SCIENCE ON TEACHER Tube: A MIXED METHODS ANALYSIS OF TEACHER PRODUCED VIDEO

by

Margaret (Marjee) Chmiel
A Dissertation Submitted to the Graduate Faculty of George Mason University in Partial Fulfillment of The Requirements for the Degree of Doctor of Philosophy Education

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Summer 2013

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by

Margaret (Marjee) Chmiel
Master of Arts
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Summer Semester 2013
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DEDICATION

This is foremost dedicated to my husband Trevor John Owens for his tireless support, insight, grocery shopping, laundry folding and cheerleading; my parents Zofia and Chester for sacrificing a great deal to support my education over the years; and to my dogs, Bowser and Zelda, who had to go without long walks and extended petting sessions.
ACKNOWLEDGEMENTS

I would like to thank Joseph Maxwell for the opportunity to work with him these past four years. Our projects together have been some of the most intellectually demanding writing and thinking I have done and I have grown tremendously from the experience. Joe has introduced me to philosophical and theoretical perspectives that will be with me throughout my career. I would like to thank Erin Peters Burton for her support and for sharing in our mutual enthusiasm for science education. Erin helped me connect the dots regarding my research interests when I was still struggling to define them. I’d also like to thank Kim Sheridan for working closely with me during the earliest stages of composing this research project, and bringing her unique research perspectives into this study. Finally, I must acknowledge my colleague and companion Trevor Owens. He was a sounding board and a proof-reader, but most importantly, he was the strong hand helping me back up whenever I fell down.
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LIST OF ABBREVIATIONS

User generated videos .......................................................... UGV
Kindergarten through 12th grade .............................................. K-12
Discourse Analysis................................................................. DA
ABSTRACT

SCIENCE ON TEACHERTUBE: A MIXED METHODS ANALYSIS OF TEACHER PRODUCED VIDEO

Margaret (Marjee) Chmiel, Ph.D.
George Mason University, 2013
Dissertation Director: Dr. Joseph Maxwell

Increased bandwidth, inexpensive video cameras and easy-to-use video editing software have made social media sites featuring user generated video (UGV) an increasingly popular vehicle for online communication. As such, UGV have come to play a role in education, both formal and informal, but there has been little research on this topic in scholarly literature. In this mixed-methods study, a content and discourse analysis are used to describe the most popular UGV in the science channel of an education-focused site called TeacherTube. The analysis finds that achievement tests and their focus on vocabulary and recall-level knowledge, together with influences from popular culture, drive much of the content found on TeacherTube.
CHAPTER 1: INTRODUCTION

User Generated Videos (UGV) have gained attention among educators in recent years. Digital cameras and editing software make it relatively easy to create quality videos, and websites like TeacherTube allow teachers to share their own videos and discover those created by others. By facilitating communication in what is often thought of as being a solitary profession (Lortie, 1975) a site like TeacherTube provides teachers with new opportunities to share ideas with one and another. TeacherTube provides an infrastructure for teachers to make the sorts of videos they wish to see and use with their classrooms, and the variety of content teachers have been making available in the years since TeacherTube’s inception is staggering. From rock songs about, well, rocks, to visually intriguing demonstrations performed by “mad scientists,” a fascinating portrait.

Statement of the Problem

What is the role of the Internet in K-12 education? What learning opportunities does it bring and what problems does it introduce? Much of educational technology scholarship has been guided by questions centered on this issue, and the precise research questions are subject to the rapid change guided by technology innovations. Education relies on communication, and our channels of communication continue to change rapidly. Does changing those channels impact education? These are the issues educational
technology scholars try to understand, and this study is part of the wider attempt to
cultivate this understanding.

Questions revolve around innovations in hardware (for instance, the use of
interactive white boards in the classroom) as well as software (the effects of e-readers on
literacy development). In this study, rather than looking at what technology is “doing” in a
particular classroom, I am interested in looking at what teachers are “doing” with a
particular set of technologies. UGV are possible due to a confluence of technologies:
improved bandwidth makes viewing videos a possibility from most computers, video
editing software has become easier to use in recent years, and digital cameras have gotten
smaller and cheaper. Together, these technologies allow “home-made” videos to
proliferate online and social networking has made it easier than ever for the videos to be
shared, stored, and discovered. The ease of creating and finding these videos has made its
way into K-12 classrooms, but there has been no scholarship investigating what is being
created and what is currently out there. As I will discuss in the conceptual framework,
UGV in K-12 education is receiving a great deal of attention from the popular press and
blogosphere, yet we know very little about it as researchers and scholars. The primary
problem this study addresses is to begin filling in this gap of scholarly understanding in
the light of growing popular attention.

A secondary problem this study addresses has to do with the historical
contextualization of science curriculum. There exists a history of scholarship examining
science-teaching artifacts. This line of inquiry cannot tell us anything definitive about
how the artifacts are used in a standard classroom. But they reveal trends, patterns, and
ideas in science education. For example, Lawrence (1951) discusses how pressure from textbook adoption committees and a growing list of criteria for what is considered “quality science education” has caused textbooks to increase from “200-300 pages to approximately 600-700 pages.” Lawrence’s research sought to determine whether “bigger” was in fact better. He documented a change in the length of textbooks that remains with us today. More than 50 years later, Chinn and Malhotra (2002) looked at a sample of textbooks and other artifacts to discover how closely their inquiry tasks modeled the sort of work done by scientist. In doing so, they examined over 400 inquiry tasks and determined that most science activities can be classified as simple illustrations or demonstrations rather than authentic inquiry.

The politicization of certain scientific topics can be revealed through such artifact analysis. Skoog tracked the waning and weakening of the treatment of evolution that began in the 1960s, was exacerbated in the 1970s and continued along during the time of his publication (Skoog, 1984). Such research can demonstrate how different countries represent certain scientific topics (De Posada, 1999; Han & Roth, 2006; Irez 2009) and track how our pedagogical advancements are manifested in textbooks (Eide & Heikkinen, 1998).

Textbooks are not the only artifacts that have warranted analysis by scholars. As technology brings new curricular artifacts into the classroom, these artifacts open up new research questions. This was true for “motion pictures” (Davis, 1923) as well as video games (Squire, 2006; Annetta, 2012). It is in this tradition that the current study is situated. User-generated video sites provide us with a new type of artifact that is being
used in classroom teaching and learning. Video itself is by no means new, but the social distribution platform where we find UGVs is a new technology, and it adds rich dimensions for analysis above and beyond what we traditionally think of as “video”. Unlike all the other artifacts mentioned above, these videos are produced and distributed by teachers themselves. This new technology distributes science content via national and international audiences while the products are created by local teachers, working toward their own classroom needs. This long-view of science education curriculum across time and media reveals patterns, trends, and deficits in the way we, the adults, teachers, and educators, pass along scientific understanding generation after generation. The historical context of UGV in a longer tradition of science curriculum is one of the issues addressed in this study. For example, there has been documentation of the bias towards representing white males as scientists in earlier generations of science curricula (Kelly, 1985; Sjøberg & Imsen 1988). Do these problems go away, 30 years later, in a more democratized media such as UGV? Likewise, we have scholarship regarding how science is communicated in classrooms and via traditional publications of curricular materials. What of these findings carry over into UGV, and what new issues do UGV bring into the greater science education landscape? By gathering data about curriculum over time and via various media, science education scholarship can get a better understanding of its weaknesses and strengths.

TeacherTube is one of several video sharing sites, and these websites are rapidly growing in popularity, receiving considerable attention in recent popular press (DeSantis, 2012; Miller, 2012; Strauss, 2012; Tucker, 2012). Video sharing sites are impacting the
way many people work, play, and learn inside traditional schools and out (Duff, 2007; Burke & Snyder 2008; Agazio & Buckley, 2009; Juhasz, 2011). Despite the attention these video sites have received from the education community, educational research has been relatively silent on the topic. This study adds to the long history of science education research concerned with education artifacts used in the classroom by researching UGVs of science teachers.
CHAPTER 2: CONCEPTUAL FRAMEWORK

I see two primary components of the conceptual framework that will inform the theoretical foundation of this study: What is our current understanding of UGV sites, and what is our current understanding of best practices in science communication for the purposes of science education?

UGVs are new territory for educational researchers and for this reason there is little existing literature on the subject. To compensate for this deficit, I will take ideas about UGV from the popular press and integrate them with scholarly research from fields outside of education. The other important component of my conceptual framework, science communication, has been well researched and documented. In this chapter, I will discuss my experiential knowledge in this area, followed by an overview of scholarship on the role of social media in learning. I will close the chapter by giving an overview of key ideas from the science communication literature that will shape my analytical lens.

Experiential Knowledge

As a brand new science teacher, I had an amazing support network of fellow teachers that shared their lessons with me. As I became more experienced, I wrote lessons and shared them with colleagues both in and out of my school. One of my colleagues designed a complete chemistry course curriculum comprised exclusively of self-directed labs. Students could select their own trajectory and work their way through a series of
labs at their own pace. The labs were punctuated by larger performance-based assessments but there were no exams that did not involve making something and there were no problem sets. He received a great deal of interest in this curriculum from other chemistry teachers (and certainly the students) and was encouraged to share it more widely via a formal publisher. He approached a few publishers with this curriculum, but there were no takers. So he continued to share what he made with anyone who was interested through informal channels. By the time he retired in 2003, however, the curriculum retired with him. Without his advocacy and example, the curriculum fell out of use. As I read about the new avenues for self-publishing and digital distribution, I wonder to what extent teachers are taking advantage of these broadened opportunities to share their knowledge and expertise with wider audiences, unfettered by the traditional publishing gatekeepers. There is very little research in the educational research literature that addresses these questions.

Many teachers love to create and share learning resources, though much of it happens informally. This content creation and sharing is still poorly understood by the educational research community. I used to create and share cartoon comics strips chronicling the melodrama of atoms and elements as they bonded, reacted, or reached excited states. Eventually I learned how to translate these comic strips into computer animations. This is when I began thinking about the web and its potential to change how I could create and distribute these chemical cartoons. I wanted to know more, so I went back to school to study educational technology. This led to a leadership position at Public Broadcasting Services (PBS), where I was an associate director of instructional design.
Here, I worked on designing online learning opportunities for educators ranging from pre-school care-givers to school district technology leaders. Back then, most of my colleagues had not even heard of Facebook, much less understood the connecting power of social networking, but PBS was already thinking about harnessing the connectivity of the web to build connections among teachers, around resources. We were working on an online tool called Peer Connection, which was funded by the Department of Education, where teachers would post and share their ideas and materials for lessons.

The idea itself was timely, but the execution was a challenge. There were many technical barriers for teachers at the time. Teachers were not accustomed to using online platforms for communication. It was unclear what motivation busy teachers would have for taking the time to share their hard work with the faceless void of the web. The culture of sharing among teachers was natural in the school building, but that culture had a hard time translating online. As a young teacher, I benefited greatly from clever colleagues who shared their wonderful materials with me. I found teachers to be born sharers. But for some reason, it was hard to translate this culture of sharing into online spaces in 2006.

I moved to another grant-funded project in 2008 with The National Geographic Society. My responsibility here was to work on designing games and interactives aimed at middle school science. I worked very closely with a team of teachers in focus groups to test and evaluate these games and interactives and I found that channeling their expertise led to tremendously successful designs. My digital tools elicited enormously positive responses and I was excited to see so many technology-shy teachers look at these digital tools and decide that this is what they needed to dip their toe into the digital waters. After
lobbying heavily for our organization’s involvement in other social media platforms (and of course inheriting the inevitable responsibility of managing those platforms) I discovered a population of science teachers and educational technology specialists enthusiastically talking and sharing articles and ideas over channels such as Twitter, Ning, Facebook, YouTube, TeacherTube, and others.

By the time the grant at National Geographic was running out, I learned two things: (a) Even technology-fearful teachers will embrace digital learning tools if they appear to be worth their time for creating worthwhile and intriguing lessons and (b) Innovations in digital learning materials are incredibly hard to monetize. I left National Geographic to work as an instructional technology specialist for a local school district. My first year in this position brought me to an elementary school where many of the staff were recent college graduates. I saw a new generation of teachers that were raised on Wikipedia and YouTube as educational resources.

Since I began my journey outside of the classroom in 2003, so much has changed in terms of teacher and administrator perceptions of technology. On websites such as TeacherTube, teachers readily share their ideas with one and another. We struggled with supporting this type of sharing on PeerConnection, but TeacherTube runs on it. Teachers are embracing web technologies to create their own materials and their own lessons. In an age of restrictive curriculum and preoccupation with standardized tests, TeacherTube can represent a break from, or an enhancement of, what Pearson, McGraw Hill, Addison-Wesley have to say about science. With the increased use and popularity of social networking sites, particularly video sharing sites (comScore, 2010), teacher-generated
content is free to transcend the usual boundaries of classroom, school building, and district.

Given my experience as a teacher, teacher trainer, and media producer, I am well-qualified to explore and contextualize teacher-produced digital media. To do this, I propose to (a) explore the diversity of videos created and shared by teachers and (a) contextualize these videos within the wider context of science communication at the K-12 level.

**Criticisms of YouTube**

Before exploring some of the reasons behind the excitement coming from the educational community for UGV, I’d like to address the critics of these sharing sites, specifically the largest of these sites: YouTube. Media studies scholar Juhasz (2011) argues that “YouTube is a mess.” Juhasz summarizes her criticisms of the website: “YouTube dissolves the real. YouTube is host to inconceivable combos. YouTube is best for corporate-made community. YouTube is badly baked. Why is what could be a tool for political change used mostly to spoof mainstream media?”

Her criticisms are representative of those made against YouTube, but as discussed in my previous statement, we don’t know whether these criticisms apply to educator-specific UGVs as research on education-specific UGV sites is lacking. For this reason, discussion of YouTube is imperative in this conceptual framework, so long as we are constantly checking in with how similar or different YouTube is to smaller, more specialized UGV sites.
YouTube’s presence in scholarly literature is one reason to discuss it within a conceptual framework, but there is a structural reason as well. Many UGV sharing sites, including TeacherTube, were built with YouTube in mind: both with the goal of compensating for its deficiencies and/or to replicate its successes. With these factors in mind, it is the case that the YouTube literature provides a useful comparison for discussing TeacherTube.

As Juhasz demonstrates, UGV sharing sites have their critics, but the scope of these sites is so huge, blanket statements and criticisms are difficult to uphold. According to the Pew American Life Project 69% of US Internet users watch or download online video with 14% of users posting video (Purcell, 2010). Furthermore, 26.15% of global broadband traffic is tied up in video streaming and over one third of the 50 most visited websites are also video sites (Cisco, 2010). A People are using UGV to different ends. Given the scores of freely available, on demand video resources, many in the education field have taken notice (Snelson, 2011). More than 300 colleges and universities have collectively posted in excess of 65,000 original videos on YouTube alone. Some of the popular but controversial massively open online courses, such as Udacity, use YouTube as their primary content delivery. Whatever the shortcomings of UGV sites might be, their presence in education doesn’t seem to be going away any time soon.

**Crowd Accelerated Innovation.** What does a UGV sharing site have to offer educators above and beyond the role of a traditional educational video? Consider the observation from Lortie nearly four decades ago that teaching can be a solitary profession. Teachers rarely get to see one another working (Richardson, 1998). Several
researchers have initiated proto-video sharing sites to encourage teachers to watch video lessons from other teachers and contribute their own, but none of these has been able to go to scale (Sherin, 2000; Shrader et al., 2002; Star & Strickland, 2008). With the ubiquity, popularity, and ease of use of UGV sharing sites, the potential is there to scale opportunities for teachers to share and learn from each other’s work.

Outside of formal education, UGV sharing sites are already being used as a way for people to share their skills, and learn from one and another. During a 2010 TED conference, (TED is short for Technology, Entertainment, and Design, though the conference has expanded to cover numerous other topics) acclaimed technology journalist and TED curator Chris Anderson delivered a talk titled, “How Web Video Powers Global Innovation” (2010). Anderson argued that user generated videos from websites such as YouTube are becoming an important catalyst for change and innovation in a variety of fields. Anderson’s talk built upon an earlier TED presentation, when journalist Jonathan Chu made the following observation:

Dancers have created a whole global laboratory online. Kids in Japan are taking moves from a YouTube video created in Detroit, building on it within days and releasing a new video, while teenagers in California are taking the Japanese video and remixing it to create a whole new dance style. (Chu, 2010).

Dancers on YouTube were challenging one another to virtual dance competitions. These challenges lead to notable changes in trends in the field of dance. Through this international sharing, the nature of contemporary dance was changing due to the opportunities for sharing and communication that YouTube brings.
Why talk about trends in dancing? Because it reveals how effective YouTube can be for disseminating change — change that is tangible in the practices of people. Inspired by Chu’s observations, Anderson embarked on a deeper investigation of UGV. As a result of this investigation, Anderson proposed that UGV had the potential to foster “crowd accelerated innovation”. By crowd accelerated innovation, Anderson means the ability for many people with common interests in geographically distributed areas to communicate digitally and spur ideas and innovation among one and another at a rate that greatly exceeds what was possible without digitally facilitated communication. Anderson studied a variety of different communities. What he found was that regardless of the subject matter, be it juggling, graphic design, or burlesque costume design, similar patterns of communication and sharing emerge in these communities. Participants would adopt different roles in the YouTube community, and through the interaction of these roles, cross-pollination of ideas, innovation, and growth would occur in these different communities. Among the “crowd” are a variety of individuals with discrete roles: the innovators themselves, commenters offering perspective, encouragement or feedback on the video; mavericks bringing in fresh perspectives and challenging accepted notions; trend-spotters noting emerging patterns and fashions in the field; cheerleaders providing support, encouragement, and incentives to those posting their video; skeptics to provide necessary criticism and critique; and super-spreaders who broadcast the innovation and evangelize outside of the small community.
**Alone, together.** For Anderson, crowd accelerated innovation offers a way to bring together people interested in a variety of endeavors, especially those where people might be geographically isolated or dispersed. Shirky, a leading scholar on the social and economic impacts of the internet, documents how social media allows individuals to find and collaborate with like-minded individuals and work remotely with people who might otherwise never had the opportunity to interact. These opportunities are explored in Here Comes Everybody: The Power of Organizing without Organizations (2008) and later Cognitive Surplus: Creativity and Generosity in a Connected Age (2010). The later book, in particular, offers a glimpse into the sheer numbers of people actually contributing content to the web: hundreds of millions of active bloggers, billions of uploads to photo sharing sites, geo-tagging photos to applications such a Google Maps, millions of man-hours editing and contributing to multi-lingual Wikipedia pages, and so forth.

For some people, the advantage of UGV sharing sites is about more than content creation, it is about finding a community that shares your interests (Rotman & Preece, 2010, p.330). “A recent study by Scholastic and the Gates Foundation found that teachers spend only about 3 percent of their teaching day collaborating with colleagues. The majority of American teachers plan, teach, and examine their practice alone” (Mirel and Goldin, 2012). Mirel and Goldin found that 90% of teachers would like to have opportunities for common planning and collaboration, suggesting that barriers to collaboration are structural issues, not reticence on the part of teachers. And there is reason to suspect that increased collaboration can have positive effects on student learning. Japan and Finland, countries viewed as the standard bearers in public education
due to their top ranking PISA and TIMSS scores, perceive teacher collaboration as essential to school improvement and student success. The isolation of teachers is problematic for teachers and students alike. Given the isolated nature of the teaching profession, the desire teachers have to collaborate, and the potential benefits that would result from collaboration, educators are a population that could benefit from crowd accelerated innovation. Anderson’s crowd-accelerated innovation is a new way to think of an older idea with roots in economic thought. Hayek (1978) used the term catallaxy to describe “the order brought about by the mutual adjustment of many individual economies in a market” (108-109).

When it comes to educational technology, the idea of self-assembling, informal communities of people with competing and conflicting goals has also been termed “affinity space” by Gee (2007) and the practice of school-aged children seeking online affinity spaces has been extensively documented by scholars of educational technology (Duncan, 2010; Black, 2005; boyd, 2008; Greenhow, 2011; Ito et al., 2010; Squire & Giovanetto, 2008; Owens, 2010). These ideas are similar to Hayek’s and Anderson’s, in that community and networking are at the heart of the phenomenon, but within that community we find varying and often competing interests among people.

One of the major themes that have emerged from these educational technology studies is the chasm between what children are doing online (in their affinity spaces) to learn and grow various useful skills and the type of disconnected, isolated learning that might be found in school (Jenkins, 2009). Much of this research documents the creative digital lives of children, and schools end up taking implicit blame for stifling creativity.
But “schools” are not the same thing as “teachers” and creative digital production can be found among these teachers as well. To what extent, it is difficult to say, as there has been little documentation in that area. One of my hopes for this current study is to begin to provide this documentation.

