

In my work with teachers fresh out of their undergraduate education, I meet young teachers that never known a profession in which learning interactives or lesson plans could not be Googled. As a result of these experiences, I have noticed that the Internet has changed teaching and teachers, and these changes have been under-researched and under-theorized.I am especially interested in teacher-creation of education/ pedagogical artifacts. I make no claims that this is universal, my experience as a teacher, curriculum designer, and teacher trainer, have long demonstrated teaching to be a highly collaborative profession for some. With the Internet's potential for global outreach, and the advancement of media production tools, such teachers have the potential to share items of increasing technical sophistication with wider audiences than ever before. But what I saw in my day-to-day work with teachers didn't necessarily translate to online spaces. When writing a competitive analysis for a very large, public media organization in the US, (the details of which I cannot share, but merely mention as a way to describe my own point of interest), I discovered that many websites had been launched in attempt to foster these teacher collaborations. My speculation is that such websites were likely borne out of the same anecdotal beliefs that teachers love to share their curricular creations. However, it seemed that few of these websites survive very long and even those that do survive, do not achieve notable user traffic. For this reason, those sites that do accomplish this difficult feat are of great interest to me, and this experience has greatly shaped my scholarly interests.

For this study, I hope to pursue a mixed-methods analysis of science-education videos found on the video-hosting website, TeacherTube (www.TeacherTube.com) by examining 100 of the most recent videos posted throughout the examine phenomenon such as, what genre of science education videos are educators posting (for example: how-to videos, content lessons meant for students, examples of student work, professional development videos, expositions on teaching theory, science demonstrations, etc.,)? In order to further enrich our understanding of what teachers are producing and sharing, I would like to delve into the type of science that is being communicated in these videos in terms of subject and targeted grade levels, and, to focus on a particularly vexing concern in the science education research community, what epistemology of (or dispositions toward) science are being communicated in these videos? Because we are not studying the people sharing these videos, but rather the artifacts shared, such an analysis may tells us more about what types of information the medium of user-generated video affords than it does about teachers' pedagogies or beliefs. This remains an important issue to examine because this medium is proliferating, and its boundaries and limitations are not well understood. I will examine what role "school" play in the videos in order to determine how the videos "locate" themselves as instructional tools(for instance, do they speak of learning standards or test-taking strategies? Are they completely content-driven or agnostic of the school setting?) Finally, what are the relationships among genre, subject, targeted grade level, and scientific presentation and viewer response, as measured by the amount of views and "favorites" the video has obtained?

In what follows, I will make the case that the Internet's facilitation of user-content creation and content sharing has dramatically altered traditional publisher-audience roles, and allowed individuals access to previously unheard of access to world-wide distribution. Teachers might be a small percentage of these overall content creators, but they are content creators nonetheless, and their contributions should be recorded and analyzed so that we can better understand the challenging and evolving role of the science educator in the 21st Century. Finally, I will discuss my framework for the analysis of curricular material that pertains specifically to science education.

From Producers to Consumers

One critical change the Internet has had on culture is the facilitation of media creation and dissemination. The expense and scarcity of media distribution that once required content producers to rely on publishing houses, recording companies, printing presses, and movie studios is now obsolete. Any individual with access to technology now has the opportunity to create and distribute his or her work, and this has significantly changes the landscape of every information-based industry. Record companies struggle with obsolete revenue-generating models, book-publishers panic for relevance, journalists compete with bloggers, and user-content generated sites like Youtube and Vimeo birth pop-cultural phenomenon that exceed the viewership of network television programming. A father with a camera phone and nitrous-oxide induced son can now garner more eyeballs than a prime-time show on cable news. In this changing media landscape, we need to understand how the practice of teaching adapts to and responds to these changes.

The most popular video sharing service, Youtube, has thousands of videos created for the express purpose of teaching users a variety of skills ranging from knitting, building a computer, drawing, cooking a particular dish, house-training a dog, and everything in between. In March

2009, YouTube announced the launch of YouTube EDU (http://www.youtube.com/edu), where viewers an find an organized collection of YouTube channels produced by college and university partners. At the end of its first year, YouTube EDU had grown to include more than 300 colleges and universities and over 65,000 videos of lectures, news, and campus life. These are freely available for public viewing (Greenberg, 2010) and these videos are only a portion of the content on YouTube with potential educational value. The exact quantity of online video available via Web 2.0 sites is unknown, but the figure has been estimated at nearly 35 million hours (Snelson) of video content. A report from Pew Internet & American Life suggests that 69% of U.S. Internet users watch or download video online and 14% have posted videos (Purcell, 2010). Video accounts for 26.15% of global broadband traffic (Cisco,2010) with over one third of the 50 most heavily visited websites being video sites. Internet traffic rankings from Alexa (2010) and comScore (2010) reveal that YouTube is the most highly visited video destination of them all.