These various descriptions of online interactions, whether they are called affinity spaces, cognitive surplus, or crowd acceleration, correspond to sociological observations of scientists’ interactions in the non-digital world. That is to say, these opportunities for collaboration to drive innovation have been found to be vital to the nature of scientific work. Sociologists of scientists such as Knorr-Cetina (1999) and Latour and Wolgar (1986) note the importance of professional collaborations and connections among scientists to scientific advancement and innovation. This physical proximity of colleagues is something that has eluded teachers. And proximity, sharing a space with others, is an overlooked component in defining what makes a “community”. The traditional views of community as shared beliefs, values, and practices is problematic in that it leaves out the diversity, tensions, and disagreements that are very important parts of a community. Contiguity, being near other people, and bringing diversity to the table, is as important as what is shared and agreed upon in understanding the function of a community (Maxwell 2012, pp. 49-67). In this respect, we can see that online collaboration creates opportunities for contiguity where there were no opportunities before. In Anderson’s discussion of crowd accelerated innovation, he highlighted the role of critics and challengers, demonstrating an understanding that disagreements within a community push the field farther. Understanding the role of online spaces in providing a kind of
proximity that fosters community is useful in thinking about how UGV sites could enhance normally isolated professions.

**Why TeacherTube?**

Teachers are seeking resources via UGV sites. There are a number of YouTube inspired websites directed at teachers (Snelson, 2011) and in many cases, videos appearing on one site can be found on another, demonstrating the “viral” nature of this medium. For this study, I am targeting the website TeacherTube.com. TeacherTube is a website created by former educators that originated as a YouTube clone (Burgess & Green, 2009) in early 2007. TeacherTube was designed to look like and work like YouTube, but it added value beyond YouTube because schools and districts often block YouTube out of a fear that students could be exposed to some of YouTube’s objectionable material. Even YouTube’s education-specific channels (where many colleges and universities post their lectures) are blocked at many schools, and for understandable reasons. YouTube comments, even on seemingly innocuous videos, are notoriously offensive. The categorization and tagging of material is crowd sourced. This means that even a simple search for “science education” videos has turned up material that could make educators uneasy when working with a classroom of students. As a result, administrators, technology directors, teachers, and school boards prefer to forfeit access to the many free educational videos and block YouTube out of the classroom all together.
TeacherTube was initially built to resemble YouTube but in the years since the two websites have existed, YouTube has gone through a number of changes and upgrades, leaving TeacherTube behind. Now the two websites are very different, and those differences can be important when it comes to what is possible in terms of sharing, collaboration, and communication. Submissions on TeacherTube are heavily moderated and the comments are more restricted. Of the few comments that appeared on TeacherTube videos, many thank the person for making the video available on TeacherTube because YouTube is blocked at their school. For all the faults of YouTube commenting, however, recall that Anderson identifies commenting as essential to the crowd accelerated innovation process. If we restrict, limit, or discourage comments, are we losing more than the insults and offensive rants?

An additional advantage offered by TeacherTube is that it allows users to download videos so that they can be viewed without an internet connection. This is impossible to do with YouTube, but it is a valuable feature for teachers who work with limited or unreliable access to the internet. The advertising that appears on TeacherTube is similarly vetted to be school-friendly: a guarantee that is absent on YouTube.

TeacherTube has limitations and deficits compared to YouTube. The interface feels very clunky in comparison to new versions of YouTube or other video sharing sites such as Vimeo. Registration is free and optional, but if you forgo registration, you will have to watch a commercial before each video. Often, it is the same commercial that is played video after video and this can become tiresome very quickly. Because the website relies heavily on ads, and ads are pulled from third party web services, the movement of
information on TeacherTube can feel very slow. Additionally, I have found that
TeacherTube servers are overtaxed and the website is often down. This seemed to be
more of a problem prior to a major redesign of the site that occurred in fall of 2012, in the
middle of my study. Another issue I’ve found with TeacherTube is that the search
function works well if you know what you are looking for, but the lack of a robust
suggestion feature, so prominent on YouTube, results in weakly linked content.
Serendipity, which can be such an asset of social applications, is all but absent on
TeacherTube.

New competitors in the school-safe UGV scene are a testimony to TeacherTube’s
success. There are other video sharing sites trying to get a foothold in the school-safe
market such as Schooltube, but the problems faced by TeacherTube are only exacerbated
here. Other sites emerging in this area, such as watchknowlearn.org offer school-safe
options by being aggregators of videos pulled from a number of sites, including
TeacherTube and YouTube. Watchknowlearn represents a new generation of UGV sites
and could be a good place for further inquiry. Currently, that site brings in many videos
that are not explicitly teacher-produced. It partners with organizations such as the
Annenberg Foundation, BBC, and National Geographic. This reliance on traditional
media outlets means that watchknowlearn is not a good site for better understanding what
teachers are creating, or even sharing. Teachers suggest content for the website, but they
don’t have the freedom to upload content. TeacherTube is uniquely situated in that it is:

- primarily teacher driven
popular *enough* among teachers and similar *enough* to YouTube to give us a strong conceptual foundation because of the extensive literature on that mainstream site

- illustrative of the unique characteristics and challenges faced when UGV sharing sites try to thrive in schools

**The flipped classroom.** Despite the challenges UGV sharing sites face in schools, their popularity and relevance in education is growing. Teacher produced videos have been receiving increased attention among school administrators and the popular press. Recently, there has been talk about schools implementing “flipped classroom” models of instruction (Strauss, 2012). A “flipped” classroom is one where students receive direct instruction at home (most often via video, podcast, or interactive lesson that can be accessed from home) so that they can use class time to solve problems, collaborate with peers, or work with the teacher for remediation or enrichment. It gets its name because the model envisions “flipping” so that the lecture is homework and what would traditionally be thought of as homework (solving problems, writing, etc.) would be done during class time. Given the plethora of instructional material freely available online, some educators have wondered what the “value added” of face-to-face class instruction could be. For many, flipped classrooms are the answer. Face-to-face is where collaboration, discussion, and custom intervention can happen in ways that the internet cannot achieve.

There has been some excitement surrounding flipped classrooms. Harvard Law School provided training for its faculty in the implementation of the model, and non-
profit training organizations are working to disseminate it (Strauss, 2012). The flipped classroom ideas has been floating around college campuses in science and engineering classrooms for at least a decade, but it was popularized and brought to national attention in part due to Salman Khan, the creator of The Khan Academy. The Khan academy is a series of “low tech, conversational videos” available free and online with no registration wall that are mostly narrated by Khan himself (Kaplan, 2010). The videos specialize in math-based concepts narrated by the MIT alumnus and former hedge fund manager (Kessler, 2012). Khan’s national attention took off when Microsoft founder Bill Gates heaped praised on The Khan Academy as a resource Gates used with his own son. According to a 2012 article from CNN Money, The Khan Academy has received over 18 million page views and is seen an average of 70,000 times a day (Kaplan, 2010). For popularizing YouTube videos as an instructional medium, Khan was named one of Time’s “100 Most Influential People” (Edutopia, 2011).

There have been other high-profile efforts seeking to replicate Khan’s success. At the time of this writing, the people behind the TED Talks launched a new online tool that can help “flip” any YouTube video. TED Ed (the education-oriented offshoot of TED) has their own channel of educational videos produced by experts in individual fields, but they include a “flip” tool is designed to work with any video a teacher chooses, including one of her own making. Teachers can find a YouTube video and hit a “Flip it” button to create and publish supplemental content and questions. Teachers keep track of participation via a digital dashboard (Kessler, 2010). For many years, TED has been a sort of taste-maker in a variety of fields, and this is their first foray into K12 education, so
it is somewhat noteworthy that their entry into K12 education embraces the flipped
classroom idea. More than embracing, they are making room for teacher produce videos
to “live” side-by-side with their own collection of world-renowned speakers. Both Khan
and TED Ed are part of a growing movement towards “open education” resources. That
is to say, freely available web resources that can be used in place of tradition curricular
media (Bonk 2008).

**Teachers as producers.** There is reason to believe that what is happening with
video will manifest in other content media in education. As digital slowly becomes an
important delivery method of content in K12 schools, there is good reason to believe that
more and more teacher generated content will make its way into these materials. iBooks
Author is an application for iPads, which allows anyone to create and distribute
textbooks. Some teachers are diving in to create and share digital textbooks using these
applications (Sapers, 2012). Digital publishing and distribution among teachers and
educators is part of a greater trend communications scholar Henry Jenkins calls,
“participatory culture” (Burgess & Green, 2009). “Participatory culture is a term often
used to talk about the apparent link between more accessible digital technologies, user-
created content, and some sort of shift in the power relations between media industries
and their consumers” (p. 10). While participatory cultures can be liberating for amateur
media makers, they often have destabilizing, disruptive effect on established media
enterprises. These disruptive effects have disturbed businesses such as book publishing or
the music recording industry. Educational publishing has been somewhat spared from the
challenges faced by commercial publishing houses. However, between online textbooks,
bring your own device initiatives, and adoptions of classroom tablets indicate this may be changing. To be sure, publishing giant, Pearson has invested heavily in the creation of a search platform for free digital, learning materials (Kolowich, 2012), a harbinger of things to come in school publishing. Participatory culture raises important questions about power, resources, expertise and authority (Burgess & Green, p. 11).

The notion of participatory culture comes from a tradition of television and film studies where one-way communication is very much the norm, and the idea has been critiqued by other scholars. Law and communication scholar Benkler (2006) suggests that in pre-industrialized folk societies, individuals were co-producers and replicators of media. Twentieth-century mass popular culture inspires alienation and asks people to be passive consumers. This is why some media scholars, like Howard (2008) with a background in folklore studies, reject the notion of participatory culture in favor of the term “vernacular web.” Howard adopted the term to describe how people talk through and use the web in their daily tasks, communication, and interests. For Howard, “vernacular” means non-institutional and it underscores the point that the internet has not really changed us. People have always been co-creators of their media and it has really only been during a few decades of the 20th Century that mass media has institutionalized and dominated views of how people and media interact. For scholars coming from a television and film tradition, participation in media creation does seem novel. Because Jenkins writes frequently on the topic of school-aged children and their role in participatory culture, his ideas feature prominently in scholarly literature. However,
Howard and Benkler remind us that passive consumption of media is an historic deviation.

While YouTube is a commercial enterprise, the easy-access to sharing your own work provides people with the opportunity to reclaim some of the co-creation familiar to Benkler and Howard. Few teachers like using standardized curriculum (Apple & Teitelbaum, 1986), preferring instead to put their own “spin” on a lesson. This is readily visible when reviewing videos on TeacherTube. While piloting this study, for instance, I found a video created by a teacher named Douglas Valentine who uses the sobriquet Dr. Loopy. Dr. Loopy has uploaded 132 videos on TeacherTube and his act is very reminiscent of the famous Bill Nye videos. Many of Nye's video clips are uploaded on TeacherTube, but Dr. Loopy and others inspired by Bill Nye contribute replications and co-creations of that type of video.

Dr. Loopy, along with other frequent contributors to TeacherTube are not representative of teachers in general, and this study attempts to make no such claims. We know from analysis on other content sharing venues on the web that there are some pretty consistent trends across platforms that inform user participation and behavior. In her study of children’s online habits, Ito et al (2010) differentiated users as “hanging out,” “messing around” and “geeking out.” The smallest group of users were those who created and contributed the most content. This was the group Ito refers to as “geeking out”. Most users are mere watchers, that is to say that most of us are “hanging out” online. Other researchers found similar patterns. Active creators accounted for 13% of total visitors and 19% qualify as “critics” providing ratings and comments (van Dijck, 2009). Most people
are simply viewers and that is the role I take in this study. Like these viewers, I am going to TeacherTube looking for science videos. I will be “hanging out,” looking for work done by those who “mess around” or “geek out”.

**Talking Science**

In the above paragraphs, I outlined some of the ideas and scholarship surrounding user generated videos and established that there has been little work done on the topic of science teachers and UGVs. But if we ignore UGVs and look at how teachers and students talk about science, we find decades of research regarding science communication. Like any professional discipline, science has highly specialized vocabulary and linguistic rules and regulations that practitioners use to communicate with one and another. These rules, regulations, and practices mediate scientific communication, but these conventions can also serve to keep some people away from science. As Lemke notes, “Science is not limited to one culture, one dialect of English, or one style of communication. Science teaching today is.” (Lemke 1990, p. 138).

Presenting science to students this way means that science is “too unfamiliar, or too unlike” what students have been taught to find interesting or valuable” (p.139). Lemke defines the stylistic norms of scientific language that is perceived as “correct” and “serious” so far as teachers and students are concerned:

> Language must be as verbally explicit as possible. It should be verbal rather than nonverbal.
Language should avoid colloquial forms of language. Words like “like, you know, gonna” are examples of colloquial language as are uses of first and second person pronouns.

1. Use technical terms in place of colloquial synonyms.
2. Avoid personification, especially human attributes or qualities or actions.
3. Avoid metaphoric and figurative language, especially words that are emotional, colorful, value-laden, humorous, or hyperbolic.
4. Be serious and avoid sensationalism.
5. Scientific language avoids history if possible. When history is invoked, it must be separated from scientific content. Personalities and references to human beings should be avoided.
6. Avoid references to fiction or fantasy.
7. Use causal forms of explanation and avoid narrative and dramatic accounts.
   This includes not only fictional stories, but any form of discussion that uses story form. This includes dramatic forms such as dialog, mystery and dramatic action.

As Lemke points out, these rules create a contrast between the language of human expression and the language of science. Many teachers, being good communicators, know that they need to violate some of these rules in order to humanize science and make it accessible to students. Lemke found deviations from these rules would result in increased attention from students. While these deviations gained attention from students, they increased a risk that students would perceive themselves as being “talked down to”
or somehow not being “genuine science”. We’ll see violations of these rules throughout the corpus. TeacherTube videos are created to/and selected by others for their ability in breaking from student expectations. As we will see throughout this study, teachers regularly and intentionally break these rules in order to engage students.

**Scientific explanations.** In any discussion of “talking science”, we have to examine why it is that we talk about science in the first place. In our corpus, I expected to see teachers defining terms, descriptions of a process or cycle, and explanations of scientific phenomenon. Much of the current analysis of science communication in science education pertains to scientific explanations (Chinn & Malhotra, 2002; Duschl & Grandy, 2008; Driver, Asoko, Leach, Mortimer, & Scott, 1994; Windschitl, 2008). In better understanding how science is talked about, scientific explanations warrant close examination. There are several definitions of scientific explanation and for the purposes of this study, we use the following:

It provides knowledge of the mechanisms of production and propagation of structure in the world. That goes some distance beyond mere recognition of regularities, and of the possibility of subsuming particular phenomena there under. It is my view that knowledge of the mechanisms of production and propagation of structure in the world yields scientific understanding, and that this is what we seek when we pose explanation-seeking why questions. The answers are well worth having. That is why we ask, not only “What?” but “Why?” (Salmon, 1978, p. 701).

Salmon’s ideas about scientific explanation are influential in science education research and they have influenced a pedagogical explanatory framework developed by
Braaten and Windschitl (2011). Bratten and Windschitl advocate for scientific explanations that target the unseen mechanism behind natural phenomenon as a way to engage students in deeper, mechanistic thinking. The authors contrast scientific description, which is a focus on the observable features of a phenomenon (such as condensation), “in contrast[with], an explanation for condensation [which] emphasizes unobservable processes such as molecular motion and energy, employs key scientific ideas and theories, and often seeks underlying causes for a commonly observed phenomenon” (p. 641). In other words, a thorough explanation is not only about “what”, but “why” (Salmon, 1978, p. 701).

While philosophers of science such as Salmon have proposed definitions of scientific explanations, research into classroom discourse reveals that teachers and students vary in their understanding of what it means to “explain” (Seah, Clarke, & Hart, 2011). To be sure, explanations that go beyond the “what” of a phenomenon have been rarely documented in classroom interaction (Driver et al., 1996). As part of a larger understanding of science in teacher UGV, I will examine scientific explanations as one component of analysis. Explaining natural phenomenon is one important characteristic that distinguishes science from other K-12 school topics. In particular, an emphasis on stating laws without exploration of causes and mechanisms can lead to a problematic, superficial understanding of scientific phenomenon and the nature of scientific work. In this study, I am interested in better understanding where TeacherTube videos are situated when it comes to descriptions versus explanations as they are conceived by Salmon, Bratten and Windschitl. “Explanations” (more truly descriptions) that focus merely on
conveying the “what” rather than the “why”, by tying an observed phenomenon to a stated law without providing any of the mechanisms behind the phenomenon, are based on deductive-nomological models of scientific explanation. These models have also been referred to as the “covering laws model” of explanation (Salmon, 1989). In the analysis for this study, I will refer to the covering laws model of explanation to refer to those explanations that go only so far as to tie descriptions of phenomena to their stated scientific laws, without any follow up of deeper mechanistic explanations. The covering laws model will be applied to videos that feature “whats” without “whys”.

**Conceptual change.** Just because a teacher, a video, or a textbook provides an explanation doesn’t mean that the students learn or accept that explanation. How do science educators use language to work with students to accommodate new ideas and explanations? Consider the following: Will you ever be able to see in a room that is completely dark? Will your eyes ever adjust so that you can see in such a room? Researchers were surprised to find that students were certain that eventually, their eyes would adjust in such a room and they would be able to see. Even after experiencing complete darkness, with no light, and several minutes in such a room, students believed that if they would eventually be able to see (Schneps, Salder, Woll, & Crouse, 1989). This observation is part of a larger body of research that would eventually be published as part of the documentary A Private Universe. Students had a hard time learning science that contradicted their own pre-conceived notions of how the world works, and even direct experience with the phenomenon was insufficient in getting students to reconsider...
their ideas. As the documentary poetically put it, seeing wasn’t believing, rather, believing is seeing.

These data challenged science education researchers and led them to a body of research collectively referred to as conceptual change research (Chi, Slotta, de Leeuw, 1994; Duit & Treagust, 2003). The cognitive models adopted by these researchers were informed by the work by Gestalt psychologists and Piaget’s developmental psychology (Posner, Strike, Hewson, & Gertzog, 1982). Science education researchers realized that learning is the “result of the interaction between what the student is taught and his current ideas or concepts” (Posner, et al., 1982, p. 211). In dealing with scientific misconceptions, Posner and others investigated what conditions were necessary for learners to accommodate new ideas in science. The following were the conditions they identified:

- Dissatisfaction with existing conceptions: A learner must have accumulated unsolved puzzles or anomalies that leave them dissatisfied with current explanations and understanding.

- The new concept must be intelligible. The learner must be able to grasp the idea in the first place. When a phenomenon is especially unfamiliar, good communicators will often employ analogies and metaphors are useful.

- The new concept must appear initially plausible. Plausibility draws on other knowledge schema because to be plausible, an idea has to be somewhat consistent with what else the learner knows about the world.
• The proposed idea must appear to at least have the capacity to answer unsolved questions.

• The new concept must be fruitful. This is to say that it must demonstrate the ability to extend knowledge and open new avenues of inquiry.

To this end, anomalies and analogies are important features of conceptual change. As we will see in my analysis, these communicative strategies emerge to different degrees among some of the videos. These conditions have been identified in research on management as well. The above conditions are similar to the process identified for innovation adoption, where peers or near-peers (rather than mass media) must present potential innovation advantages in order to persuade adoption (Rogers, 2003).

**An inquiry framework for science curriculum.** Research on explanation and conceptual change examines how we “tell” about science when we talk about science. But “telling” people about science is only part of the story. Science is an epistemology sprung from the need to seek answers about the natural world. That is to say that “asking” is as much a part of science as is “telling”, but it has been under-theorized in much of the research on textbook and curriculum materials. Chinn and Malhotra’s (2002) established a framework to evaluate authentic inquiry tasks in science curriculum. Their framework is useful in analyzing a variety of curriculum materials, from textbooks, to workbooks and educational software. Given its utility and use in analyzing a number of curricular artifacts (outside of textbooks), this framework has shaped my own approach to science content, and I will in part be looking at TeacherTube through this lens. Their framework is agnostic toward the content and individual state standards, instead focusing more on
scientific habits of mind. These features add further utility to this framework for the
current study. Upon their exhaustive analysis of science curriculum, Chinn and Malhotra
concluded:

Our central argument in this article is that many scientific
inquiry tasks given to students in schools do not reflect the
core attributes of authentic scientific reasoning. The
cognitive processes needed to succeed at many school tasks
are often qualitatively different from the cognitive
processes needed to engage in real scientific research.
Indeed, the epistemology of many school inquiry tasks is
*antithetical* to the epistemology of authentic science.

(p.175)

Chinn and Malhotra’s study draws examples from published science curriculum that
range from what the authors call “simple illustrations” through “authentic inquiry”. These
items are distinguished by looking at several factors such as how the curriculum treats the
relationship between theory and method, the role of community knowledge, and how
generalizations are made, for example.

Chinn and Malhotra’s framework and subsequent findings have been instrumental
in shaping the way I look at science curriculum, and their work will heavily influence the
discussion of my findings. While their analytical framework, and its focus on text and
software, doesn’t lend itself to a full analysis of UGV, their ideas about simple
demonstrations and authentic inquiry influence the way I think about communicating
science. It serves as a science-specific Bloom’s taxonomy (Bloom, Englehart, Furst, Hill, & Krathwohl, 1956). For example, a popular video on TeacherTube demonstrates that the visually interesting physical change that occurs when the candies called Mentos are dropped into diet cola. There are no explanations as why this happens (in fact, the video itself is mislabeled as demonstrating an exothermic reaction). The colas are arranged to look like a fountain and the whole thing is coordinated to music. The popularity of this video says something about what we think qualifies as “science,” though I caution that we do not know, and this study can’t tell us, the context in which this video might be used. Chinn and Malhotra can help science educators and content producers take stock of the gap between genuine scientific practice, and how we depict science via curriculum. The general public is used to visual representations of goggles, lab coats, and explosions as short-cut representations of science that it is easy to overlook how far such acts are from the actual practices of science. These representations are common on TeacherTube, and Chinn and Malhotra’s framework doesn’t provide us with the tools to deal with such representations. An analysis tool focused on language and representation is needed. Discourse tools that focus on multimodal communication, cultural assumptions, and transmedia features are available for a thorough analysis.
Discourses of science. My perspective on researching communication is heavily influenced by Gee’s work on discourse (2010b). In his words, “People use language to communicate, cooperate, help others, and build things like marriages, reputations, and institutions. They also use it to lie, advantage themselves, harm people, and destroy things like marriages, reputations, and institutions” (2011a, ix.). I am interested in what science teachers are “building” when they talk about science with students. The philosophical considerations of how we talk about science outlined in the above sections helps identify some of the larger units of analysis that I intend to employ in this study while analytic techniques brought in from discourse analysis can help with smaller, more fine-grain units of analysis focusing on the multi-modal presentation of video (test, speech, music, appearance, dress, etc.). This understanding of language — as a medium that lets us work with others, help others, build things, communicate a particular understanding of who your audience might be, transmit assumptions and expectations etc., — is of great interest to me as I examine the videos on TeacherTube. In the following chapter, I will go into greater detail about Gee’s understanding of discourse and how it was used in the following chapter when I discuss qualitative data analysis.

In this conceptual framework, I have described how scientific communication — whether it comes from classroom teachers or the materials they use — has been of great interest to education scholars. This is because it has the potential to shape the public understanding of science. The participatory nature of the internet, explored in great depth during the first half of this section, has opened new channels of communication and these
channels are waiting for the comprehensive analysis performed upon the more traditional modes of communication science education.
CHAPTER 3: RESEARCH METHODS

Research Goals

Understanding science communication via social media in general and UGV in particular is currently underexplored by researchers. With social media becoming an increasingly important medium for communication and digital distribution of educational content growing, I anticipate growing interest in this field.

Research Questions

What does science education look and sound like on TeacherTube? In order to address this over-arching question, I break the inquiry into the following specific questions:

1. What topics are represented?
2. What models of explanation do the videos employ?
3. How is science represented or communicated in this medium?
4. What opportunities do viewers have to interact with/ provide feedback to the videos?
5. What are the relative frequencies of visual and audio representations of science on the science channel on TeacherTube?
6. How do teachers appropriate cultural forms to communicate science ideas in these videos?

7. What assumptions do teachers make about the audience of their videos?

8. What personas do teachers perform to communicate science in these videos?

9. What discourses related to science and school do teachers draw from to communicate in different science in UGV?

To address these research questions, I interrogated a variety of visual research methods and found guidance from the following quote from two quantitative content analysts.

Although at first blush it might appear counterproductive to reduce the rich material in any photograph to a small number of codes, quantification does not preclude or substitute for qualitative analysis of the pictures. It does allow, however, for the discovery of patterns that are too subtle to be visible on casual inspection and protection against unconscious search through the magazine for only those which confirm one’s initial sense of what the photos say or do. (Lutz & Collins 1993, p.89).

In considering videos on TeacherTube, this resonated with me and convinced me that a mixed methods approach would be a good way to lay the foundations for a robust research trajectory: To this end, I am interested in the potential of putting quantitative and
qualitative data in conversation with one and another, both at the data level as well as the analytical level.

**Data Collection**

**Site selection.** For this study, I wanted to find a UGV sharing site that has a large amount of videos submitted by actual classroom teachers. TeacherTube seems to be the strongest website in this area. While there are many teacher submitted videos on mainstream sites like YouTube, there are also several videos produced by mainstream media companies, potentially introducing noise into my data. Some of these professionally produced videos reside on TeacherTube as well, but not nearly as many. To concentrate specifically on teachers as video producers and sharers, TeacherTube is currently an ideal place to look.

**Video selection.** The goal of my selection is to find a robust and coherent collection of science teacher videos that TeacherTube’s administrators and TeacherTube’s users view the most frequently or consider the most high-quality. The rationale for focusing on high quality videos is to both get a sense of the strongest videos being created here and to focus analysis on the videos that are most likely to be viewed. In this sense, the goal of my purposeful sampling strategy is not to identify characteristics of some kind of “average” video, but instead to understand characteristics of the videos that both the site creators and site users find to be the best and most useful videos. In a UGV sharing site, it could be easy, for instance, to stumble upon dozens of videos that have only been viewed once or twice. An examination of relatively obscure user generated content is outside of the scope of this study.
Videos on TeacherTube are searchable by keyword and they are also organized by site statistics. I mention this because it is an important point of departure in how most users might find videos on the site (via keyword) and my proposal, which utilizes site statistics. Site statistics offer a more systematic approach for video discovery. For example, a science teacher may come to the site and search for any of hundreds, if not, thousands of science terms, like refraction or equilibrium. It is impossible to guess what search terms individuals would use, however the way the site categorizes and promotes different videos does offer a comprehensive way to create a purposeful sample of what the site and the site’s users deem to be the most high quality videos.

Site-wide, TeacherTube videos are organized into subject area channels. I sampled the science channel and pulling videos using the following three site statistics:

1. Videos that are the most “viewed”. These videos have the greatest number of total views and are counted regardless of whether or not viewers have an account with TeacherTube. Note that TeacherTube enables easy downloads from the website to assist teachers with unreliable internet connections. This feature does obscure the true number of views received by a video, since off-line views are not counted in the viewing total.

2. Videos most frequently marked as the “most favorite”. Only individuals with accounts with TeacherTube can mark videos as the most favorite. Registration for videos is free and is required for advanced interactions with TeacherTube such as marking a video as favorite, commenting on a video, or downloading a video. Accounts allow users to by-pass commercials.
3. Videos listed as featured videos. These are videos selected by TeacherTube staff and are often used to highlight partnerships, such as a TeacherTube partnership with NASA.

The “most favorite” and “most viewed” ways of sorting the science channel are based on a numerical prioritization. The best way to select these videos is to respect this ordering, so for each of these I will simply take the first 100 videos that the site offers. The first 100 videos from each of the sub-channels will be selected for the content analysis. In the case of the featured videos, this is simply a case of videos being either featured or not featured, so the videos are sorted by the date they were uploaded. At the time of this research was conducted, there were only 99 videos listed as featured. There was some overlap between the favorite and viewed videos, so the total n= 254 videos.

Videos for the qualitative analysis are drawn from the sample of 254 videos. Because my research focuses on teachers as creators, I disregarded videos that were created entirely by students as well as those videos that were originally created for traditional media (for example a televised science series or commercials that made it into the corpus). The videos selected for qualitative analysis are those that I will argue represent the greatest contrasts or differences of the range of items found in the sample. By examining these differences, I hope to demonstrate the range of content found among the elite videos of TeacherTube and make a stronger argument for the internal generalizations that exist in the corpus.
**Timing.** Data Collection took place over the course of a single weekend in July, when activity on TeacherTube is low. The videos were downloaded so that they could be stored for analysis and reference onto an external hard drive. I used the reference tool Zotero to take screenshots of the pages that the videos were pulled from, so that I could keep the appearance and displayed metadata on file during the course of my research. During the course of my research, there was a major update to TeacherTube’s user interface, including the removal of comments, and their servers seem to have stabilized. Nonetheless, I have been able to preserve the appearance of the site as it existed during the time of data collection.

**Data Analysis**

As I am proposing a mixed methods study to capture depth and breadth of content on TeacherTube, I will discuss the two analytic paradigms separately.

**Quantitative components.** A descriptive content analysis (Neuendorf, 2002, p. 53) was used to analyze the videos. Descriptive statistics were used in order to highlight trends and patterns in the corpus. Content analysis is typically performed to make generalizations “about the relative frequencies of visual representations of particular classes of people, actions, roles, situations or events” of media circulated content (van Leeuwen & Jewitt, 2001, p. 10). The goal of my content analysis is to make generalizations about the high quality videos on TeacherTube, though not to make broader generalizations about user generated video.

The unit of analysis is the individual videos. I generated an initial codebook and refined it while piloting data. Several changes were made to the original set of codes to
accommodate for some unexpected findings. For example, there were a few videos that were mislabeled in science and belonged in math. There were several videos created by students, not teachers. There were several videos where I couldn’t tell whether a teacher had produced them or whether they were produced by a traditional media outlet. The codebook was updated to handle these ambiguities.

Categories needed to be mutually exclusive, independent of each other, and unambiguous. The categories and their respective variables are as follows:

1. Production: Who may have produced the video?
   a. The video was produced for traditional media (television show, television commercial, televised documentary, textbook publisher’s video)
   b. The video looks to have been produced by a teacher
   c. The video looks to have been produced by a student
   d. Non-traditional production via third party or ambiguous production

2. Music: What, if any music is present in the video
   a. Music is present and content is delivered primarily through music
   b. Music is present and delivers some of the content
   c. Music is present only as an accent (does not deliver content)
   d. No music is present in the video

3. What is the primary topic represented
   a. Life sciences (includes health science and ecology)
   b. Physical sciences (chemistry and physics)
c. Earth and Space Science

d. Science Lab procedures or/ and laboratory safety

e. Calls to action or highlighting a particular news event

f. History of science

g. Scientific method, nature of science, epistemology

h. Other (video was mis-classified and not a science topic)

4. Was there a secondary topic and if so, what?

a. Life sciences (includes health science and ecology)

b. Physical sciences (chemistry and physics)

c. Earth and Space Science

d. Science Lab procedures or/ and laboratory safety

e. Calls to action or highlighting a particular news event

f. History of science

g. Scientific method, nature of science, epistemology

h. No clear secondary topic/ does not apply

5. Scientific explanations: Is a scientific phenomenon explained in the video and if so, does the explanation go beyond the covering law (does it get into the how and why and beyond defining “what”)?

a. Yes-an explanation is present that goes beyond the covering law

b. No explanation present or explanation is more of a description, does not go beyond the covering law.

6. People: What kinds of people can be seen or heard in the video
a. Teachers
b. Students
c. Scientists
d. Other adults
e. Role-playing adults (this variable trumps teachers, other adults, etc.,)
f. Anthropomorphic non-humans
g. Teacher/ adult voice over
h. Student voice over
i. Combination of above
j. No presence of humans in sound nor visual

7. Sex: When humans are present are they:
   a. Male
   b. Female
c. Indeterminate
d. Both male and female are present
e. Does not apply

8. What is the setting of the video?
   a. Outdoors (on Earth)
b. Classroom (excludes visible laboratory benches, etc.,)
c. Laboratory
d. More than one of these
e. Other (includes space)
9. Presentation: What presentation is used to deliver the content?
   a. Live action
   b. Animation
   c. Powerpoint, keynote, or other presentation slide software
   d. Photo slide show
   e. More than one of these
   f. Other

10. Apparent purpose of the video
   a. Define vocabulary
   b. Demonstrate (with no explanation) a natural phenomenon
   c. To describe the steps or stages in a process or cycle
   d. To explain a phenomenon (is it attempting to address “Why does X happen?)
   e. To pose a question to students (without giving an explicit answer in the video)
   f. To demonstrate a procedural or safety technique (how to set up a Bunsen burner, how to use an eye wash)
   g. To model the scientific method or scientific inquiry
   h. A call to action (to recycle, to abstain from smoking, etc.,)
   i. “Other eye”: to show students something that can’t be shown readily in a classroom, for example a microscopic event, slow motion
To display a student project or student work (for example a class-wide chick hatching project)

More than one of these

Other

**Inter-rater reliability.** A total of 30 videos randomly selected from the sample were coded independently by two coders. Table 1 features the results of the inter-rater reliability analysis. While there are no universal criterion for “cut-off” scores, some widely accepted guidelines (Neuendorf 2002, p. 143) were used to inform this study.

The study was designed to anticipate and avoid the most common threats to reliability. The first of these threats listed by Neuendorf (2002, p. 145) is a poorly executed coding scheme. This was addressed by applying revisions to the codebook after a pilot test. These revisions helped us take into account unexpected trends and patterns and allowed us to refine categories as necessary. The next threat is inadequate coder training. In this case, the second coder was not as familiar with science education and educational technology as I was, so we went over the rationale behind the categories and discussed them in the context of videos that were outside of the corpus data. Finally, coder fatigue can be a threat to reliability. This threat was addressed by keeping the codebook from becoming too lengthy while equipping it to deal with all of the data and questions and giving coders ample time to do the coding.

Next, we employed a few different statistical tests to determine inter-rater reliability. We started with a very basic overall percent agreement demonstrating the total overlap of agreement. Next, we used Cohen’s kappa and Scott’s pi as both of these take
into account the extent to which agreement would occur by pure chance. Both of these tests have received criticism for being too conservative and we were able to embrace their conservative cut-offs. Krippendorff’s alpha was added as it takes into account agreement as a result of chance, but also the magnitude of disagreements among coders.

A 70% agreement is considered to be reliable, indicating that the purpose category is weak on this measure. Given that percent agreement fails to take into account the possibility of random chance agreement, Krippendorff’s Alpha, Cohen’s kappa, and Scott’s pi were also calculated. The equations for each of these tests are listed in the Equations section of this dissertation. Purpose is also weak on the Krippendorff alpha measure, where Krippendorff (1980, p. 147) proposed a very high reliability standard at above .80. That particular standard would also call into question the reliability of all but primary topic, gender, and types of people. On the other hand, using Cohen’s kappa, .75 and beyond indicates excellent agreement beyond chance and .40 to .75 indicates fair to good agreement beyond chance (Banerjee et al., 1999). Scott’s pi is derived from the same conceptual formula, and thus serves as an added reliability measure that can be evaluated similar to Cohen’s kappa.

Note that the category “Covering Law” has a high percent agreement, but because it was a binary variable, it is difficult to get higher numbers in the Cohen’s kappa and Scott’s Pi calculations. Altogether, these reliability results suggest that the coding has been reliably applied to the videos well beyond any kind of chance agreement.
Overall, there was strong agreement between the coders except for the category of “secondary topic” as so few videos had a distinguishable secondary topic. Therefore, the secondary topic category was discarded for reporting.

Table 1

<table>
<thead>
<tr>
<th></th>
<th>% Agreement</th>
<th>Scott's Pi</th>
<th>Cohen's Kappa</th>
<th>Krippendorff's Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Produced by</td>
<td>83.3%</td>
<td>0.744</td>
<td>0.746</td>
<td>0.748</td>
</tr>
<tr>
<td>Music</td>
<td>80.0%</td>
<td>0.696</td>
<td>0.698</td>
<td>0.701</td>
</tr>
<tr>
<td>Primary Topic</td>
<td>90.0%</td>
<td>0.848</td>
<td>0.848</td>
<td>0.851</td>
</tr>
<tr>
<td>Covering</td>
<td>90.0%</td>
<td>0.666</td>
<td>0.667</td>
<td>0.672</td>
</tr>
<tr>
<td>People</td>
<td>96.7%</td>
<td>0.960</td>
<td>0.960</td>
<td>0.961</td>
</tr>
<tr>
<td>Gender</td>
<td>86.7%</td>
<td>0.803</td>
<td>0.803</td>
<td>0.806</td>
</tr>
<tr>
<td>Setting</td>
<td>76.7%</td>
<td>0.689</td>
<td>0.692</td>
<td>0.695</td>
</tr>
<tr>
<td>Presentation</td>
<td>80.0%</td>
<td>0.701</td>
<td>0.704</td>
<td>0.706</td>
</tr>
<tr>
<td>Purpose</td>
<td>60.0%</td>
<td>0.544</td>
<td>0.548</td>
<td>0.552</td>
</tr>
</tbody>
</table>

Because my goal of the content analysis is to generate descriptive statistics about the content in these videos, there will be no inferential statistics. The purpose of the content analysis in my study is in line with van Leeuwen and Jewitt’s (2001, p. 27), “The methodology [content analysis] can be used to provide a background ‘map’ of a domain of visual representation. Having conducted a content analysis, the researcher can then interpret the image or the imagery in qualitative ways.”
Given the role content analysis plays in this study, there is less of an emphasis on hypothesis testing than we might expect to see in a more traditional, stand-alone content analysis. Nonetheless, descriptive statistics can provide some quantitative descriptions that could confirm or invalidate some preliminary patterns I have noticed regarding the TeacherTube science channel corpus. These preliminary observations will be revisited during the analysis and discussion:

- **Music conveying content** is a component of the majority (more than half) of favorite, featured, and most downloaded videos.

- **Deep explanation** does not appear to be a priority for the videos on TeacherTube. A minority (less than half) of the videos go beyond The Covering Law level of explanation.

- A majority (more than half) of the most downloaded and most viewed videos are clips from traditional media.

The first two bullet points are based on my preliminary observation of videos on TeacherTube whereas the third point references the finding by Burgess and Green’s (2009) finding about the dominant role traditional media is increasingly playing on YouTube (p.59). These descriptive statistics can inform future studies as well as provide some context to the videos selected for qualitative analysis, thereby being completely transparent regarding to what degree a given video is representative or exceptional within the wider corpus.

In the texts about visual methods by both van Leeuwen and Jewitt (2001) and Rose (2007), the authors advocate for pairing content analysis with qualitative methods in
order to provide greater detail and depth to visual interpretation. These qualitative methods are addressed in the next section.

**Qualitative components: Discourse analysis.** The qualitative component of this study is concerned with how teachers talk about and represent science in their videos, for this reason, I have selected discourse analysis as the analytical framework for this section. There are a variety of approaches to discourse analysis (DA). Some of these retain close ties to linguistics and focus deeply on studies of grammar. Other approaches are more focused on topical issues, ideas, and themes. My questions are much more in line with this latter approach because I am interested in the discourses of teachers in particular, I have looked to discourse theorists working in educational scholarship. This is one reason I am particularly interested in the work of Gee (2011b). Gee’s most recent work has focused on discourse as it pertains to learning and digital media (Gee, 2007; Gee & Hayes, 2010) making it uniquely applicable to my study among the approaches to DA. “We live in a digital age awash in images and texts that combine words and images” (Gee, 2011a, p. 187). For Gee, all of these come together to form “multimodal” texts in that they combine different modes like language, images and music. For this reason, his framework offers a comprehensive approach to analyzing the videos.

Many traditions in discourse analysis have strong ties to research traditions concerned with power and institutions (Fairclough, 2003; Rose, 2007, p. 172) whereas Gee’s DA examines what he calls “world building:” I am interested in the “worlds” these science teachers are building, and the nature of science and science education in those worlds. In discourse analysis, language is understood to be a medium to work with
others, represent reality, help others, build specific kinds of language, communicate a particular understanding of who your audience might be, what assumptions and expectations they might have. This conception of language is useful in exploring the questions I have about science videos on TeacherTube. Gee recently published something of a “how-to” guide regarding employment of this analysis (2011a) and as an appendix to his book, he includes a section called, “Discourse Analysis for Images and Multimodal Texts” (p.187). This appendix does a nice job of addressing the role DA can play in digital media in particular. DA is often included as a visual research strategy (van Leeuwen & Jewitt, 2001; Rose, 2007) but Gee’s direct, succinct writing on the topic further convinced me that his approach could be the most useful for my research purposes. He suggests that “The theory [of DA] applies because, in fact, discourse is about communication. We humans can communicate via other symbol systems or via systems composed using modalities other than language or ones composed by mixing other modalities with language” (2011a, p. 187). Images (moving and still) serve as a potent medium for communicating through symbol systems, and this is useful for my inquiry into video.

In Gee’s How to Do Discourse Analysis: A Toolkit (2011a), Gee proposes 27 tools that can be employed in DA. Each “tool” is a specific set of related questions to ask of the data. The idea is to use the tools all at once, with an understanding that some tools will be more useful than others, depending upon the data to be analyzed. The tools are organized into four types: theoretical tools; building things in the world tools; saying, doing, and designing; and theoretical tools. The theoretical tools (p. 149) are centered in
different theories about how language connects individuals experience in the world and culture. These theories draw from a variety of fields such as cognitive psychology, literary criticism, anthropology, and sociology. An example of a tool from this section is the “situated meaning tool” in which we ask what assumptions utterances make assume of people’s previous experiences and knowledge (p. 153). This is useful in instances where a teacher in the video says something like “remember how we discussed X the other day.” The situated meaning tool indicates that the teacher assumes he is speaking to his class of students and they are watching this in a larger context of ongoing lessons.