Teachers as producers

Youtube caters to a wide audience with interests so vast it exceeds the scope of this study. On a more practical level, Youtube is often blocked in schools and thus the material available (or not) to teachers would be mostly irrelevant within the instructional day. This study is an attempt to characterize the current state of content creation and sharing that exists on one particular content sharing site called TeacherTube. TeacherTube is a video sharing site that is similar to Youtube. Despite its potential educational usefulness, Youtube contains a great deal of content that could be vexing for K-12 schools and as a result, TeacherTube has found a niche among educators as it boasts the same user-friendliness and accessibility as Youtube but with a greater control for school-appropriate content. As of July 2008, TeacherTube contained over 26,000 videos and as of October 2010, it had over 725,000+ educational members and over 200,000 educational videos . The site gains more than a million page views per month. TeacherTube was launched on March 6, 2007 and was initiated by Jason Smith, a Superintendent from Texas, his wife, and younger brother.

The power of user-generated video for education is readily apparent. To be sure, teachers have long been innovators and creators of their own professional tools, and sharing those tools is a long-standing tradition among teachers. Sharing lesson plans, worksheets, and booklets locally has long been a part of the K-12 teaching profession. What has changed more recently has been teachers' access to video production software and the Internet's ability to provide for far-reaching video dissemination opportunities. TeacherTube is one of the most successful and "sticky" of all teaching-content sharing sites and as such, makes it ripe for analysis geared toward better understanding what teachers are sharing and what the audience likes to see. While there has been a good deal of scholarly interest in student-aged children's production of digital media (Ito, 2007; Jenkins, 2009) there has been relatively little research on teachers-as-producers or teacher produced artifacts.

Scientific Content on TeacherTube

Of course, with such an enormous volume of web video, it would be impossible to analyze the site as a whole. A researcher needs to focus in on a targeted "channel," that is, a part of TeacherTube that groups together like content. This study focuses on the science channel. In what follows, I will outline why the science channel is of particular interest to me as a researcher. Due to my background as a former high school chemistry and physics teacher as well as a science education game designer with National Geographic, I am especially interested in how science is portrayed on TeacherTube. Since the Cold War, science education has been comparatively well funded, particularly by government and industry (Rudolph, 2002; Chmiel, 2006) because it was perceived as the key to keeping the US ahead in the race for innovation, especially as it pertained to weaponry. Current government administrations cite science as the key to economic prosperity. Concern about the character of American science education has been a perennial issue (Schwab, 1962; NCEE, 1989; Martin, Mullis, Gonzales, & Chrostowski, 2004), but current calls for scientific literacy emerge from the recognition that, "science is no longer the specialized activity of a professional elite" (Wilson, 1998, p. 2048). With U.S. citizens increasingly showing a lack of understanding in areas of scientific consensus like climate change (Jakobsson, Mäkitalo, & Säljö, 2009; Kohut, 2009) and evolution (Keeter, 2009), the need for scientific literacy among citizenry becomes increasingly apparent.

Scientific issues influence a variety of core public policy concerns, and a basic understanding of these issues is crucial for civic engagement in a democratic society. Science education must aim to produce students who are prepared to not only to "increase economic productivity through the…knowledge…and skills of the scientifically literate person" but also "engage intelligently in public discourse and debate about matters of scientific and technological concern" (Yager, 2006, p. ix).

Many stakeholders in science education fear an apparent disconnect between current teaching methods in science and the habits of mind required to engage with contemporary science (NRC, 1996; NRC, 2000; AAAS, 2009). The etiology of this disconnect was elegantly diagnosed by population geneticist and science education thought leader Joseph Schwab, who wrote many decades ago that most students encounter science as a "rhetoric of conclusions" (Schwab,1978, p.134) in a textbook. Schwab noted that students see the results of years of study, questioning, professional dialog, revision, and argumentation as neat and sterile facts. In other words, the science we hear or read in the news about vaccines, climate, a newly discovered hominid, metabolism of “carbs,” etc., is structured very differently from the science we learned in high school where all of our experiments had a predetermined right and wrong answers. Anomalies were “corrected,” not pursued or explained.