The largest group of tools is a group Gee refers to as the “building things in the world” tools (p. 83). An example here would be “identity building tools.” Here, Gee encourages looking at language as a site where people establish what sort of person they are. In his words, “a person, might be, at one and the same time or different times, acting as a parent, a male, an African-American, a professor, an avid video gamer, and an Evangelical Christian, a committee chair, and other such identities” (p. 106). His point being that this very same person might use certain words, phrases, or inflexions when directing a committee meeting at a university where he is employed and speak an entirely different way during a church picnic. His language would change yet again when speaking with a potty-training two-year-old daughter. By examining this language, we can learn more about the identities he is enacting during a given discursive interaction.

A third set of tools, the “saying, doing, and designing” tools explore all of the tasks language seeks to accomplish that go beyond mere communication of ideas. This is where Gee is closest to the linguistic roots of DA. These tools include considerations
such as whether the vocabulary used is derived from Germanic or Latinate roots (in English, our more formal, specialized, professional discourses are Latinate where our common-everyday language is Germanic. Think of the difference between dog and canine, god and deity, tell and narrate) (p. 53).

The final set of tools is called the “language in context tools”. These tools ask us to consider what we know about the context in which we’ve uncovered these utterances. For instance, the “make strange tool” asks us to elicit the anthropologist's practice of interrogating what understandings we might take for granted, understandings that those from other cultures (or discourses) might find odd (p. 19). The frame tools asks us to widen the context of what it is we are analyzing to make sure that our analysis remains unchanged even in a wider context, in other words, keeping us honest and making sure we are not analyzing out of context (p. 37).

The qualitative analysis seeks to answer the following research questions (mentioned earlier in this chapter): How do teachers appropriate cultural forms to communicate science ideas in these videos? What assumptions do teachers make about the audience of their videos? What personas do teachers perform to communicate science in these videos? What discourses related to science and school do teachers draw from to communicate in different science in UGV? To answer these questions, I draw only from videos that were identified as likely being teacher produced. Videos that appear to be produced by students of via traditional media will be documented during the content analysis, but they are outside of the scope of this study for the discourse analysis.
Among the teacher-produced videos, three categories of video types emerged as being common: “lecture” videos, music videos, and “other”. These categories are discussed in greater length in the next section, but for now I will note that music videos were explicitly coded for, while lecture and “other videos” emerged during the content analysis. I draw several videos in each of that contrast with one and another to demonstrate the diversity within each category.

For each video I analyzed, the following tools proved to be instrumental in the analysis (though this not an exhaustive list):

1. The significance building tool. This tool asks what people are drawing attention to with language. What are they saying is most significant (p. 92)?
2. Identity building tool: What identities is the person in the video enacting or brining into play? What other identities are they drawing on? How are they playing with the identity of (for example) a teacher, scientists, etc., (p.106)?
3. Signs, systems, and knowledge building tool. This tool examines what type of language and symbols (technical language, mathematical symbols, etc.,) are privileged in the communication (p.135).
4. The connections building tool: This tool looks at how the video brings in the prior experiences (or assumed experiences) of the viewer (p. 126).
5. Relationship building tool: How is the communication attempting to building, maintain, or create relationships between the speaker and the audience (p. 144)?
6. Intertextuality tool: What outside information and content is being brought into the communication (p.165)?

7. Figured worlds tool (p.168):

8. What values about science, teaching and learning are evident?

9. What assumptions are evident about assumptions of the student audience?

10. The Big “D” discourse: How is the person using language, acting, and presenting themselves to enact a specific socially recognizable identity (p. 176)?

11. The frame problem: This tool does the work as the feedback strategy for validity advocated by Maxwell (1996, p. 94). Both Maxwell and Gee ask the researcher to get additional information about the context to see if it falsifies my discourse analysis. I was able to speak with some of the teachers in the videos and there work will be cited as personal communication. This will be used as a validity check (Maxwell, 1996) though it is also blended with analysis.

Validity Issues

The primary validity concern with the content analysis is ensuring that claims drawn from the analysis are grounded within the limitations of the study. Content analysis techniques were developed to make generalizations about traditional media, but the extent to which these techniques translate into UGV is unknown. For this reason, the
content analysis serves only to develop descriptive statistics about the corpus and not to generalize beyond the study’s population.

Determining inter-coder reliability provides some measure of standardization as to what values the variables are given. The content analysis literature does not have any strict cut-off points for inter-rater reliability, but we followed general rules of thumb published in Neuendorf (2002) and this rationale is described on page 50. The content analysis will make no claims regarding audience interpretation or use of the videos, and claims about the videos will be restrained. All videos discussed are also publically available on TeacherTube, and are thus available for scrutiny.

In addressing validity concerns to my qualitative data and analysis, I turn first to Maxwell’s (1996) approach to the topic. The content analysis is part of a strategy for strengthening the claims made in analysis. In discussing qualitative details of the videos, the reader will be able to contextualize how common or uncommon a given video category is based upon the descriptive statistics provided. The content analysis in this study will provide me with descriptive statistics to contextualize any claims I might make from the qualitative data that might be implicitly quantitative in nature. “Any claim that a particular phenomenon is typical, rare, or prevalent in the setting or population studied is an inherently quantitative claim that requires some quantitative support” (Maxwell, 1996, p. 95). The content analysis provides the study with transparent information regarding how representative a given video might be of the type of content found on TeacherTube.

Threats to the validity of the discourse analysis are managed in a few ways. Back-up copies of all the videos will be kept on a hard drive. These videos selected for
Qualitative analysis will be described using rich data, “data that are complete enough that they provide a full and revealing picture of what is going on” (Maxwell, 1996, p. 95).

Concerning validity of interpretation, I use Gee’s discourse analysis, which is an analytic method developed for describing educational talk. Gee has a few recommendations for handling validity. When addressing the validity of analysis for situated meanings (discourse that goes outside of the actual utterance) Gee recommends “the frame problem tool”, that is, seeking outside information to contextualize the interpretation. “The frame problem” tool intersects with Maxwell’s recommendation to seek context and input from research subjects about the discourse you are interpreting. I did this by discussing my findings with three of the content creators featured in the discourse analysis.

Gee discusses validity for discourse analysis as being constituted by the following four elements (Gee, 2011b, p. 123):

1. Convergence: A discourse analysis is more, rather than less valid, as it offers compatible and convincing answers across as many of the tools in the toolkit as possible. In my study, I address this by employing as many elements of the toolkit as are appropriate for the research questions defined by the study.

2. Agreement: The answers to the questions in the toolkit should be convincing to native speakers and members of the Discourse implicated by the analysis. For this reason, I occasionally bring in findings or observations from other researchers, particularly from Lemke’s 1990 *Talking Science*. That book contains deep, rich analysis of in-classroom conversations. The depth and
breadth of that work provides an excellent framework for seeking agreement and discrepancy.

3. Coverage: The analysis is more valid the more it can be applied to related data. In this study, the content analysis provides this sort of analogous data, as to comparisons to Lemke’s findings.

4. Linguistic details: Validity in discourse analysis lies partly in the analyst and the analyst’s ability the ability to argue that the communicative functions being uncovered are linked to grammatical devices that can serve the interpreted functions, according to the judgments of “native speakers” of that social language.

On this point, I rely on Lemke’s rules for “serious” science language, outlined earlier in the conceptual framework. Lemke’s rules focus the study on the appropriate linguistic factors in so far as the research questions are concerned. Some linguistic details are interesting, but outside of the scope of this study. For instance, Gee talks about isolating word roots to identify whether the roots are Germanic or Latinate. Germanic words are typically those we use as part of common-everyday language (dog, deadly) where Latinate are part of a more professionalized, specialized language (canine, mortal). These are fascinating discourse issues, but they distract us from the current research goals.

Regarding the possible validity threats as to how I will go about selecting videos for qualitative analysis, I will make clear that the selected videos are meant to represent diversity within emerging themes. This is to say that the videos selected represent
different approaches to common themes and ideas discovered through the content analysis. By contextualizing the videos within content analysis and actively stating that I am seeking discrepant data, I aim to make my selection for qualitative analysis as transparent as possible.

This active search for discrepant data will also help mitigate any bias I am bringing into the project. Because of my own background, I suspect that my familiarity with physical science and older (high school aged) students might bias me toward looking at content aimed at that range. I tend to have a blind spot when it comes to elementary education and for this reason. I believe the content analysis puts useful boundaries and restrictions on the sample from which I draw for qualitative analysis. The methods and questions will also privilege analysis of some video over others. For example, by and large the most viewed video in the corpus is “Frog Dissection Instructions”. During data collection, this video had 41,285,554 views. To put this number in context, note that the second most viewed video had 13,727 videos. This a significant data point regarding how teachers are using TeacherTube, but it is the only dissection video in the corpus, and there is no narration. This gives me little to analyze qualitatively within my selected framework, and it is an anomaly in terms of numbers of views as well as video content. By contextualizing the videos within content analysis and actively stating that I am seeking discrepant data, I aim to make my selection for qualitative analysis as transparent as possible.

**Ethical Issues**
Online researchers struggle with the ethics of online research (James & Bushar, 2009; Kozinets, 2010) and new ideas and standards are emerging all the time. The following paragraph captures the unique challenges faced by Internet researchers:

The Internet is not really a place or a text; it is not either public or private. It is not even one single type of social interaction, but many types: chats, postings, comments on mass-trafficked blogs, sharing of sound clips and videos, telephone conversations shared using VOIP protocols. The Internet is uniquely and only the Internet. As we reason about it, we need to keep our guiding metaphors in mind. (Kozinets, p. 142).

The paragraph identifies several issues for internet researchers to consider. For instance, are the items are posted with the expectations of privacy or for public dissemination? These distinctions can sometimes be difficult to make when it comes to online research, but TeacherTube is a straightforward case. All of the videos in the corpus were made publically available by the uploader. The purpose of TeacherTube is to make content publically available. The videos can be viewed by anyone on the Internet and do not require a log in or registration to view.

As such, the research in this proposal does not qualify as human subject research according to the Code of Federal Regulations Title 45, Part 46, Protection of Human Subjects (2012), the governing regulation for Institutional Review Boards in the United Subjects. “If the research involves collecting and analyzing existing documents or records that are publically available this research qualifies for a human subjects exception” (Kozinets, 2010, p. 414) and was granted an exemption from George Mason University’s
IRB. Describing videos in TeacherTube, which have been posted with the intention of public dissemination, falls into this understanding of archival research.

For me, the primary ethical issue has been whether individuals in the videos should be identified as research participants to be studied, or content producers to be cited. I argue that the videos should be cited (identified outright, not obscured) with attribution given to the name used by the poster. I see my research relationship to the content creators as a professional one, where the video creators are professional people displaying their expertise. As such I take a cue from Kozinets, “there may be examples where culture members or culture leaders would like credit for their work.” The three teachers I spoke with are all cited as personal communication, and their work is attributed to them.
CHAPTER 4: FINDINGS OF CONTENT ANALYSIS

The Big Picture: Some Trends in the General Corpus

The result of the collection procedures outlined above is a collection of the 254 most successful videos in the science channel of TeacherTube. This included the 100 most “favorite” videos, the 100 most viewed videos and the 99 videos marked as featured. As noted earlier, this collection strategy could have resulted in anywhere from 100-300 videos, based on the extent to which the categories overlapped. The total of 254 videos suggests that, although there is significant overlap between these selection criteria, relying on any one of the categories alone would have resulted in a weaker understanding of the videos that are succeeding in the science channel. For full details on differences between these three categories see Table 2, and discussion of the table below. With that noted, the rest of this section focuses on exploring trends in the whole corpus of 254 videos. In what follows, I discuss some of the general trends found among the categories presented in the order in which they appear in Table 2.
**Who is creating the videos?** Within the corpus, I found professionally produced videos to be a far smaller overall percentage (15.7%) than I had hypothesized. Recall that Burgess and Green (2009) found that on YouTube, 42% of their sample appeared to come from traditional media sources, which they define as videos originally produced within the established media industry (p. 43). For example, many YouTube users repost music videos, documentary clips, and news footage. I had used this finding to inform my initial hypothesis about TeacherTube. However, this phenomenon does not translate into the most successful science videos on this teacher-specific site. Importantly, Burgess and Green’s research looked at a random sample of YouTube videos where this project focused on the most successful videos on TeacherTube. This difference might help explain the difference in the results.

One caveat I must add to the 15.7% figure is that there are an additional 19.3% of videos that were categorized as ambiguous. These ambiguous videos, however, are not a source for additionally reposted professionally produced video content. I had initially created the ambiguous category for videos where it was unclear if they were clips from broadcast media, or teacher or student produced. That is, the category was created as a place to note videos where it was unclear which of those three categories they came from. However, most of the videos coded as ambiguous actually seem to come from a different type of creator altogether. I found several videos that had higher production values than the average teacher, but were clearly not video for broadcast television. For example, the Smithsonian Astronomical Observatory published and uploaded a series of popular video clips about their Chandra telescope. Another example includes demonstration videos
shared by the company Arbor Scientific. These videos demonstrate the company’s products and discuss how they can be used in teaching specific principles. Another caveat I would add is that the featured videos, which are controlled by TeacherTube, promote teacher-created videos. As demonstrated later in this analysis, when the video corpus is controlled by viewers, copies of professional videos comprise a greater percentage of the sample, though they are still not quite as high as the YouTube numbers.

Ambiguity between what is professional and amateur is consistent with an emerging trend on other video sharing sites such as YouTube. Burgess and Green used this dichotomy as it is somewhat useful for classification, but they also caution that the dichotomy also fails to characterize popular uploads on YouTube (p.55). According to my research, this holds true TeacherTube as well.

In the general corpus, 18.5% of videos were classified as student work. Among this group are many individual or group assignments completed by students. This finding challenges the nature of what I thought my inquiry was about. I set out to learn more about what teachers were sharing or producing, but what I found is that nearly one fifth of the videos are student produced. This suggests expanding my understanding of the role TeacherTube plays to its users as it is a place to share student projects in addition to being a place for teachers to house their lessons and demonstrations. Not only are student videos being shared here, but as my selection criteria focused in on the most successful videos in the science channel these student-produced videos are also successfully finding an audience on the site. This understanding also points to other avenues of research to investigate the role that video sharing plays in how students report and present science
assignments. Importantly, while these videos are created by students, they are created as part of coursework. Thus, this is still (broadly speaking) part of how teachers are using video for their instructional purposes.

**The role of music in the videos.** While music is an important component of the videos with 67.4% of videos include some musical element, music is primarily a content-neutral accent (51.2%). Only 16.2% of videos contained music used to deliver content. The videos where music was the primary content delivery system are among the most favorite and most viewed so I suspect my initial overestimation of their presence stems from that. The role of music in science education is generally under-theorized, so there was little else to draw upon for this hypothesis. In particular, given that teachers seem to be drawn to the value of music as a pedagogical tool (both as creators and consumers of these videos) it would seem that it would be valuable to explore this kind of vernacular pedagogy emerging from teachers interest and practices. When it comes to what viewers “want” (either via views or favorites) these types of videos have a strong presence and will be analyzed in greater depth later in this study.

**Apparent purpose of videos and levels of scientific explanation.** As for the apparent purpose for videos, explanation of a phenomenon was the primary purpose for only 9.4% of the videos, so it is no surprise that few videos in the entire corpus go beyond the covering law of explanation (only 22.8% were classified as such). For a video to be coded as going beyond the covering law, it needed to meet the following requirements. First, some sort of explanation had to be present. The video had to address a “why” question. Thus, any video that provided mere definitions or examples (i.e., “This
is a Fresnel lens”) were not coded as going beyond the covering law. If an explanation was present, we tried to determine whether the video addressed the underlying, unifying cause. If it did, then the explanation was coded as going beyond the covering law. For example, “when a liquid is heated, it expands” does not address the underlying cause of why this happens. It merely connects a statement to a guiding law, without explaining the natural phenomenon behind that law. This explanation does not go beyond the covering law. On the other hand, “when a liquid is heated, molecules move faster and farther apart, causing the liquid to expand” would be coded as going beyond the covering law.

Coding for the covering law meant that we were coding for a certain type of scientific explanation. Therefore, it follows that if videos were coded as going beyond the covering law, they must have featured some sort of explanation. Note however that a greater overall percentage of videos were classified as going beyond the covering law (22.8%) than there were videos coded for having a primary purpose of explanation (9.4%). This happens when a video develops a scientific explanation above and beyond the primary purpose of the video. For example, a video that was part of the “Research at the University of Florida” series called “Cell phones and Eliminating Malaria in Zanzibar” discussed how a researcher in Florida approached a real-world problem. The purpose of this video was to “explain a scientific method.” In this case the researcher (a geographer) explained his method for tracking new malaria cases brought into Zanzibar. In doing so, the geographer talks about his small role in a much larger, more complex study involving other disciplines and identifies the multitude of factors that are taken into
consideration and the proposed strategy, providing one of the few models of how scientists use statistical reasoning to approach problems.

Coding for purpose typically involves looking at the message being conveyed: is the video providing definitions? Is the video modeling a laboratory? Is the video explaining a phenomenon? We found that during preliminary coding, there were several videos (especially among those videos that were student produced) that did not have any purpose other than to show off student work. For this reason, the “student project” category was created as a catch-all category for videos that appeared to be created by students and did not readily address any other pre-defined purpose. This category is discussed at greater length in a subsequent section.

**Primary video topics.** Physical science (physics and chemistry) are the bulk of represented topics (42.9%) with earth and space following at 26.0% and life sciences at 20.5%. Very few videos dealt with topics in the history of science or made explicit appeals regarding the nature of science. The history of science videos that appear deal exclusively with providing examples of scientists who are non-white and non-male, that is to say, they serve as an attempt to demonstrate diversity in science. I was surprised to find no videos regarding the history of scientific ideas, as there is evidence that teachers regard the history of science ideas as an important way to communicate the nature of science (Chmiel & Peters-Burton, 2011).
**People in the videos.** Of types of people that appear in videos, teachers (18.5%), role-playing adults (17.3%), and teacher/adult voice-overs (18.1%) were most common. Scientists were present though rare (scientists appear in only four videos). Images of students were relatively rare (5.5% of videos) though this isn’t completely unexpected, as many schools and districts have policies against publishing children’s images online. Among the people, voice-overs, characters, and anthropomorphized characters, the majority depict only males (44.5%) with both genders being more readily represented than females only (23.6% as opposed to 13.0%).

**Exploring Differences between Most Viewed, Most Favorited and Featured Videos**

As previously mentioned, while the different selection criteria for successful videos overlapped in some cases, they identified many videos that were only selected on the basis of one selection criteria. In this section, I explore differences that emerged in comparing videos from each of the three selection criteria, the most viewed videos, the most favorited videos and the featured videos. See Table 2 for reporting of item by item differences between these categories.

**Video recording formats and presentation styles.** Another general observation is that the videos are primarily live action (45.7%) with other formats represented relatively uniformly 11.8% are animated, 16.5% are PowerPoint presentations and 16.9% are photo slideshows. These findings are indicative of the types of production and editing technology that are accessible to teachers and students.
### Table 2

*Coded Results for All Videos and By Selection Category*

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Most-viewed videos: The primacy of mashups. The total views for videos are counted by views regardless of whether or not the viewer has a TeacherTube account and generally will also count repeat views by users. Throughout the course of this study, the same video has remained the most viewed video. It is a frog dissection video that had 41,285,554 views at the time the data was pulled off of TeacherTube in July 2012. The video is anomalous in its enormous number of views as well as content. There were no other dissection videos in the corpus and there were very few soundless videos. The second most viewed video was a music video about “Radiation, Conduction, and Convection” with 13,727 views. Again, recall that videos could be downloaded and views resulting from downloaded videos are not recorded, so the number of views is somewhat of an approximation.

The “Frog Dissection Video” is the second most viewed video on the entirety of TeacherTube, across all subjects and grade levels. But in investigating the viewing numbers relative to other videos on TeacherTube, I stumbled across something that questions what the raw numbers of views and “favorites” might mean in this analysis. While investigating where the video stood relative to other videos, I discovered a video called “Water Cycle Song” listed as the fourth most viewed video. A version of this video appears in my corpus. However, the particular instance of the video that is at the fourth most viewed position is listed in a “middle school” channel and not in the science channel I used for data collection. This exposes one of the difficulties of analyzing user-generated video. The video categories are also user-generated and there is no guarantee that categories are accurate or comprehensive, and this is a limitation inherent to the
medium being studies. To be sure, three math and logic puzzle videos found their way into my corpus.

- There are a few notable differences among the most viewed population as compared to the general corpus:

  - Professional videos make up a greater percentage of most viewed videos than what is seen in the general corpus. 27% of most viewed videos were coded as being professional as opposed to 15.7% of the general corpus.

  - Student created videos make up a greater percentage of most viewed videos than what is seen in the general corpus. 30% of most viewed videos were coded as being student produced as opposed to 18.5% of the general corpus.

  - Music videos make up a greater percentage of most viewed videos than what is found in the general corpus. 21% of the most viewed videos were coded as being music videos as opposed to 13% in the general corpus.

Closer analysis of these trends in the most viewed videos, however, exposes further complications in categorizing user-generated videos. Take, for instance, the student produced music video for “Radiation, Conduction and Convection”. The video is primarily an animated slideshow (likely PowerPoint) that utilizes professional photographs as well as what I suspect to be professionally created animated .gif (graphical image format) files that came bundled in some software. The song used in the video comes from a company called Rhythm, Rhyme, Result, and was created by an impressive team of collaborators including an Associate Professor of music from
University of California-Berkeley and an MC/lyricist enrolled as a medical student at Emory University. Other songs produced by this company appeared elsewhere in the corpus.

So while the video is likely produced by a student, the important content, and likely the content that brings in the viewers, is professionally produced. As we’ll see in my section about music videos, teachers create and share videos with their own musical lyrics. Nonetheless, the professionally produced music and the melodies of popular songs (with lyrics substituted out to deliver the science lesson) are heavily represented among the most viewed videos. This demonstrates that mashup culture (Lamb, 2007), a lingua franca of the web (Kakutani, 2010) successfully permeates school culture. The extent to which these types of videos are among the most viewed demonstrates the interest in these kinds of “mashups” as a medium to develop science content. This idea of mashups and their role in science education videos will be discussed in greater detail later in this analysis and in the subsequent chapter.

**Our favorites: Stars of the small screen.** Marking a video as “favorite” takes slightly more effort than simply viewing the video. A user has to have created a user account in order to be able to “favorite” a video. Forty-seven of the videos appear in both categories (most favorite and most viewed), so that the total of featured and favorite videos is 153. So, while there is significant overlap between videos that succeed in each category more than half of the videos in each sample (53) appear in only one of the two.

Like the most viewed videos, professional videos comprise a greater percentage of the sample than the general population, with 27% of the most favorite videos being
professionally produced. In fact, three of the five most favorite videos are from a publisher called Ignite! Learning. Another similarity shared by the most favorite and viewed videos are the “music” videos: those videos where content is primarily delivered through music and song. These videos comprise 21% of the most frequently favorited videos. Indeed, it is this type of video that is frequently found in both the most favorite and the most viewed categories.

The favorite and viewed videos differ in two apparent areas. The first is among student produced videos, which are part of the “favorite” group at a much smaller percentage than the most viewed and general population. Only eight student produced videos are among the most favorite. Also among the most favorite videos are a large percentage of videos featuring a “role-playing human.” This finding arises primarily from the presence of professional Bill Nye “The Science Guy” videos where real-life scientist Bill Nye takes on various personae in explaining scientific phenomenon. Nye is not the only such character found in this sample of videos, however. A Texas-area teacher by the name of Douglas Valentine plays a character he calls Dr. Loopy. Similar to Nye, Dr. Loopy explains various scientific ideas. Both Dr. Loopy and Bill Nye have several videos on TeacherTube that are among the most favorite.
**Featured videos: cultivating a community.** Despite repeated inquiries, I was unable to speak with anyone at TeacherTube about how they selected their featured videos. I did notice that certain users were frequently among the featured videos. The Chandra Observatory telescope launched by NASA is an example. None of the videos overlapped in all three categories and only two videos were shared among most favorite and featured (none were shared between most viewed and featured). To be sure, teacher created videos were at their greatest percentage rate in this category (48.5%) and videos marked “other” or ambiguous were also prominent in this category (30.3% compared to 19.3% of the general population). These “other” videos will be described in greater detail elsewhere in this study. Few student produced videos or student projects are present in this sample, and the proportion of videos that are music videos is much lower than the general sample (only four videos). This leads me to speculate that “Featured Videos” are a way for TeacherTube to shape their vision of what kind of video-sharing platform they want to be, and provide added attention to content partners.

**Emerging Genres: Patterns by the Numbers**

After examining the videos based on the categories of selection criteria I then looked back over the corpus to identify distinct emergent genres for further analysis. In this section, I discuss trends in each of these genres and compare them to the rest of the corpus. See table 3 for a full comparison of each of these emerging genres.
Video lessons: Resources for a flipped classroom. Unlike other categories discussed in this content analysis section, this category is one that emerged and was not a category that was initially coded for. The “lesson” videos are an emerging category that was defined as teacher produced and are not primarily delivered via music. The content in this section varies from demonstrations on how to use scientific equipment to lectures being delivered via chalkboards, overheads, or presentation software. This is the category where most of the videos that might be part of a flipped classroom strategy would appear. While many of the videos in this sample are among the longest videos in the corpus, with videos in the 20 minute to 15 minute range not being uncommon, the mean length of videos in this sample is about six minutes, about two minutes longer than the mean for the general corpus, but with slightly greater variance (as the lesson videos include many of the longest videos) (lesson sample M= 5:58, SD= 0.20 and general corpus M= 4:08, SD= 0.17).

A total of 85 videos in this category were identified from the teacher produced videos, making it a significant proportion of the total videos, but we have to proceed with caution in any distant reading of the frequencies that appear in this sample. This sample of videos has multiple videos uploaded by the same, relatively small number of creators. Because we find so many videos from the same users, certain patterns and habits of teachers posting these types of videos dominate the frequency of what we see in this sample. For instance, one such user is a Texas teacher named Douglas Valentine who uses the screen name “Dr. Loopy.” Valentine has a total of 27 videos in my sample and his Dr. Loopy videos are shot as a series with many common elements. This strongly
influences some of the patterns and frequencies that we see. For instance, many of his videos start with the 1980s pop song “She Blinded Me with Science” and are shot with multiple locations. This influences the degree to which we see accent music and multiple settings, though neither of these patterns say much about these videos as a whole.

Valentine explicitly addresses his students in one of his earliest videos and tells that the purpose of the videos is to review for the TAKS (Texas Assessment of Knowledge and Skills). This skews the sample heavily towards accommodating the types of learning we’d expect to see for test preparation: vocabulary review, review of cycles and processes, and a few demonstrations that emphasize vocabulary over deeper explanation.

Several of the Dr. Loopy videos in this sample are repeats in that he has edited down some of the longer videos into smaller pieces of content, and both edited and unedited versions appear in the sample. Valentine’s science TAKS reviews are among the oldest videos in the corpus and his work as Dr. Loopy will be discussed in greater detail later in this study.

Another frequent contributor in this sample is Michael McCauley, a middle school science teacher in a rural suburb located about 30 miles outside of Portland, Oregon. McCauley currently has a total of 391 videos uploaded on TeacherTube, including some of his students’ animations that he has posted on their behalf (two of these student videos is among the most viewed in this corpus). McCauley’s videos are aimed at slightly older students than Valentine’s. McCauley has a charisma on camera and unlike Valentine, he does not use a fictitious character, though he has a variety of engaging props. His choice of topics also seems to deviate from what you would expect
to find on a standardized test. While he has a few videos on typical middle school topics such as air pressure, he also talks about science behind topics of general interest. For instance, one of his videos deals with the change of dinosaur locomotion over time. This video was categorized as a nature of science video under secondary topic, but secondary topics are left out of the results discussion because they did not pass the inter-rater reliability thresholds. Other videos are reminiscent of the popular television show *MythBusters*. For instance in “Mouse vs. Mountain Dew,” McCauley explores an urban legend of a mouse being dissolved in a can of Mountain Dew soda. McCauley tests this theory with an Erlenmeyer flask full of Mountain Dew and a vole that did not survive an encounter with McCauley’s house cat. McCauley also demonstrates the interaction between Mentos candies and Diet Coke, although unlike other instances of this phenomenon found on TeacherTube, McCauley offers a (correct) explanation of the physical changes that occur to make this dramatic interaction happen. Other videos such as “Barometric Barbie” feature humorous but in depth explanations of scientific phenomenon that are more readily identifiable as parts of the state standards. Videos in this category mostly feature a single male teacher, with 65.9% of the videos being exclusively male, compared to 44.5% in the general sample.

Several videos in this sample use software packages such as VoiceThread or Camtasia. Both of these software packages provide professional development, online tutorials and examples of how to use their products in a flipped classroom. To be sure, the videos found on TeacherTube are similar in style to the videos featured on the homepages of these software packages. Camtasia’s teacher evangelists include a high school
chemistry and biology teacher, and it is worth noting that this sample contains some of
the most advanced science content in the corpus, including topics in Advanced Placement
physics, biology, and chemistry.

This is not at the exclusion of the lower grades. Dr. Loopy addresses an upper
elementary audience and a frequent user that goes by “mrtee073” (“Mr. Thompson” on
his slides) has several highly illustrated slides and addresses content that is likely pulled
out of an elementary curriculum.

In this sample we also find a few videos describing laboratory technique
demonstrations (such as a demonstration of methods for separation and filtration in
“Junior Cert - Science experiments - Chemistry 1 of 4” and “Frog Dissection
Instructions”). A total of 13 videos in this sample were described as having the primary
purpose of demonstrating a laboratory technique with 5 videos being coded as having
laboratory technique as their primary topic and 26 videos as having laboratory techniques as a secondary topic. Examples where lab technique is a primary topic include videos like “Sci Not 5”: a demonstration of how to do scientific notation on a graphic calculator that could be applicable across various scientific and mathematical disciplines or “Cheek Cell Iodine Slide” where the teacher explicitly states that this is a video to demonstrate a lab technique, with little integration of content information.

![Figure 2. A teacher assembles a hydrometer and discusses the chemical principals behind the apparatus.](image)

Overall, very few of the most successful videos on TeacherTube show much of live action laboratory demonstrations and this is somewhat surprising. Consider the role of web video in science. JOVE (Journal of Visualized Experiments) is a peer-reviewed “scientific journal devoted to the publication of biological, medical, chemical and physical research in a video format” (Journal of Visualized Experiments, 2006-2013). This description of JOVE applies to the scientific research community, the fact that in
science education, few successful web videos address laboratory technique illustrates a gap between scientific practice and “school” science.

**Did you know that elephants are made of elements?: Musical science videos.**

Music was a component 171 videos, and 34 of these videos delivered content primarily through music. For the purpose of this study, these videos that primarily delivered content via music are called “music videos” and they are the topic of the current analysis. Note that this category is not mutually exclusive with the other emergent genres of videos as a small number of videos discussed here also appear in professional videos and student produced videos. Recall that this video sample comes into this corpus because these are among some of the most viewed and most favorite videos in the science channel of TeacherTube, indicating that these catchy, clever combinations of science content and music are sought by the users of TeacherTube.

When it comes to music video it becomes very tricky to say where traditional media ends and teacher and student generated video begins. For purposes of coding, a video in the corpus was categorized as professional, teacher, or student produced based on the video content because coding the music itself introduces considerable ambiguity. This ambiguity is explored below as a product of “mashup-culture”. The term “mashup” has been used to describe various media, from software to music, where two or more published components are altered and combined. Bruns (2010) attributes increasing symmetry among media as a key factor in empowering more people to combine media in ways that go beyond software programming or artistic pursuits. Among music videos, there is a spectrum of mashups. In this sample 20% of the videos are posts of videos that
are copies of something reproduced entirely from more traditional media. For instance, one of the most viewed music videos is the actual, professional music video of the alternative rock band “They Might Be Giants” for their song “Meet the Elements.” In other videos, teachers or students have sung original lyrics about scientific content using the music or melody of a popular song. Examples of this include songs such as “The Rock Cycle Rap,” which is discussed below or “The Chemical Bonds Song” sung to the tune of ABBA’s “Dancing Queen”. The “music video” category is defined by its heavy borrowing and repurposing of popular culture. For this reason, I will discuss the teacher and student produced videos in greater detail in the next chapter where I focus on close reading of the videos. Discourse analysis will be a much more useful tool to understand what is going on in these videos, but I will provide a few highlights about the videos that can be ascertained via distant reading.

The music videos that emerged into this particular corpus are primarily focused on life science (28%), physical science (28%), and earth and space science (32%) with three songs dedicated to the rock cycle, the specific topic that appeared most frequently. Regarding song topics, the only outliers were one lab safety rap song acted out by students and using the music performed by Rhythm, Rhyme, Results (an educational music company discussed in the Students section of the results). The other song that wasn’t classified as a life, physical, or Earth science topic was “Scientists Accomplish” which is taken wholly from traditional media. “Scientists Accomplish” is a music video created by a company called Ignite! Learning, and it highlights scientific accomplishments of women and ethnic minorities.
The most viewed video (over 8,000 views) is “Radiation, Conduction and Convection” performed by Rhythm, Rhyme, Results and it is overlaid with a slideshow that appears to be student produced. The accompanying images and animations correspond with the lyrics, indicating that whoever put the video together was very familiar with the lyrics and content of the song. Rhythm, Rhyme, Results appears again in the third and fifth most viewed slot with their Lab Safety rap and a song about the circulatory system, respectively. The “Circulatory System” video uses a similar production of slides with well-timed clip-art and animation as “Radiation, Conduction and Convection,” but the videos were uploaded by different users.

Figure 3. A PowerPoint slide accompanies a professional recording.
The fourth most popular music video is the full, professionally produced video for They Might Be Giant’s “Meet the Elements”. The video itself features custom animations that interpret the lyrics in the song. The song names several elements and discusses where they are found and how they combine with other elements to form specific chemical compounds. This is a more contemporary and comprehensive take on the subject than another song that is popular on TeacherTube, “The Element Song” by satirist Tom Lehrer. Lehrer’s song appears several times on TeacherTube, uploaded by several different users with different visual interpretations of his 1959 piano tune that breathlessly recites the names of all the known elements at the time of the song’s writing.

Disco, zombies, and bored pupas: Student-produced videos. One of the findings of this study is that TeacherTube is not just about teachers, as many of the most successful TeacherTube videos are displaying student work. The coders were, in fact, surprised by just how much of what is on TeacherTube is in some way representative of student work, and the coding was not initially optimized to handle all of the nuances of the way that student work was represented. After all, this study initially attempted to address how it is that teachers communicate via TeacherTube and we didn’t anticipate the finding that one way teachers communicate with each other, students, and parents, is by uploading student work. Nonetheless, as discussed in the section on Qualitative components, we were able to work with the codes to try and capture the nuances we found in this category. For instance, what if a video is narrated by students who are clearly too young to have composed the video? Should that count as teacher produced or student produced? What if a teacher uploads instructions for a student assignment?
if a teacher uploads images of students at work, or students demonstrating something?

Student work can be identified in two different categories: production and purpose. The coding in production addresses who made the video: a traditional media outlet, a teacher, a student, or some other organization.

Coding for purpose typically involves looking at the message being conveyed: is the video providing definitions? Is the video modeling a laboratory? Is the video explaining a phenomenon? We found that during preliminary coding, there were several videos (especially among those videos that were student produced) that did not have any purpose other than to show off student work. There were too many of these to simply code the purpose as “other”, but there were no explanations, demonstrations, calls to action, etc. For this reason, we used “student project” as a catch-all code for purpose. It is important to note that the codes “student produced” and “student project” convey different aspects of the video. They are not the same thing. Take for instance a video called “Mrs. Asher.” The opening slide of this video credits “Mrs. Asher” and the video is a slideshow of photos of children watching eggs hatch and holding the resulting chicks while a modern remix of the oom-pah song “Chicken Dance” plays. The photos of children are punctuated with slides announcing “Mr. Gillo’s class comes to visit the chicks.”

This is a video that was produced by a teacher in order to demonstrate work being done by students in a class but it is clearly documented by the teacher. There is no science pedagogy being communicated here, but the coding captures the fact that a
teacher has created a video (teacher produced) for the purpose of documenti
ging student projects (hatching and observing chicks) in her classroom.

What about videos that are both student produced and coded as being a student project? Videos in this category include those that are clearly produced by students and do not fall under any other “purpose” code. There were enough of these, however, and they had enough in common with each other, that coding them as “other” would have diluted the “other” category. That is to say, these videos were similar enough that we wanted to make some meaningful distinction among the codes. Many of these videos look more or less the same, following a predictable pattern and are uploaded under the same username. This suggests that they may have been a class assignment and a teacher uploaded the resulting videos. The videos uploaded by “7thwadedonald” are all slideshows using professional photography of some natural phenomenon (like rain, hurricanes) or feature (rivers). These slides have no text beyond the title slide and are paired with a popular song that uses a word related to the photos in the video, though in a context that is not related to the word’s scientific meaning. For example, a video about rain uses many fine art photographs with the disco song, “It’s Raining Men”. A video with images of hurricane images plays the heavy metal song “Rock you Like a Hurricane.” These videos, where students provide little to no original contributions to scientific content were categorized as “student produced” and “student project.”
Figure 4. Several Earth science videos in the corpus pair popular music with fine art photos with no text or scientific connections.

The above videos may demonstrate a student’s ability to find digital resources (music, images, etc.) and assemble a video, but they seem to serve no clear science education purpose beyond the basic features of the assignment. As to why these appear among the most viewed and most liked, I’m not sure. My current speculation is that the videos are played because people like the songs in them, and the videos are not used in an instructional way.

The most popular student video is called “The Zombie Flu” and it is a mix of slides with what seems to be professional voice over explaining how the Influenza virus works. The idea is later dramatized by two students in what looks to be a dorm room. The students use the analogy of a zombie having had gotten into a private residence in order to feed on a human, infecting him to turn him into a zombie. This analogy serves as the students’ interpretation that they are using to explain a natural phenomenon.
The video demonstrates competence with video editing software but the students’ voice primarily comes through by making the comparison between the influenza virus and zombies. The more straightforward “textbook” explanations use images, slides, and narration that appears to be taken from somewhere else (the narrator has a British accent whereas the students appear to be American). Based on the live action footage, the students appear to be in a dorm of some sort, so there is a good chance that these are college students.

Similarly in “Biomass Infomercial,” older students (I would estimate the later grades of high school) used a mix of professionally done interviews and footage with their own added live-action editorializing regarding the benefits of biomass. This is the 34th most viewed student video (out of a total of 47), so it was not as popular as “The Zombie Flu”, though it is more comprehensive and earnest in its presentation. The idea of making a commercial for certain types of alternative energies is a popular one for science teachers, and is frequently used as an example of integrating writing and communication in science. Having had taught this very same lesson long before such editing software was readily available, I would have evaluated the work presented here as an exemplar and I wonder if the video made it onto TeacherTube to serve as an example to other students. This mix of produced video and audio with student live action was seen in a few other videos produced by older students to create “public awareness” types of videos on issues such as smoking prevention and laboratory safety.

The above videos required technical and content competence found at older grade levels, but the coders discussed categorizing “student produced” as something that could
be age appropriate. For this reason, there are a few videos in this sample that would have to have been put together by a teacher but featured work by students, and a few younger student videos demonstrated purposes beyond “student project” as well. An approach to student project videos suited for younger children involved a whole class to produce a single video on a topic. For instance, in “A Butterflies Life” [sic], kindergarten students narrate a story about the butterfly lifecycle from the perspective of a butterfly. The images are stunning and well-chosen. The musical background is soft and the audio of the students is clear and appropriately louder than the music. In other words, the video is well produced. The vocabulary, descriptors, and word choices seems as though they were likely composed by kindergarten-aged students with the assistance of a teacher. The script (part of which is written out below) is breathless, sometimes repetitive, and lacks solid transitions as one might expect in a story narrated by a five-year-old. Despite the childlike nature of the script, it comprehensively discusses the life cycle of a butterfly and uses key vocabulary terms. This video is described in greater detail in the next chapter.

My name is (incoherent)
And my name is snowball
And we are butterfly eggs
We are about to be caterpillars
We are bored because we can do nothing.
We’re glad to be caterpillars now
We can’t wait ‘till we (trails off)
We’re going to shed our skin
Look how fat we are.
We love to shed our skin.
We can’t wait until we’re pupas.

Similarly, in “Space Terms and Definitions”, slides with words such as “axis” and “orbit” are spliced with live-action video of 2nd graders acting out these motions so that
the entire video serves as a review piece created by the class, and the children created the material by illustrating the meaning of the terms. Note that the two coders agreed that these videos were different from the “Mrs. Asher” video which was not coded as a student-produced video. The “Mrs. Asher” video is classified as “teacher produced” because students were neither authored the video nor did they contribute novel scientific content.

Figure 5. Students demonstrate space vocabulary terms.

In rare instances, a student-produced video was so targeted in its purpose that something other than “student project” as assigned to it. For example “Turn the White House Green” is a slideshow that directly addresses President Obama with a request to upgrade the White House so that it is better at conserving energy. This video was brief and fit very clearly into a predefined purpose, thus it was coded as a “call to action”.