Science that is current and alive is different from the neat "rhetoric of conclusions" often portrayed in curricula created for school science (Hodgson, 1988; Chinn & Malhotra, 2002). The actual work of scientists doesn’t allow for looking up a correct answer in the back of a book. This dissonance between what we might call (for lack of a better term) "textbook science" and "authentic science" is particularly problematic when we consider the nature of scientific issues that arise in the public sphere. Students are rewarded for providing a singular, correct answer at the expense of developing reasoning and evidence-based arguments (Russ, Coffey, Hammer & Hutchinson, 2008). This leaves students unprepared to understand the nature of evolving problems in the public sphere. Scholars and professional science organizations (such as the American Association for the Advancement of Science (AAAS)) are concerned that a consistent message of oversimplified science leaves students with overt misconceptions about the nature of the scientific enterprise (Russ, Coffey, Hammer, & Hutchinson, 2008
AAAS, 2001). Scientific literacy requires an understanding of what science looks like on its way to the textbook. The most pressing scientific issues of our time occur at the frontiers of science: at the height of conceptual uncertainties with anomalous data. Decades of analysis by various science education researchers have revealed that most published science curricula, from textbooks (e.g., Daniel, Ortleb, & Biggs, 1995; McFadden & Yager, 1993), tradebooks, (e.g., Murphy, 1991; VanCleave, 1997; Whalley, 1992), software, (Houghton Mifflin Interactive, 1997; Theatrix Interactive, 1995), and websites of science activities (e.g., HIRO Science

Lessons, n.d.; The Science House, n.d.), use what science education researchers Chinn and Malhotra call "simple inquiry" (2002). These simple inquiry tasks are on one end of a continuum of inquiry type tasks leading to "authentic inquiry", the work scientist actually do. While simple inquiry tasks are not a concern by themselves, scholars are concerned that constant exposure to only simple inquiry may cultivate misconceptions among students about the nature of scientific work. For this reason, in establishing benchmarks for scientific literacy, the American Association for the Advancement of Science ultimately envisioned an education that would provide citizens with the habits of mind required to make sense of how the natural and designed worlds function, think critically and independently, and deal with problems that involve evidence, patterns, arguments and uncertainties (2009)

To provide this sort of analysis of science education content in TeacherTube, this study will utilized a framework that helps identify the respects in which the reasoning tasks displayed in the TeacherTube content are similar to and different from real scientific research. The framework is based on a theory of reasoning, models-of-data theory (Chinn & Brewer, 2001) and is used to describe how people evaluate, present, and explain data. While the proposed study only addresses artifacts created by people, and not people themselves, the study cannot claim to analyze how people "evaluate" data. However, Chinn later uses this theoretical framework in his collaboration with Malhotra (2002) to analyze curricular artifacts by documenting the explanation and presentation of scientific information , with the understanding that scientific knowledge starts with data. For the current study, where the subject is video, we see that video is a medium allowing for the hosting people's presentations and explanations just as are textbooks, tradebooks, and software previously examined using this theoretical framework and thus making the model-of-data theory a useful one for analysis. Furthermore, it is important to note that the model-of-date theory takes into consideration what it calls “simple illustrations”, that is, presentations of facts for their own sake. To this end, the model-of-data-theory can be used to underpin an entire range of scientific content.

So what do we know?

Where does this bring us? We know that people around the world are watching online video. We know that people around the world are creating online video. Some of these people are teachers, and TeacherTube is a successful, well trafficked website that exists for the explicit purpose of facilitating video sharing among teachers in a school safe environment. We also know that among the offerings on TeacherTube, there are offerings geared specifically towards science education, and we know that science education has a troubled history in the US. Despite being well-funded relative to other subject areas, US citizenry remains, on the whole, scientifically illiterate, and that given the demand for scientific understanding required by bare, civic engagement, this degree of illiteracy is unacceptable. Scholars argue that textbooks are often the biggest perpetrators of the “myth” of the scientific method, and we know that teacher created videos are not textbooks. The character of science education, via teacher-created video content, however, is unstudied. In what follows, I will list the guiding questions for the proposed research.

Research Questions

1) What genre of science education videos are educators posting (fore example: how-to videos, content lessons meant for students, examples of student work, professional development videos, expositions on teaching theory, science demonstrations, etc.,)?

2) What is being communicated in these videos in terms of subject and targeted grade levels?