Overall, student-created videos were very musical, with 74.5% of videos having some sort of music in them. It is important to note, however, that the bulk of this music
comes from content-devoid accent music. This would include the gentle instrumentals used in “A Butterflies Life” as well as the scientifically bereft “Rock You Like a Hurricane”. Students were concerned primarily with discussing vocabulary, processes, or cycles and generally lacked deeper explanatory models. While only four videos were classified as going beyond the covering law of explanation, this is more frequent than what we see in the music category which includes teacher and professional videos. While there were elements of persuasion in some videos, there was little communication about “doing” science. Procedures, methods, and hypothesis were scarcely discussed. One of the rare examples included “Mouse Trap Car” which features a 3rd grade girl in her driveway explaining how her mousetrap car works. Another rare example includes a video of a lab group explaining how to get the density of odd-shaped objects.

Given the concern surrounding posting student images online and the relative affordability of slideshow creation software, it is not a surprise that 40.4% of student-produced videos are slideshows (more than double the 16.5% of slideshows in the entirety of the corpus). While rules vary from district to district regarding sharing images of children online, analysis of this category demonstrates the enormous range of projects students can produce, regardless of their age.

Videos from traditional media. When it comes to the most successful videos on TeacherTube, 15.7% of the videos were created for more traditional media distribution, primarily television. While there are a few videos in this category that are posted in their entirety, most videos found here are clips of a full program and in this respect, there is some “authorship” that comes from the person who uploaded the video. Someone
selected the clip that they felt was worth sharing, and users of TeacherTube either viewed it or added it to favorites at a rate which allowed the video to be part of this corpus. Note that TeacherTube itself never features these traditional media videos, which means that they are in this corpus exclusively due to the behavior of users. The traditional media videos were also far more balanced along gender representation, particularly compared to the lesson videos which are heavily skewed towards males. In traditional media, even where there are male stars such as is the case of the Nye series, females are included in videos.

We find a greater frequency of videos that go beyond the covering law in this section (35%). While sections of the popular Bill Nye the Science Guy show appear frequently in this sample, it is interesting to see videos appear in this section that clearly offer a demonstration of something that cannot easily be shown in the classroom. For instance, there are documentaries of extreme weather and while they lack much scientific content, they manage to get captivating footage of dramatic weather events. A video of bullets in slow-motion ripping apart apples and tennis balls and the like falls into a similar category. I had expected to see a video by Nye or perhaps an extreme weather event to be the most viewed video in this particular sample, but the most viewed video came as a surprise to me. It was a 2003 British Honda commercial that featured a ball bearing rolling through a complex Rube-Goldberg like contraption. This was an interesting finding as the majority of videos in this study aim primarily to deliver content. This particular video clip delivers no content but it could be useful as a resource of some
sort to discuss simple machines. In any case, it points to the need for further research to be done regarding how teachers use web video in the classroom.

**Occupying the gray space: “other” videos.** A total of 61 videos were not discussed in any of the above categories. As an odds and ends category, my goal in this section is to give the reader a sense of what else remains in the corpus rather than discuss frequencies in this sample. There is little meaning to garner out of these frequencies given that these videos have as little in common with each other as they do with other videos in the sample. The videos in this category range from a few videos featuring footage of chicks hatching to space photography furnished by NASA. Many of the videos in this category exist in the gray spaces between traditional media and amateur production. For instance, several videos in this category are released by Arbor Scientific, a laboratory supply company. These are not traditional, high budget commercials. In fact, they are likely produced with the intention of being web videos, and as such, I wasn’t comfortable with classifying them as traditional media. Another video in this category is somewhat of an infomercial for a group of scientist calling themselves the “bio-bus”, a type of mobile field trip that can come to schools. A set of videos that were likely produced with the intention of being web videos from the Chandra Satellite in partnership with NASA, are also found in this category because they were being featured by TeacherTube. The user “Floridamuseum” posted videos from University of Florida of scientists and researchers talking about current challenges and researchers approach to these. This includes the “Cell phones and Eliminating Malaria in Zanzibar” discussed earlier in this study. These Floridamuseum videos were not featured by TeacherTube and
thus represent one of the very few videos in this corpus that feature the work of contemporary scientists and were made popular by the viewers and members of TeacherTube and not by the administrators who select videos to feature.

Some videos that ended up in this category were simply ambiguous as to their production origin. For example, the video called “Photosynthesis” is a bare-bones animation of a woman talking about and demonstrating photosynthesis. The narration and audio quality are very well done, better than the average teacher or student produced video. The animation is simple, but smoother than what I would expect to see from the average teacher or student project and suggests that whoever made it had the training and time to use a computer animation program to put the video clip together. Despite the fact that the production value of the animation appears to be of slightly higher quality than what I would expect to see from non-professional, the video contains no branding nor credits, making it difficult to code. This category underscores the challenges traditional content analysis methods face when it comes to web-based video, even when the corpus has a narrowed goal such as in the case of the TeacherTube science channel. Scholars in this area will continue to be challenged in discussing this new type of video format using the terms, ideas, and methods borne of traditional video.
Table 3

Coded Results for All Videos and By Selection Category

<table>
<thead>
<tr>
<th>Variable</th>
<th>Encoding</th>
<th>General</th>
<th>Lectures</th>
<th>Student</th>
<th>Pro</th>
<th>Music</th>
<th>Other</th>
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<tr>
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<td>85 100%</td>
<td>47 100%</td>
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<td>34</td>
<td>61</td>
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<td>34 100%</td>
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CHAPTER 5: DISCOURSE ANALYSIS

In the following chapter, I examine several videos from the corpus to provide a greater understanding of the variety of videos found within the corpus described in the previous analysis. My interrogation of these data will be guided primarily via Gee’s tools for discourse analysis (2011) and the spoken text in the videos is transcribed using Gee’s convention of lines and stanzas. Each video discussed will be accompanied by a screenshot of the video and relevant visual information will be incorporated into the discussion. Throughout the analysis, I will weave in Lemke’s findings from the discourse analysis published in his 1990 *Talking Science: Language, Learning, and Values*. Lemke’s study provided foundational theories about how teachers talked about science in the classroom. As such, his findings provide a nice framework to situate and contextualized the video findings below. In this analysis, I will weave in the responses from my original research questions. In particular I seek to answer: How do teachers appropriate cultural forms to communicate science ideas in these videos? What assumptions do teachers make about the audience of their videos? What personas do teachers perform to communicate science in these videos? What discourses related to science and school do teachers draw from to communicate in different science in UGV?
Throughout the discussion, I will refer where the discussed videos are situated in terms of corpus metrics. The graphs below will assist readers in understanding where each of the videos reside within the greater corpus.

![Graph of Videos Sorted by Length in Minutes](image)

*Figure 6.* Length of time of each video in minutes.
Figure 7. Number of videos uploaded per user.
Figure 8. Number of times a video was marked favorite.
Figure 9. Number of times each video in corpus has been downloaded.
Music Videos

Videos that deliver content primarily by being sung or rapped comprise only about 13% of the total videos in the corpus, but they make up more than a fifth of the videos we see among the most favorite and the most viewed. These are popular videos with viewers. There are music videos produced by students as well as a few professional videos, but in this analysis I will focus on two full videos done by teachers and a small segment of a third video done by a teacher to demonstrate the range of content found in this category. The first video, “Rock Cycle Rap”, demonstrates a pitfall of a few videos in
this category where content is sacrificed to maintain musical integrity. I selected a
different video on a similar topic called “I’m a Mineral”, to demonstrate how another
teacher delivers an Earth science lesson using popular music more successfully. The third
video I selected is about chemical bonding and is performed by a teacher who has
uploaded a few similar video. He goes on record in one of the videos to say that he finds
these songs pedagogically useful and the content of his songs is well organized, so I
wanted to juxtapose his work with “Rock Cycle Rap”. Finally, I examine a song with
original music composed by an elementary school teacher.

Mr. Lee is sorry about science. The first video I am analyzing in this section is
called “Rock Cycle Rap” and it was uploaded by “RGrant” in February 2010. The visuals
for the video consist entirely of large, dark-colored text on plane white backgrounds. The
title slide reads:

**Rock Cycle Rap**
Instrumental “Still Fly” by Page ft. Drake

**INTRODUCTION**

**Stanza 1**
1. Ya’ll know who it is, Mr. Lee
2. Science teacher MC
3. Got another science song comin at you
4. About rocks
5. You know it sounds exciting
6. Sorry sixth grade I had to do it to you
7. Huh.
8. Here I go

**CHORUS**

**Stanza 2**

1. Rock cycle
2. Round and round
3. Like the wheels on the bus rolling
4. Over the ground
5. Igneous
6. Sedimentary
7. Metamorphic
8. For sure it’s
9. Fun just like it sounds

FIRST SEDIMENTARY

**Stanza 3**

1. Sedimentary rocks are made
2. When three things happen over many days
3. Decomposition compaction cementation
4. Makes them form OK OK

HEAR ME OUT

**Stanza 4**

1. I know there’s more exciting things than rocks
2. Like chillin with your friends or playing Xbox
3. But I’ll bet that you gon’ see
4. It on the MSA (reference to standardized tests in Maryland- why learn science? It’s on the test)
5. Hear me out, listen to what I’m about to say

**IGNEOUS AND SEDIMENTARY 2**

**Stanza 5**

1. Igneous rocks form when
2. Volcanos erupt
3. Because when the lava
4. Finally gets cool enough
5. The molten material begins to harden
6. And igneous rocks are formed, ballin’ (don’t know what the refers to but it sort of wraps up the rhyme with “harden” though this is a decent explanation)
7. Formed underground means intrusive
8. Formed above ground means extrusive (not a very comprehensive description)
9. This song is so nice not (total rhyme bloat)
10. Abusive
10. Rocks everywhere they not
11. Elusive
12. Second type is sedimentary (why are we go back to this- no tie into the fact that we already talked about this)
13. Big words like this sound
14. So scary
15. Ha, but there’s no need to be scared
16. Just remember that these rocks have a lot of layers

CHORUS REPEATS

SEDIMENTARY 3

Stanza 6
1. Sedimentary rocks are made
2. When three things happen over many days (works as the rhyme, but factually misleading)
3. Decomposition, compaction, cementation
4. Makes them form OK OK
5. Each layer is made up of sediment
6. Which is soil, small rocks,
7. And whatever man (glosses over stuff)
8. And it was all laid down by
9. Deposition
10. At the bottom of a river
11. Then collision (not the same as compaction but it rhymes)
12. The layers get pressed together by compaction
13. There’s just so much action (not really because it takes so much time)
14. And I’m askin’ for you to know
15. That the top layers push down
16. on the ones below
17. Cementation yeah glues it all together
18. Sediment that’s stuck together is
19. Just so much better
20. And if you lucky you might
21. Discover some fossils
22. They even older than the food be (again with jokes, use of non-standard grammar)
23. At McDonald’s
24. Clap your hands, we have sedimentary rock
METAMORPHIC

Stanza 6
1. But there’s a third type and I hope that you haven’t forgot
2. Metamorphic rocks are made
3. With heat and pressure
4. Let me sing it to you
5. Heat and pressure

REPEAT CHORUS

Stanza 7 (spoken not rapped)
1. Yeah
2. so the only thing I couldn’t fit on the song was that,
3. one type of rock can change into another type of rock.
4. So
5. like a sedimentary rock
6. if it melts
7. and turns into lava
8. or magma
9. and then it erupts as lava and the lava cools down,
10. Now it’s an igneous rock
11. So just keep that in mind.” (strange afterthought when the song is about the rock cycle)
12. Holla


Mr. Lee announces himself and speaks directly to his class, “Ya’ll know who it is, Mr. Lee, science teacher MC.” He uses the citation of a popular hip-hop song from late 2009, making it a contemporary hit by the time the video was uploaded to TeacherTube early in 2010. This makes it unusual compared to other music videos in the corpus that drew songs that might be more accurately regarded as classics from the 1960s-1980s.

Lee uses a popular rap song to talk about rock types (he doesn’t talk much about the rock cycle even though that is the title of the video) and he uses several elements common to hip-hop to lend fidelity to the genre. He refers to himself as a science teacher “MC”, where MC stands for “master of ceremony,” an alternative name for a rapper with hip-hop roots in the 1970s. Lee is very much enacting what Gee refers to as “big D”
Discourse to cultivate a persona that is skilled and in the know about hip hop culture. He uses non-standard grammar throughout the song (I’ll be you goin’ see; chillin’ with your friends; they even older than the food be at McDonalds). The words are written out using nonstandard spelling and grammar, as well. Lee also uses an audio processor on his vocals called “auto tune”. This is used on many contemporary songs, particularly in pop music and hip-hop, making the song sound as though it might have been professionally produced.

I know there's more exciting things than rocks
Like chillin with your friends or playing Xbox
But I'll bet that you gon' see it on the MSA
Hear me out, listen to what I'm about to say

Figure 11. Lee's video features only the lyrics to his song.

While embracing the (big “D”) Discourse of hip-hop culture, Lee employs a few strategies to somewhat distance himself from scientific knowledge and understanding and his elicitation of prior knowledge references only his propensity to make songs. The introduction of the rap, before he gets into any of the content, is an apology to the students. He tells them he’s “got another science song...about rocks....You know it
sounds exciting….Sorry sixth grade I had to do it.” His apology for the content appears elsewhere in his song, “I know there’s more exciting things than rocks, like chillin’ with your friends or playing Xbox.” Lee appears to want the students to understand two things about him 1) He is knowledgeable and skilled as an “MC” and 2) He is in on the “joke” of rapping about science and offers his empathy that this is a dull subject. He dedicates several lines to this (“metamorphic, igneous, sedimentary…for sure…fun, just like it sounds”).

The introduction of new vocabulary words for their own sake figures prominently in Lee’s rap. He introduces several multi-syllabic vocabulary words with little to know time spent defining these words (stanza 5, line 12-14):

Second type is sedimentary
Big words like this sound
So scary
Ha, but there’s no need to be scared
Just remember that these rocks have a lot of layers

Using the “figured worlds tool” we see that Lee makes explicit several assumptions about his students: that they are bored with science, for instance, that nonstandard English is their preferred way to communicate, that they are intimidated by new vocabulary, and that their concerns can be assuaged by having a superficial understanding of the term. To be sure, Lee’s slideshow frequently presents vocabulary words without much in way of definition and instructions students to associate those words with each other. For instance, he alerts them to the fact that sedimentary rocks
have something to do with “decomposition, compaction, cementation” and that students are “goin’ to see this on the MRA” (Maryland’s standardized tests). Unlike the other song about rocks I examine below, Lee never uses any images or diagrams in his slideshow, he prints only the words. Lee privileges a sight-reading level recognition of vocabulary words and takes care to tell students that the singular significance of this lesson is that this information will be on standardized tests.

Lee’s song is also guilty of something I began to think of as “rhyme bloat” during the course of this study. By “rhyme bloat” I am referring to words introduced to the song to keep it rhyming or on meter, without substantive content contribution or worse yet, misleading content contribution. For instance, Lee achieves a rhyme by saying that sedimentary rocks are made “over many days,” which is a geological understatement. While he withholds substantial definitions, he inserts stanzas such as “this song is so nice, not abusive” that don’t lend to understanding of the content. His chorus is repeated three times and includes the catch “rock cycle, round and round like the wheels on the bus spinning on the ground,” even though the song barely mentions the rock cycle, and the metaphor of bus wheels “on the ground” doesn’t seem to have anything to do with the content of the song.

What does science look like in Mr. Lee’s song? It is a wall of text with unfamiliar words blended in with nonstandard grammar and spelling. It is vocabulary driven and its purpose is to succeed on the standardized test. It is dull, but Mr. Lee is not, and he is in on the joke. There are some alternate interpretations I would propose. The first is that Lee’s apologetic tone actually mirrors the way the original song is sung, with Drake
apologizing to his “haters” (detractors) for singing a song about his own success. In this respect, Lee might be drawing an intertextual parallel between how he sang the song and how it is performed by Drake. Secondly, by using non-standard dialect, a hip-hop Discourse (to use Gee’s use of the term as “big “D” discourse”), and an appeal to the Maryland state tests, perhaps Lee is making an appeal to what he thinks students find valuable about his course. Recall Lemke’s observation that the Discourse of science (especially school science) is disconnected from student experiences and is made to seem difficult because its curriculum “emphasizes topics and approaches to topics to far outside of students’ experiences, needs, and interests to be easily learned. Science teachers are always looking for new motivations and demonstrations, new ways to make science real, immediate, and interesting to students” (Lemke, 1990, p.154).

The several instances of “rhyme bloat” I found in this video (and many more in student-produced music videos) made we wonder if this was a perpetual problem. If a person is going to take a pre-existing melody and try to fit a science lesson into it, are throw-away stanzas and nonsense rhymes inevitable? For some reason, the bad songs really stuck with me after the content analysis, and I would have concluded that rhyme bloat was a common problem if I did not go through and do an analysis of several songs. After looking carefully at several teacher-produced music videos, I found Mr. Lee’s rhyme bloat to be the exception rather than the rule.
At home on MTV. Perhaps geology doesn’t lend itself to good lyrics? I wanted to find another song about a similar topic to see if this is the case. “I’m a Mineral” was created by Dr. Loopy, one of the earliest and certainly most prolific of TeacherTube videos in the science channel. Dr. Loopy is the name adopted by Texas teacher Douglas Valentine. We’re going to explore Valentine and Dr. Loopy in greater detail in the next analytic section, but I wanted to describe his music video in contrast to “Rock Cycle Rap”, because of its relatively high production value and good use of examples. Valentine’s students are in fifth grade, making them a year younger than Lee’s.

Valentine has 30 videos in this corpus, including a two-part video about rocks and minerals. One section of this video includes a satirical advertisement for a compilation album called “Rocks Don’t Roll”. This is done in the style of the musical Time Life CDs that would compile music from various genres like 60s Music Revolution, Legends of Country, or The Ultimate Rock Ballads. In these commercials, snippets of songs play while footage changes to correspond to the song, and the “Rocks Don’t Roll” section of Valentine’s video does the same.

All of his videos contain multiple shots, multiple edits, and special effects including green screen technology. This allows the people in the videos to appear in a variety of backgrounds. He takes full advantage of this in the “Rocks Don’t Roll” compilation. One of the songs in the medley is called “I’m a Mineral” and it’s sung to the tune of “She’s a Maniac” (1983). Valentine is wearing a boxy suite jacket over a casual t-shirt with a slender tie and sun glasses resting on his head. The outfit is reminiscent of the men’s fashion popularized in the 1980s by the show Miami Vice. His wife, who
accompanies him in many of his videos, is similarly dressed in 1980s fashion with a side ponytail, headscarf, sunglasses, and an overly large sweatshirt that says “iron” on it. His wife is green screened into the video and sometimes doubled to give the appearance of multiple back-up dancers. Other times, during musical interludes, her racing feet appear in the background, reminiscent of the actual music video developed for the song when it was released in 1983.

Lee uses music to achieve intertextuality. Valentine adds a layer of intertextuality by using visual cues that integrate nostalgia with science content. Given how much older some of the visual references are than Valentine’s students, the audience for the videos appears to be other teachers as well as students. Valentine embraces the role of a rock star or performer, the way that Lee does, but Valentine also embraces science content.

Figure 12. Music video for "I'm a Mineral" by Dr. Loopy.
I’m a Mineral

Stanza 1
1. I can be made of copper
2. I can be made of iron
3. Or a diamond harder than steel
4. We’re so deep underground
5. With the pressure and heat
6. It’s so hot it’s crazy
7. I can be in your money
8. I can be in your car
9. I can be in your body as well
10. Sometimes I’m shiny sometimes I’m dull
11. I’m useful to everyone...
12. Sometimes I am crystalline
13. Other times I’m powder-like
14. I can be a common thing
15. Or I can be valuable
16. I’m a mineral
17. Mineral
18. That’s for sure
19. And I’ve never, ever, been alive before

Valentine’s song goes into detail about features of minerals. He puts on more of a performance than Edmonds (who we will meet next) by having his full body on camera and singing and dancing. He uses the green screen to add diagrams or photographs of relevant images, and adds texts over the images to underscore certain points or add more context to what is being sung. For instance a penny, a car, and a flexed bicep flash on the screen in sequence to correspond with lines 7-9.

The “I’m a Mineral” song stays focused on the content and “rhyme bloat” isn’t a problem. Unlike Lee, Valentine doesn’t introduce any egregious misconceptions (he equates rarity and value, which isn’t entirely accurate). Valentine’s song isn’t as meticulously organized the next song we will examine by Mr. Edmonds, but highlights standard textbook information we would expect to find about minerals, and provides
several examples. In this song, Valentine’s science is highly visual and celebratory. For as playful and silly as the video is, Valentine remains earnest throughout. His performance is sincere and the work that he puts into post-production editing is unparalleled in this corpus unless you compare it to professional videos.