3) Which epistemologies of (or dispositions toward) science are being communicated in these videos?

4) What role does “school” play in the videos (for instance, do they speak of learning standards or test-taking strategies? Are they completely content-driven or agnostic of the school setting?)

5) What are the relationships among genre, subject, targeted grade level, and scientific presentation and viewer response, as measured by the amount of views and “favorites” the video has obtained?

<u>The sample</u>

A total of 100 videos will be pulled during various points throughout the year, allowing me to identify videos by date posted, thus enabling other patterns such as total views and popularity to emerge. The researcher will look at 25 videos once in July, once in October, once in January, and once in March in order to create a snapshot of activity at different points of the school year. Videos posted within the previous seven days will be discarded, as they do not have enough viewership data. Thus, the videos that will be filtered are the last 25 to have been posted a week prior to the researcher’s query. The researcher will exclusively query the “science” channel in order to see the broadest selection of science video types. The videos are defined by the user, thus anything that has been defined or tagged as “science” will be considered for the analysis. The risk that something was mis-tagged by a user or creator is endemic to user-generated content, and for this reason, it would be disingenuous for the researcher to second-guess or censor the data. Even with these precautions, it is worth noting that the lifeblood of any social sharing website is the influx of new content. A static site is a sign of Internet death. New content brings new page hits. Therefore, no study of a social website can offer more than a snapshot in time.

It is also important to note that TeacherTube allows users to post and share documents, images and other media. While these are clearly important media for teachers, they are outside the scope of this study.

<u>Procedure</u>

The researcher will document the following items for purposes of descriptive statistics:

1) Title of the video,

2) Name of the author,

3)Number of other videos the author shared

4) Date the video had been uploaded,

5)Total views of the video on TeacherTube as of the date of the research

6) Numbers of "favorites" from other users

7) "Apple" rating (this is similar to the

8) Numbers of comments as well as a transcription of the comments

Each of the videos will then be downloaded so that they can be used with video data coding software. The videos will be coded via open-coding in order to "fracture" the data and put it into categories facilitating the comparison of data within and between these categories. This is done to develop theoretical concepts (Maxwell, 1996) about the content of the videos. The coding categories will be developed by the researcher, but will draw from genre conventions consistent with science-oriented video such as "how-to" "chemistry demonstrations," "nature-footage" and others that may be recognizable to a general audience. An initial coding structure will be generated via a research pilot study, but these codes will be kept relatively open to be employed as needed to best describe what is sure to be dramatically different content. The codes emerging from this initial analysis will be entered into a codebook to later be used by a second rater. Both raters will nominate videos to be captured via rich description in order to provide readers with a full, deep, picture of the content. The videos that will end up in the final report will be decided upon by consensus of the raters.

A second pass at analysis will be performed in order to identify the types of scientific epistemologies and dispositions conveyed in the video. This analysis will employ emic categories taken from Chinn and Malhotra's (2002) analysis of textbooks, tradebooks, software, and web sites and based on the models-of-data theory of how people evaluate and represent scientific data (Chinn & Brewer, 2001). This framework is based on a continuum of what the authors define as "simple illustration" to "authentic inquiry" and uses well-bound indicators such as, "Is there data-theory correlation," "Are simple, contrastive arguments employed," "Is there reason to discount data," etc., (See Appendix A). It is important to note that for the most part, authentic inquiry is nearly impossible to capture when teaching science at the K12 level, but most certainly in a brief video. The purpose here is not to "rate" videos in terms of how "true" their epistemologies are relative to authentic inquiry. Rather, this is a useful tool to characterize what is being conveyed and develop ideas and themes about the types of science that readily lend themselves to this particular medium should we see consistencies or trends emerge. As with the open-coding in the previous step, this analytic component will be subject to inter-rater reliability and the raters will nominate and decide on providing rich descriptions illustrative of the categories that emerge using this analysis. If the researchers encounter content on TeacherTube that falls outside of currently accepted, main-stream scientific knowledge (for instance "intelligent design" UFOs, "evidence" of ghosts, etc.,) these will be included as part of the research data, but in a designated genre and with some attempt to characterize the author's use of evidence and data while noting that the content describe falls outside of scientific norms.

Once data has been collected and analyzed, I will turn my attention towards looking for connections among genre and epistemologies (for example, demonstration-type videos frequently seem to model making and testing predictions; student-centered videos frequently model the socially-constructed nature of science), determining whether any patterns emerge regarding the quantity, quality, and types of posts that emerge at different times of the year, analyzing how genre and epistemology type tend to interface with viewer popularity and ratings, how do different genre types foster different dispositions towards science, and in what capacity do we note the presence of school?

Addressing potential validity threats

In this study, there is no overt concern about reactivity, since we are studying videos that individuals have posted. However, there ought to be some concern about the reliability of the codes applied and concern for bias. Before I discuss how I can control for bias, I want to be explicit about where I am coming from. I'm professionally interested in empowering teachers by the use of technology, and firmly believe that because out students live in such a digitally inclined world, technology enhanced learning is critical. That is to say, I am very much in favor of the idea of a Web 2.0 tool that can facilitate such empowerment. I am also an advocate of science education for the purposes of scientific literacy, and therefore value science education that approaches the features of authentic inquiry above those of simple illustration and I am very quick to be critical of science education content that seems unable to go beyond simple illustration, regardless of the medium it is presented in. To be sure, I am concerned that textbooks overly homogenize the content we teach our students, and am worried that publishers are often more concerned with profit margins than they are with good, robust pedagogy or presenting challenging ideas to our students. In total, as much as I am supporter of technology and innovation in teaching, this does not cloud my desire to see high-quality, curricular products that will engage teachers and students in thoughtful and meaningful science education.

In order to provide validity to my data, I propose the following:

1) Rich data descriptions will be provided for several videos, especially as exemplars of coding. As part of the rich descriptions, screen-shots of videos may be provided if they are found to be illustrative of a data point. Rich data are "detailed and complete enough that they provide a full and revealing picture of what is going on" (Maxwell, 1996, p. 95). Ideally, these data go beyond providing a source for supporting instances, they serve to test developing theories. However, I will supply a source of sorts by including an appendix of video URLs will be provided so that readers of the study can access the video data on their own and verify that the videos appear as described.

2) Simple descriptive statistics will be provided in conjunction with the rich data. These quasi-statistics are particularly useful because I will be analyzing a large amount of data and quasi-statistics will enable me to asses the amount of evidence in my data as it relates to conclusions or potential validity threats.

3) Inter-rater reliability will be used during the open-coding of genre and the closed-coding for scientific epistemologies.

Limitations

An important limitation of this study is that it only analyzes the videos that appear on TeacherTube. The study does not attempt to contact the individuals who posted the videos and there is no way to verify the precise identity behind every individual behind each video. To be sure, videos may be posted by individuals that are not teachers at all. Some of these videos may have been posted by students. Nonetheless, these data points can still be regarded as valuable when considered in conjunction with information about how often the videos are viewed and favorite-ed, as it tells us something about what the Internet audience, in general, is interested in when they visit a video sharing site that bills itself as specializing in teacher- produced video. The relative success of a site like TeacherTube also makes it somewhat of an anomaly. By studying the content on this site,we are examining the content of a very successful teacher sharing site. There are untold dozens, perhaps more, of such content sharing sites that are no where near as successful. This study tells us nothing about what makes TeacherTube successful and other sites unsuccessful.

Just as we have limited information about the individual posting the video, and surely no that tells us why the individual posted the video, we don't know who is watching the videos and for what purpose.

References

American Association for the Advancement of Science (2001). *Designs for Science Literacy: with companion CD-ROM*. Oxford University Press, USA.

Bennett, S., Maton, K., & Kervin, L. (2008). The "digital natives" debate: A critical review of the evidence. *British Journal of Educational Technology*, *39*(5), 775-786. doi:10.1111/j.1467-8535.2007.00793.x

Bonk, C. J. (2009). *The World Is Open: How Web Technology Is Revolutionizing Education*. Jossey-Bass.

Chinn, C. A., & Brewer, W. F. (2001). Models of Data: A Theory of How People Evaluate Data. *Cognition and Instruction*, *19*(3), 323.

Chinn, C. A., & Malhotra, B. A. (2002). Epistemologically authentic inquiry in schools: A theoretical framework for evaluating inquiry tasks. *Science Education, 86*(2), 175–218.

Cuban, L. (2003). *Oversold and Underused: Computers in the Classroom*. Harvard University Press.