**Getting the concepts to stick.** A middle school teacher named Mr. Edmonds (user name dsecms) has a total of four videos in this corpus. His students are in seventh grade. Each of these songs are about physical science and based on popular tunes. There is a song about work and power sung to the tune of “Joy to the World” (1971); his *Properties of Matter Song* sung to the Beatle’s “Ob La Di” (1968); “Speed is Distance over Time” is sung to “Ain’t No Mountain High Enough” (1967) and a song about chemical bonds is sung to Abba’s “Dancing Queen” (1976). Many of these are enduring pop hits with catchy tunes, but well before his students’ time. The melodies are likely more familiar to teachers than students.
There is reason to believe that Mr. Edmond’s videos are geared to other teachers as much as they might be geared to his own students. In his video for “Speed is Distance over Time”, he introduces himself:

Hello, I’ve been a middle school science teacher for a number of years now. I enjoy working with the labs with students and so forth. But it’s getting the physical science concepts to stick with the students. So I discovered writing song parodies to some of the oldies and other popular songs. Seems to be a big hit. And it’s really helped students to solidify some of the concepts. (Edmonds, 2012).
This introduction is the only instance I’ve seen in the corpus of a teacher appearing to address other teachers and provide a cursory overview of the perceived pedagogy behind the use of music. I was also struck by what Edmonds did not say — the blanks he wants listeners to fill in. In his statement, Edmonds appears to say that while he finds science labs enjoyable, he gives us a “but”. The implication is that labs are insufficient when it comes to making concepts “stick” for students. He tells us that these songs help “solidify concepts” presumably fulfilling a learning objective that is not met via laboratory work and adds that they seem “to be a big hit” with the students. This implies a two-fold goal of not only getting across “concepts” but also being an enjoyable experience for students.

**Chemical Bonds Song**

**INTRODUCTION**

**Stanza 1**

1. Ooh yeah
2. Ionic bonds
3. Covalent bonds
4. Both of them chemical bonds
5. How are they made?
6. What’s the difference?
7. Watch you’ll see...

**IONIC BONDS**

**Stanza 2**

1. First we’ll start with ionic bonds
2. A metal and nonmetal are involved
3. The metal gives over electrons
4. The nonmetal it receives
5. Atoms become ions
6. The metal might have one, two, or three
7. Electrons for the nonmetal to receive
8. It all depends on what’s needed
9. To make the number 8
10. For the nonmetals outer shell
And if it happens for them
They both become ions
Charged atoms
They become ions
The metal’s positive
The nonmetal’s negative
They become ions..oh yeah
The metal’s plus
The nonmetal’s minus
And opposites they do attract
So what you get
When they come together
Is an ionic bond
Sodium?
Chloride

COVALENT BONDS

Stanza 3
1. So what about those covalent bonds
2. It’s not about loss or gain of electrons
3. Valence electrons they are shared
4. To complete the outer shells
5. Of the nonmetals (incoherent)
6. It’s when non-metals join
7. To make covalent bonds
8. Which share electrons
9. Their covalent bonds
10. Not a transfer
11. Instead they share
12. Valence electrons, oh yeah
13. Ionic bonds
14. Covalent bonds
15. Both of them chemical bonds
16. How are they made?
17. What’s the difference?
18. Play the song again
19. Ionic bonds
20. Covalent bonds
21. Both chemical bonds

Like Lee, Edmonds uses a karaoke track so that we can hear the full recording of the music without the vocals as he sings. However, Edmonds recording has the camera
set up to be facing him, in what appears to be his house. As he sings, he holds up large cue cards with key phrases, diagrams and mathematical equations that underscore or enhance information he is singing about. The cards are easy to read and he works his way through them effortlessly while he looks into the camera and sings. Outside a few of the advanced physics lectures that appear in the corpus, Edmond’s videos are some of the few instances that prominently use the language of math to describe scientific concepts.

Edmond’s lyrics focus tightly on the concepts at hand. Any commentary that addresses the students is done either to relate student experiences (in the speed song, for instance he talks about “when you run”) or to structure the lesson. For instance, his chemical bonds song reads like a loosely-structured lesson plan or learning cycle. The song begins by stating the lesson’s objectives (stanza 1; lines 1-9).

From here the song goes on to give thorough definitions of ionic and covalent bonds, with Edmonds holding up cards demonstrating the bonding process. He uses several vocabulary words in context, and assumes his audience is already familiar with these terms, “they become ions” (stanza 2, line 14) “to make covalent bonds which share electrons” (stanza 3, line 7) “valence electrons they are shared (stanza3, line 3).” In contrast to Lee’s song, where Lee frequently jumps around between topics to keep pace with the melodies or rhymes in the song, Edmond’s uses conversational signposts to tell us where he is going (“So what about those covalent bonds? It’s not about gain or loss of electrons”) and finishes the song with a sort of “check for understanding” (“Ionic bonds…covalent bonds…both of these chemical bonds…how are they made…what’s the difference…watch the song again.”).
In his introduction, Edmond’s mentions enjoyment twice. He talks about science labs being enjoyable and about his songs being a “big hit”. Like Lee, he has written and performed multiple songs (though Lee’s other work doesn’t appear in this corpus), presumably because he senses a positive response from his students. Outside of the musical performance, however, Edmond’s doesn’t do any additional work in trying to relate to students or apologizing for the content. Edmond’s assumptions of the viewers is that they are fluent with certain scientific vocabulary words and he uses these words to define new terms or explain processes. His cue cards do not hold the full lyrics of the song, rather, they use key words, pictures, or diagrams to underscore key points.

Edmond’s also structures his lyrics to move through a topic the way a good lesson might: stating the lessons objectives, inserting a few examples along the way, using conversational sign-posts, and ending with a check for understanding. In other words, Edmonds hangs on to his identity as a science teacher. The songs may be older and perhaps regarded as out of date by critical middle schoolers, but they are catchy and there is little to no “rhyme bloat”. Edmonds’ view of science in these songs is concept driven and while he may be as concerned about standardized tests as Lee, he doesn’t address this in his videos. His focus seems to be on making scientific definitions and explanations easy or pleasant to recall, and something to be used to supplement or enhance laboratory exercises.
**Original composition.** Ash Kizer is a third grade teacher from Alabama. Two of his 20 TeacherTube videos appear in the corpus of popular videos. Aside from sharing videos on TeacherTube, he has a website and Facebook page where he posts new content a few times a month. Most of his contributions on Facebook are audio-only recordings of science songs. Kizer plays guitar and other instruments and sings in these recordings. Unlike the other songs in this corpus. Kizer’s songs are original compositions with original melodies. His videos are branded The Bonus Point Podcast and he has a logo, introduction music, and a tagline (“Edupop music by the band with a brain”) that appear on his website, in his TeacherTube videos, and various social media outlets. Given the somewhat unique character of these compositions, I will briefly analyze one of his songs.

The song “I Am Sound” is sung from the perspective of sound itself.

The following song is sung with in a wistful, folk style. Kizer performs the song by singing and playing the guitar, looking at a camera apparently set up in his house or apartment. Later, in this analysis we will explore Kizer’s non-musical content where he pays careful detail to lighting and staging. By comparison, this video is poorly lit. Elsewhere, Kizer is attentive to visuals for learning, but this is a much more straightforward recording of his performance. The lyrics of his song walk us neatly through the all the parts of the ear in typical ear diagram.
I Am Sound

Stanza 1
1. I am a sound
2. And I’m traveling through the air
3. Traveling past your hair
4. Into the pinna of your ear
5. I am a sound going down an ear canal
6. And I’m vibrating the ear drum now
7. I will continue on
8. Somehow
9. I’ll shake the hammer
10. And the anvil
11. And the stirrup will be made
12. To transfer the sway and
13. So it will go
14. Through the oval window
15. Into the cochlea
16. I am a sound and I’m traveling through your nerves
17. I am the sound you heard
18. Telling your brain that
19. It’s a bird (makes whistling bird noises)
The song stays on topic and does not rely on rhyme bloat to move us between the main ideas and it walks through the vocabulary words with little context, though as I noted, once it is paired with a diagram, the explanatory potential of the song emerges. In the first line he identifies the perspective of the song, it is being sung by a sound itself. The second line communicates that sound travels through the air as a medium. The song communicates the process by which we hear sound, in this fashion communicating a causal chain of events and a process. Many of the lines include technical science vocabulary, pinna (line 4), ear canal (line 5), ear drum (line 6), hammer, (line 9), anvil (line 10), stirrup (line 11), oval window (line 14), cochlea (line 15), nerves (line 16) and brain (line 18). In the end, he reveals that the sound the song is actually the chirp of a bird, a sound he then mimics. Kizer relies on narrative. He tells a linear story about a sound that will “continue on somehow” (line 7-8) adding an element of a hero’s journey.

Kizer’s song stands out from the other songs in the corpus in a few ways:
The melody is original, Kizer doesn’t use a familiar melody as a way to broker interest among students. The focus of the song in his video is very much about his performance as a musician. In his other video, we see Kizer in the role of a science teacher but in this video, he is a guitarist in his home. In this sense, this recording looks very similar to many YouTube videos of singer/song writers playing original music.

Kizer’s musical performance is the least connected out of all the videos to overt popular culture references. Kizer seems to want to be seen as his own sort of musical-science entity, again, complete with branding and with no overt borrow of an established style or persona. While Kizer sings of an anthropomorphic subject the way that Valentine does, Kizer’s song is also a linear narrative, which sets his song apart from the rest of the corpus.

Reflections on music videos. In all four videos, the teachers are communicating something about who they are to their students as well as other teachers, and all three teachers use people’s understanding of music and popular culture to do this. Lee speaks most directly to his students. He addresses them by their grade level, says “I’m sorry I’ve got to do this to ya” and references the fact that he is performing yet another song. Lee uses music and musical conventions that are most contemporary with his students. To be sure, relating to his students is of great importance to Lee. As part of this, Lee attempts to empathize with the dullness of his subject or the “scariness” of new vocabulary terms. He emphasizes vocabulary recognition and prioritizes terms. This is reinforced by what Lee has left out of his videos. There are no pictures or diagrams, for instance, which is
curious because images of exploding volcanoes or cooling lava are relevant and could certainly assuage the perceived dullness of the topic.

Edmonds and Valentine use popular culture as well, but from a time that is memorable to teachers and other adults. Edmonds remains every bit the science teacher as he looks at the camera and sings a lesson, holding up cue cards with diagrams, equations, and keywords. He notes the role of these songs as being a supplement in his total curriculum and something meant to serve students who need reinforcement of scientific ideas and concepts. Valentine’s video appears at the end of a longer, more traditional lesson. With its costumes and special effects, his video comes across as a fun and silly reinforcement of the lesson, though the effort put into the total production indicate that the video is anything but an afterthought. Kizer demonstrates that there is some original music in the corpus. He also demonstrates a teacher trying to create his own musical identity via TeacherTube, and in doing so, limiting his references to established musicians or popular performers.

**Videos for a Flipped Classroom**

The following four videos will look at teachers providing direct instruction to students via non-musical means. The four teachers in this sample are all frequent contributors, with a total of 893 videos uploaded between the four of them. They are all male but teach at a range of levels, from advanced high school courses down to third grade. The third through twelfth grade teachers provide the most straightforward overviews of content, avoiding jokes and humor where the two middle grade teachers are accomplished showmen.
Derrick McNeil’s Nuclear Decay Stability provides the most academically advanced of content I’ve seen in the TeacherTube corpus. McNeil has uploaded 236 videos to TeacherTube, making him the second most prolific video creators in the corpus. His four corpus videos are all featured videos. His videos were chosen for prominence by TeacherTube, none of his videos make it into the most viewed or downloaded lists. From this, one can infer that his videos represent the kinds of things the creators of TeacherTube want teachers to use their site for, while the fact that the other videos in the corpus are much more used by site visitors suggest the clear distinction between what TeacherTube users come to the site for and what TeacherTube creators believe their site is about. McNeil’s videos most resemble what it is that people have in mind when they picture “flipped classroom” models, and while McNeil wasn’t the only teacher embodying that exemplar, there were very few of these in the TeacherTube corpus. More typical are videos such as Michael McCauley and Doug Valentine, both of whom use humor and showman-ship with nods to shows such as Mr. Wizard, Billy Nye the Science Guy, and MythBusters. Finally, I examine a video about the rock cycle created by Ash Kizer, whose song about the parts of the ear was featured in the previous section. Kizer’s video is engaging and visually compelling while offering a straightforward content overview.

McNeil has a single video camera mounted and pointed at a whiteboard. He is operating the camera himself, as we see him departing and approaching the camera on his own to turn it on and off. He was a head set with a microphone so that he can move about freely in front of his whiteboard without compromising his sound quality. He doesn’t go
far, of course, as he stays within the frame the entire time, but he does turn to the board
on occasion to point to something. His audio remains crisp and clear even when his back
is momentarily turned to the camera.

Figure 16 McNeil focuses on a single graph.

**Nuclear Decay Stability**
Derrick McNeil

**INTRODUCTION**

**Stanza 1**
1. Now
2. What I wanted to do
3. Real quick
4. Is talk about this graph
5. Um you may see this graph
6. On
7. The AP exam
8. You may see this graph
9. On the IB exam
10. Both of ‘em have
11. That nuclear energy component to it

GRAPH LESSON

Stanza 2
1. Um
2. But I really wanted to quickly talk about it so this is binding energy per particle
3. We came up with that
   a. We can come up with that number
4. By using what we did in that last step
5. We calculated the amount of energy that’s
6. The total binding energy
7. If we divide it by the number of particles
8. We end up getting the binding energy
9. Per particle
10. K...
11. And then under here there’s the mass number
12. So this is a nice little decay graph
13. And the reason I’m drawing this graph
14. IS to talk about stability
15. And um
16. When you look at this graph
17. You’re kinda like “What the heck?”
18. What it turns out is that
19. These points where the curve is stable
20. IS where there’s very little change in the binding energy
21. This section right here
22. Where I have very little binding energy
23. And
24. Uh
25. Mass and a very little mass
26. In this region right here
27. Is less stable
28. Than
29. This region right here
30. The relative
31. The flatness
32. Of that region
33. Is gunna give me high stability
34. So if you look at a relatively flat region in there
35. You have high stability
36. Where
37. Anything else
38. The higher the curve
39. The less stable it is
40. So this region over here
41. Has some stability
42. But it’s still relatively unstable
43. Where this region over here
44. Has very little stability
45. Which should make sense
46. If you have particles with very little energy per particle
47. A few particles with very little energy binding them
48. It doesn’t seem to make any sense that those particles would want to bind
49. Where these regions over here
50. High number of particles
51. And high amounts of energy per particle
52. So…
53. These regions up here
54. Are really relatively stable
55. They don’t like to decay, right
56. And if you think about it
57. When we talk about uranium plutonium
58. There’s a high amount of energy that’s bonded there
59. And there’s a high number of particles
60. Which means these are relatively stable
61. When it comes to radiation
62. You’re talking about huge half-lifes
63. When you talk about plutonium
64. And uranium
65. So they’re
66. They’re “relatively” stable
67. But they’re still incredibly dangerous to deal with
68. Where other particles there’s very little
69. Like deuterium
70. Very little binding energy
71. Very little particles
72. So I mean deuterium is right over here
73. Unstable
74. Incredibly unstable.
75. Where you’re talking other elements over here
76. They’re relatively stable
77. It doesn’t mean that they’re not dangerous
78. It just means that the stability
79. The decay rate is a lot less
80. OK? Cool?
81. So just
82. If you see this graph on a test
83. That’s what it’s trying to tell you
84. This is meaning relatively unstable
85. Nnn…sort of unstable
86. Really stable. OK?
87. Your talking iron is gunna be
88. In this region
89. Cool? (walks up to turn off camera.)

McNeil’s video is the least performance-like of all the videos in the corpus. He
doesn’t take on a persona, there is no act, and there are no visual special effects. His
graph of bonding energy and nuclear stability is the focus of the camera and his audio is
given priority. The graph itself is not visually complex. It is drawn with a black marker,
axis labeled. Despite the visual simplicity, the scientific content is complex and assumes
a great deal of background knowledge on the part of the viewer. To be sure, by starting
the video with the words “Now, what I want to do real quick” gives the viewer the sense
that we’ve caught McNeil in the middle of an ongoing conversation. He frequently
addresses a “you” in the video, again giving the impression that this is one part of an
ongoing conversation. We get the sense that McNeil is talking specifically to people with
whom he has an established relationship outside of the videos. He speaks in a manner that
is natural and unrehearsed. For instance, he will interrupt himself mid-sentence to clarify
an idea: “It just means that the stability…The decay rate is a lot less…OK? (stanza 1, line
80)” He inserts several verbal cues for students to check for understanding. McNeil poses
these as questions and pauses briefly even though this is clearly a one-way
communication and students cannot respond. Nevertheless, he asks “OK, Cool? (stanza 1,
McNeil does work in the video to model the thinking processes involved in understanding the graph. He discusses performing calculations in the first person plural ("By using what we did... We calculated... If we divide it... We end up getting"). Visually, McNeil is the authority standing at the whiteboard, imparting his knowledge. But he says otherwise, by describing the mathematical steps required to get the information as something "we" did or "we" could do. The objective seems to be to communicate that this sophisticated content is accessible to students and draws on their past experiences and understanding. In this respect, McNeil provides one of the best examples of the cumulative nature of scientific knowledge in the corpus.

McNeil addresses the potential intimidation a student might have in looking at the graph ("You're kinda like "What the heck?") (stanza 1, line 18) and uses this statement to layer meaning and understanding onto what is happening in the graph. With the new layers of information, he explains why those layers should be intelligible and plausible to students by stepping back from the variable displayed on the graph and looking at the mechanistic explanations, connecting these to the mathematical representation ("It doesn’t seem to make any sense..." They don’t like to decay, right... And if you think about it...”). McNeil’s video doesn’t use humor, music, or jokes. It comes very close to “talking science” but even he breaks some of the rules by using colloquialisms such as “like” and first and second person pronouns as well as inserting emotions ("What the heck?") (stanza 1, line 18)).
While McNeil’s language sounds very much as though he is addressing a present class of students, the visuals say otherwise. He looks directly at the camera the entire time. The camera is situated in a way that would obscure the view of an actual class, and there is no background noise to suggest the presence of other individuals. The video appears to have been created intentionally to be accessed online.

The graph and McNeil’s audio explaining the graph are the given the greatest value in terms of the video production. The Advanced Placement and International Baccalaureate exams are provided as the reason for understanding the material, they drive the motivation. But McNeil’s language is more inclusive than the “sage on the stage” appearance of the video. The primary subjects in the video are “we” and “you”. McNeil occasionally checks in to make sure students are “cool” in terms of understanding the information presented and he brings in the mechanistic understanding of the physical chemistry to explain why the quantitative representation should “make sense” to students. To use language from conceptual change research, McNeil is establishing that the information he is presenting is intelligible and plausible to students (Hewson & Thorely, 1989).

McNeil bookends the lecture by explaining that he is discussing the graph because it is something that will likely appear on the Advanced Placement or International Baccalaureate exams. I hypothesized that McNeil was using these videos as part of a flipped classroom approach. McNeil was easy to track down online, so I was able to reach out to him and verify that this was correct. In our conversation, McNeil said that he teaches both of these advanced courses in a heavily urban district outside of Denver,
Colorado (D. McNeil, personal communication, December 21, 2012). The school is located in a low-income suburb of Denver with African American students comprising 50-60% of the student population and Hispanics 20%. According to McNeil, students were intimidated by these courses until he began to offer them as entirely self-paced, and his video lectures are a key part of this. Students pace themselves through the lectures on their own time or during class time and are able to go back and access previous material at any time. They spend their in-class time working with McNeil, other students, or on their own going through problem sets and labs. This has dramatically increased enrollment in the advanced physics courses, further diversifying the skillset and ability of students enrolling in the courses. For McNeil, the lectures are targeted specifically at those students who might be struggling with science concepts, but want to challenge themselves with an Advanced Placement or International Baccalaureate course. “Gifted kids don’t get much out of a lecture”, (D. McNeil, personal communication, December 21, 2012). His advanced students are free to spend their time working on advanced problem sets, laboratory inquiries, or deepening their knowledge by assisting other students.

In my work as an educational technologist I frequently hear from people voicing concerns that under-serviced student populations don’t have access to technology and that educational technology efforts misguided in that they do not service our most at-needs student populations. Given McNeil’s work in a school where the majority of students qualify for free and reduced lunch, I asked him if he experienced problems with student access to technology. Despite the fact that McNeil’s students are from a lower
socio-economic status, he’s only had a single student in his years of using this model who was unable to access YouTube on his own. This student had accommodations built into his school day to provide access.

McNeil originally began using TeacherTube because YouTube was blocked at his school. However, McNeil found TeacherTube servers became easily overwhelmed and the site would frequently go down, so he now uses a combination of YouTube for student home access and the school’s learning management system for in-school access. He had essentially given up on using TeacherTube, and was surprised to hear that his videos were still featured so prominently on the channel.