Cisco (2010). Cisco visual networking index: Usage study. Retrieved from http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/Cisco_VNI_Usage_WP.html

comScore (2010, May). comScore Releases May 2010 U.S. online video rankings: YouTube streams all time high of 14.6 billion videos viewed. Retrieved from http://www.comscore.com/Press_Events/Press_Releases/2010/6/comScore_Releases_May_2010_U.S._Online_Video_Rankings

Daniel, L., Ortleb, E. P., & Biggs, A. (1995). Merrill life science. New York: McGraw-Hill.

Gee,J.P. (2007). *What Video Games Have to Teach Us About Learning and Literacy. Second Edition: Revised and Updated Edition*, 2nd ed. Palgrave Macmillan, New York, NY.

HIRO Science Lessons (n.d.). URL: http://homepage2.nifty.com/sympathy/jikken/jikken.htm.

Hodgson, D. (1988). Toward a philosophically valid science curriculum. *Science Education*, *72*(1), 19-40.

Houghton Mifflin Interactive (1997). InventorLabs Technology. [Computer software, CD-ROM].
Somerville, MA: Houghton Mifflin Interactive.

Ito, Mizuko. 2007. "Technologies of the Childhood Imagination: Yugioh, Media Mixes, and Everyday Cultural Production." Pp. 86-111 in *Structures of Participation in Digital Culture,* edited by J. Karaganis. New York: Social Science Research Council.

Jenkins, H. (2009). *Confronting the challenges of participatory culture: Media education for the 21st century*. Cambridge, MA: MIT Press.

Jones, C., Ramanau, R., Cross, S., & Healing, G. (2010). Net generation or Digital Natives: Is there a distinct new generation entering university? *Computers & Education*, *54*(3), 722-732.

Lenhart, A., Purcell, K., Smith, A., and Zickhur, K. (2010). Social Media and Mobile Internet Use Among Teens and Young Adults. Pew Internet and American Life Project. Washington D.C.

Livingstone, Sonia and Bober, M. (2004) *Taking up opportunities? Children's uses of the internet for education, communication and participation. E-Learning*, 1 (3). pp. 395-419. ISSN 1741-8887

McFadden, C., & Yager, R. E. (1993). SciencePlus°R : Technology and society. Austin, TX: Holt,
Rinehart, and Winston.

Murphy, B. (1991). Experiment with light. Minneapolis, MN: Lerner.

Snelson,C. (2011) YouTube across the Disciplines: A Review of the Literature. MERLOT Journal of Online Teaching and Learning, 7(1). Retrieved from: http://jolt.merlot.org/vol7no1/snelson_0311.htm

Purcell, K. (2010). The state of online video. Retrieved from the Pew Internet & American Life Project website: http://pewinternet.org/Reports/2010/State-of-Online-Video.aspx

Provenzo, JR, Provenzo, E. F., Jr, Shaver, A. N., & Bello, M. (2010). *The Textbook as Discourse: Sociocultural Dimensions of American Schoolbooks*. New York, NY: Taylor & Francis.

Prensky, M. (2001). Digital Natives, Digital Immigrants Part 1. *On the Horizon*, *9*(5), 1-6. doi:10.1108/10748120110424816

Rudolph, J. L. (2002). *Scientists in the Classroom: The Cold War Reconstruction of American Science Education*. Palgrave Macmillan. New York: NY.

Russ, R.S., Coffey, J.E., Hammer, D., Hutchinson, P. (2008). Making classrooms assessments more accountable to scientific reasoning: A case for attending to mechanistic thinking. *Science Education*, *93*(5), 875-891.

Theatrix Interactive. (1995). Bumptz Science Carnival [Computer software, CD-ROM]. Emeryville,
CA: Theatrix Interactive.

The Science House (n.d.). URL: http://www.ncsu.edu/science house/index.html.

Strickland, R.G. (1962). The langauge of elementary school children, its relationship to the lanugage of reading textbooks and the quality of reading of selected children.Retrieved from http://www.eric.ed.gov/ERICWebPortal/detail?accno=ED002970

"Educators get TeacherTube". NY Daily News. December 10, 2007. Retrieved 2008-07-10.

Whalley, M. (1992). Experiment with magnets and electricity. Minneapolis, MN: Lerner.

Wolf, M. (2007). *Proust and the Squid: The Story and Science of the Reading Brain*, Harper, New York: NY.

VanCleave, J. (1997). Janice VanCleave's guide to the best science fair projects. New York: Wiley.

Yager, R. E. (2006). *Exemplary science in grades 5-8: Standards-based success stories.* Washington, DC: National Science Teachers Association.

Appendix A

Continuum of Inquiry Activities in Science (see hard copy)