21st Century Simplicio. Michael McCauley is a middle school teacher in Twality Middle School in Tigard, OR about 30 miles south of Portland. McCauley has uploaded 391 videos. He has the greatest quantity of videos uploaded by anyone in the corpus. McCauley’s videos typically provide in-depth explanations that go beyond the covering law of explanation, and unlike several of the teachers covered in the qualitative analysis, none of his corpus videos say anything about state exams. In fact, many of his videos appear to be based off questions of everyday or local interest, with little mention or tie to specific curriculum goals. For example, in dinosaur locomotion, he asks what we can know about how dinosaurs walk. In another video, he addresses an urban legend about a mouse dissolving in a can of Mountain Dew and performs the experiment using a vole caught and killed by his house-cat. All of his videos begin with a brief introduction screen. The video I selected for analysis is a middle-of-the-road McCauley video. It isn’t
the most viewed of his videos, nor has it received the most favorites, but it is representative of his work.

In his video, “Barometric Barbie”, McCauley has set-up a camera in what appears to be a classroom. In the background we see an Einstein poster peeking at us and a large Erlenmeyer flask partially filled with a fluorescent pink liquid. Like McNeil, McCauley addresses the viewer in the second person (Stanza 1, line 5: “And she’s gonna tell you.”). There is a third “person” in the video: a Barbie doll referred to as “Barometric Barbie”. She is wearing a fluorescent pink wet suite. In the video, Barbie tells McCauley about a trip to the local mountain peak, Mount Hood, and the fact that she wore a bathing suit, anticipating that it would be warmer on Mount Hood than it was in the town of Twality, Oregon.
Barometric Barbie

MCCAULEY INTRODUCTION

Stanza 1
1. Well hello
2. I’m Mr. McCauley
3. And this is my friend
4. Barometric Barbie
5. And she’s gonna tell you
6. About her trip up to Mount Hood
7. And in the process
8. Hopefully you’ll learn a little bit
9. About barometric pressure
10. And, uh
11. A little bit about
12. How pressure
13. And temperature interact
14. And we’ve talked about this before
15. As you increase pressure
16. Temperature increases
17. As you decrease pressure
18. Temperature decreases
19. OK that makes sense
20. Now
21. Barbie here is gunna tell you about her story
22. And her trip
23. To
24. The top of Mt. Hood
25. With her friend Ken
26. With Ken, right?

BARBIE CLARIFIES
Stanza 2
1. No I’m over Ken now.
2. I’m with GI Joe

MCAULEY PRODS
Stanza 3
1. Oh Ok, well, tell me about you and GI Joe

BARBIE EXPLAINS
Stanza 4
1. Well GI Joe invited me to go up on Mt. Hood. (Text overlay jokes about the quality of McCauley’s ventriloquism. See Figure )

MCCAEULEY PRODS 2
Stanza 4
1. Oh very nice!
2. And?
3. What happened?

BARBIE’S WARDROBE
Stanza 5
1. Well, he said go get ready
2. So I put on my swim suit

MCCAEULEY ASKS WHY
Stanza 6
1. Barbie
2. that’s uh
3. strange
4. Why would you put on your swimsuit?

BARBIE’S ALTERNATE CONCEPTION
Stanza 7
1. Well
2. I thought
3. If I went up
4. On Mt. Hood
5. I’d be closer to the sun
6. And if I get closer to the sun
7. It’s gonna be a lot warmer

MCAULEY ACCEPTS BARBIE’S EXPLANATION
Stanza 8
1. Wow
2. Well that’s interesting
3. I guess that makes sense

BARBIE’S CONCEPTUAL CHANGE
Stanza 9
1. Well, When I got to Mt. Hood
2. To the top of Mt. Hood
3. It was really really cold!

MCCAULEY CHECKS IN WITH BARBIE
Stanza 10
1. You weren’t dressed appropriately

BARBIE SAYS NO
Stanza 11
1. No

MCCAULEY BEGINS EXPLANATION
Stanza 12
1. So what happened?
2. Well
3. Barbie
4. This is what happened
5. You gotta think of atmosphere
6. Or the air
7. As like, blankets
8. When there’s lots and lots of air piled upon you
9. Like when your down here in
10. Like
11. Uh
12. Tigard
13. Or Twality
14. There’s lots of air
15. And so it’s a lot warmer
16. And so when you have less and less air piled upon you
17. As you go higher and higher up in the mountains
18. It gets colder and colder
19. So let’s just take your trip
20. And I’m gunna
21. I’m gunna put blankets on top of you
22. And those are like
23. Air
24. Let’s give it a go
25. OK, so when you’re in Tigard
26. Barbie
27. It’s like you have lots and lots of blankets on top of you
28. That’s the air
29. Lots of atmosphere

BARBIE JOKES

Stanza 13
1. I can’t breathe

MCCAULEY EXPLAINS

Stanza 14
1. Just think of it as air
2. Barbie
3. All right
4. Let’s do this
5. All right
6. Can you see now?
7. All right
8. Well as you’re driving along
9. Let’s say
10. In your car with
11. With GI Joe
12. You get up to
13. Let’s say
14. Sandy
15. Now
16. Sandy’s about
17. A thousand feet higher than it is in
18. Tigard or Twality
19. OK?
20. Now
21. The temperature
22. Because there’s less pressure
23. The temperature’s gonna drop
24. By about three and a half degrees Fahrenheit
25. SO let’s say you start in Tigard
26. And it’s
27. Uh Forty-four degrees
28. When you get to
29. Uh Sandy
30. It’s like taking off one blanket
31. Now we take off this one blanket here
32. Now the temperature has dropped
33. To about forty degrees
34. OK? So.
35. It’s it’s cool
36. But not freezing yet
37. Alright so you keep driving
38. You and GI Joe
39. And now you get to
40. Um
41. Government Camp
42. Now Government Camp
43. Is about
44. 2,000 feet
45. That’s like taking off
46. Another blanket
47. Alright we’re gonna take off another blanket
48. And now the temperature has dropped to about
49. thirty-seven degrees
50. Still not freezing
51. But it’s definitely cold
52. Especially in a swim suit
53. Well OK
54. Drive up the hill a little farther on
55. Uh uh uh
56. Mt. Hood
57. And now you hit The Pass
58. And The Pass
59. Is about
60. 3,000 feet
61. Now
62. The temperature has dropped
63. And you take off another layer of of uh
64. Blankets
65. Now
66. You’re at about
Barbie agrees.

**Stanza 15**
1. That makes so much sense

McCauley concludes.

**Stanza 16**
1. Yes it does
2. So
3. As you go up the hill
4. Barometric pressure
5. Drops
6. And the temperature goes down
7. And it’s called an adiabatic collapse rate
8. Which is about three and a half degrees Fahrenheit for every thousand feet so
9. If you’re gunna go up on the mountain
10. Put on some warm clothes

McCauley expresses initial puzzlement at Barbie’s wardrobe choice. Barbie explains her rationale, that she would be “closer to the sun” (Stanza 7, line 5) where she expect to be warmer. McCauley acquiesces, “I guess that makes sense” (Stanza 8, line 3). To use the ideas from the conceptual change literature, McCauley accepts that Barbie’s ideas were intelligible and plausible. He points out that Barbie was dissatisfied by her initial conceptions. From here, McCauley uses layers of blankets, covering Barbie, to explain adiabatic cooling and highlight the insulating properties of air. He walks Barbie
and the viewers through a trip up Mount Hood, coming to various stops along the way. McCauley does not use a generic mountain top, he speaks specifically about a mountain students in his area would be familiar. Students and teachers outside of Oregon, in the general TeacherTube population, might not be so familiar with Mount Hood and its neighboring locales. In this respect, the video seems to have been made very much with McCauley’s students as the primary audience. McCauley periodically references the altitude of the various locations along the way to reference students’ hometowns (stanza 12, lines 10-12 “Like, Uh Tigard Or Twality”). McCauley uses locations familiar to the students and uses an analogy between a familiar insulator (a blanket) and a more unfamiliar insulator (air) in order to provide a fruitful reference point for Barbie and the audience. Recall that this is a strategy for achieving intelligibility. Such reference points serve to anchor McCauley’s explanation to tangible events student would have experienced. In doing so, McCauley demonstrates the fruitfulness of his conceptual model. It is this fruitfulness that ultimately leads Barbie to say “That makes so much sense” (stanza 15). To which McCauley replies, “Yes it does” (stanza 16, line 1). With Barbie’s eager assertion that the explanation makes “so much sense” and McCauley’s confidence in saying, “yes it does”, McCauley paints his explanation as one that is understandable and intuitive to any person who has experienced traveling in increasing altitudes. This is interesting in light of Lemke’s observation in Talking Science (1990), “Students are taught, often very subtly, that science is opposed to common sense” (p.138). McCauley positions Barbie to pose her “common sense” understanding of temperature and altitude, acknowledges that there is some “sense” to her logic, and then
demonstrates the utility of his interpretation in a manner that also appeals to “common sense”.

Figure 18 Blankets are used to demonstrate thermal properties of air.

McCauley presents this explanation as a dialog. It is a dialog between himself, the teacher, and Barbie. Recall that dialog was one of the ways to break the rules of talking about science according to Lemke (1990). The misconception presented by Barbie may have been an idea McCauley may have heard before. Barbie is represented as somewhat of a “ditz.” Her understanding of temperature and altitude are naïve, she makes silly wardrobe choices, and interjects tidbits about her love-life in a scientific discussion. We will see this type of dialog and dynamic in two more of the videos we analyze. This style of dialog has long roots in scientific communication, roots that predate the modern use of the word “science”. This was the style adopted by Galileo in Dialogue Concerning the Two Chief World Systems (Galilei, 1632/1962). Galileo compares Copernican and
Aristotelian models of the solar system via discussions between philosophers and layman. Galileo’s “Barbie” was a character named Simplicio. Simplicio was an adherent to the Ptolemaic and Aristotelian models and modeled after Galileo’s detractors, include high-ranking officials of the church. McCauley and his “Simplicio” resolved their scientific differences more amicably.

Through Michael McCauley’s use of his real name and location throughout his enormous corpus of videos, he was very easy to track down. A Google search lead me to a newspaper announcement of his “teacher of the year” award. During our phone conversation (M. McCauley, personal communication, December 28, 2012) he told me that he has over 300 videos that have been produced and shared publically, and another 100 or so videos that reside only on internal servers, as they depict students doing work. McCauley uses these in his teaching, but does not share the videos online due to student privacy issues. McCauley jokes that he “speaks technology with an accent.” He is careful to employ it only when he sees that it can solve a clear problem, but he also sees it as a “sales tool” to middle school students. McCauley not only gets inspiration from shows like *MythBusters*, but he points out that this is the language his students are speaking in. They are immersed in a media landscape that wraps information in humor and intriguing vehicles. Creating this type of media is therefore a way to remain within their language. This connects back to McCauley’s appeal to science as common sense. His goals in keeping science from being “a special truth available only to experts and mainly incomprehensible to the layman” (Lemke, 1990 p. 138) is evident in his medium and message.
Technology also serves to make a home-school connection with students. McCauley saw that his students and his own children would often respond that they did “nothing” when asked about their school day at home. By providing parents with these resources, he reasoned that parents might have some conversation starters to get their students to open up about their activities.

The videos on TeacherTube are only half of the story. He pairs these videos along with PDF links to all of the homework and school work, and he has a robust, opt-in email list for parents where he regularly updates them about what students are working on. He also shares relevant videos from The Khan Academy. McCauley has been offering on-demand lessons for a long time, starting with recorded dial-in lessons when he began teaching in the 1980s. His interest in video lessons was accelerated as the socio-economic demographics of his district began to change. The school district changed from being largely middle-class to a district with many poorer, immigrant families, particularly migrant workers. Absences became a big problem, and the videos were useful in assisting many students in these circumstances. McCauley readily offers the caveat that videos cannot help all students. Many of his students do not have access to the internet and equity is a problem that he “constantly thinks about”. He is currently working with the school to pilot a BYOD (bring your own device) program where the school provides computers or tablets to students who do not have their own. Turnover rates for students are relatively high in the district, as their population is mobile, so there are several questions as to whether and how a BYOD program can work.
McCauley asks his students to produce their own animated videos to explain something they learned in science as well. Two of these student videos are in fact in this corpus (“CJ’s Exploding Whale” and “Conner & Luke Tornado”) for its relatively high view count. McCauley holds a film festival and students are awarded “Golden Dinosaur” awards for their work. Unlike McNeil, McCauley has stuck with TeacherTube because YouTube presents too great a risk of exposure to inappropriate content. McCauley used to cross-post his videos on TeacherTube, but after a video about an experiment with gelatin surfaced YouTube suggestions for scantily-clad women wrestling in Jello, McCauley moved exclusively to TeacherTube.

Science theatre with Dr. Loopy. Another popular series of videos are those uploaded by Douglas Valentine as his character Dr. Loopy. Valentine is an interesting contrast to McNeil and McCauley because he is a fifth grade teacher and he has an extensive background in theatre. McNeil and McCauley, both secondary teachers, have undergraduate degrees in science whereas Valentine, like many elementary teachers, is more of a generalist. You may recall from an earlier section that the Loopy videos stand out in their meticulous post-production editing. The videos are never a single camera shot, as they are with McCauley and McNeil. There are multiple cameras, special effects, and sound effects that are layered into the production. His videos are also united via strong branding. He plays introductory music (a modified version of the song the 1982 song by Thomas Dolby, She Blinded Me with Science) with introductory footage. Valentine has uploaded 132 videos to TeacherTube. This is certainly a lot compared to most TeacherTube users, but less than McCauley and McNeil. He has sets with elements
of branding on them such as the “TAKS Labs” where TAKS stands for the Texas Assessments of Knowledge and Skills. His videos are among the oldest in the corpus, with the oldest one being uploaded in May 2007.

Figure 19. Valentine places the camera below his overhead lens to demonstrate refraction.

Imagine, for a moment pulling up a video of someone explaining the structure of a sonnet, or the Civil War. As the audience, we might find it strange if this individual was wearing dishwashing gloves, a green-bob wig, and comically thick glasses. But somehow, this eccentric look is at home in a science video. We understand that this is a reference to a “mad scientist” persona. This is the costume used by Texas teacher Doug Valentine and his character “Dr. Loopy”. While Dr. Loopy’s appearance is intentionally silly, there is something about it that fits in with an idea of who a scientist might be: he is
eccentric and strange, common stereotypes of scientists (Friedman & Donley, 1989; Toumey, 1996). He is also white, approaching middle-aged, and male (Lemke, 1990); further consistent with stereotypes of scientists. Even his *nom de video*, Dr. Loopy, couples authority and knowledge (Dr.) with silliness and eccentricity (Loopy). There is something about science that makes it more acceptable to us, the viewer, to see it presented with an overt silliness divorced from the actual content of the subject matter being presented. That is to say, there is something socially recognizable about this juxtaposition of silliness presenting physics content. To be sure, Valentine readily cites his inspiration for Dr. Loopy:

The idea of Dr. Loopy came from shows like "Mr. Wizard" and "Bill Nye" except (I) wanted a scientist that had good intentions, but the humor arises from his seriousness and his assistant's incompetence. I wanted to be able to get the science across in a humorous way. The character was influenced by a number of things including a late night movie host that used to appear locally on television in Tulsa when I was younger. The other characters came from Jerry Lewis, Dick Van Dyke, and any number of comedians. (D. Valentine, personal communication, February 6, 2013).

Outside of this “silliness,” standard classrooms structures and relationships exist (the relationship building tool and the politics building tool, p. 117-118). Dr. Loopy tells
and defines and serves as the scientific authority. Valentine also plays the role of “Charles”, the bumbling assistant who (more so in other videos) is the Simplicio. He voices misunderstandings and, as Valentine points out, plays the comic to Dr. Loopy’s straight man. In this video, Charles clumsily holds up the transparent, translucent, and opaque surfaces:

**Dr. Loopy Discusses Light**

**Stanza 1**
1. When we think of things
2. That make light
3. We think of
4. The sun (Handel’s *Hallelujah* plays in background)
5. The sun
6. Like most things that give off light
7. Also gives off
8. Heat
9. We could also see light
10. In
11. Lightening (thunder sound effect)
12. A light bulb (electric zapping sound effects)
13. A flashlight (light-saber sound effects)
14. Or even
15. A tiny lightening bug (sound effect of male voice giggling followed by “cool”)
16. Light travels in a straight line
17. Unless an object
18. Gets in the way
19. If an object blocks the light
20. It is called
21. Opaque (sound effect of crowd laughing)
22. If an object lets light through
23. It is transparent (sound effect of slide whistle)
24. If an object lets some of the light through
25. It is translucent (sound effect of crowd gasping)
26. Sometimes
27. Light bounces off objects
28. Like
29. Water
30. We call this
31. “Reflection”
32. Sometimes light bends as it travels through an object
33. This is called
34. “Refraction”
35. Let’s take a closer look at that (points off camera, a zipping sound effects occurs during a video transition).
36. Why am I upside-down?
37. Because you’re looking at me through a lens
38. A very special kind of lens called
39. A Fresnel lens
40. This is a type of lens that you would find
41. On your overheads in your room
42. Bet you didn’t know it would do that
43. Huh?
44. But why does it do that?
45. It does this because it is refracting the light
46. The lens is not flat
47. No
48. The lens is made up
49. Of thousands of prisms
50. And of course we know
51. A prism
52. Refracts light
53. Hence
54. It refracts me
55. And turns me
56. Upside down (sound effect of male voice giggling followed by “cool”)
57. Much in the way a camera works
58. Yes
59. Very interesting
60. (sound effect of several female voices saying “ewww” as Loopy magnifies his nostril)
Gee’s identity building tool reveals something interesting, particularly in this multi-modal text. If you were to strip away the sound effects, costume, music, and other props, this video is a pretty standard vocabulary lecture. It starts with a question, defines terms, and checks for understanding. The identity building of Dr. Loopy takes place solely through other sign systems that are not related to science: his costume, his goofy assistant, the use of silly sound effects. These items are layered on top of a very standard, textbook explanation about refraction but are clearly an important component in building the Dr. Loopy identity and brand.

This particular video from Valentine is similar to most of his videos in that it is focused on vocabulary and definitions. There is little in the way of explanation or laboratory demonstrations. After watching his corpus and seeing his mention to the TAKS, I wondered whether this was related to the alignment these videos were supposed
to have to the TAKS. This turns out to be the case. The Dr. Loopy character came about when an assistant principal specifically asked Valentine if he, “might video “science facts” in a fun, informative way that students could use to review tests” (D. Valentine, personal communication, February 6, 2013). Note that the quotes around science facts are original to Valentine’s email to me. With that in mind, these videos clearly accomplish that original goal.

Like Loopy’s I’m a Mineral music video, discussed earlier, this video is not done with one take. It is not a single camera shot. There is considerable post-production work that goes into adding audio and visual effects. When asked about this video production work, Valentine reported that he was self-taught and always growing and evolving in his work:

When we did the videos we would work every week leading up to the test. One video per week...So it was write during the week, shoot on Friday and Saturday, edit on Sunday, and show it on Monday. Very time consuming! (D. Valentine, personal communication, February 6, 2013).

What value does this post-production work bring Valentine? Consider that the Loopy videos focus on definitions. As Dr. Loopy, Valentine adheres to the rules for talking science (Lemke, 1990 p. 133). Following these rules results in what Lemke (p. 134) refers to as “dull and alienating language…(the) strong contrast between the language of human experience and the language of science.” Valentine uses the sound
effects, visual effects, and editing as a way to break these rules, to break out of the expected scientific language, as a way to get students to pay attention. In doing so, he fulfills the assistant principal’s request while invoking techniques for student engagement.

Dr. Loopy is a prominent fixture in the TeacherTube science landscape. Valentine’s videos were originally shown to students via closed circuit television in the school, and eventually uploaded to TeacherTube with the intention of being accessible to the students at his school. Once the videos were on TeacherTube, Valentine began to hear from other teachers around the country and Valentine was surprised to hear that students younger than the intended 5th grade audience were watching and enjoying the clips (D. Valentine, personal communication, February 6, 2013).

Documentaries from Mr. Kizer. Like Valentine, Ash Kizer is an elementary school teacher. His videos are multiple-shot affairs with post-production sound and video editing and strong branding. “The Bonus Point Podcast” is what he calls his videos. He has a website (http://www.thebonuspointband.com/), a logo, introductory music, a branded Twitter and Facebook account. Kizer composes and plays original music (his “I Am Sound” song was discussed in the music videos section) and much of it is available on his website. Like Valentine, these videos were created very specifically for Kizer’s students. In one of his videos he directly addresses a quiz “you will be taking tomorrow” to his students. In the video transcribed below, he tells students, “I’m in your classroom” (stanza 1, line 2 and stanza 3, line 3). His videos are frequently downloaded and among the most “favorite,” meaning that users logged into TeacherTube accounts bookmarking
this video as a favorite are the reason Kizer’s videos appear in this corpus. In other words, his videos don’t necessarily have the most views, but for people who have TeacherTube accounts and have logged into the website, Kizer’s videos receive special attention in the way of downloads and being marked as favorite. The video analyzed below is of his “The Rock Cycle” video, which has been downloaded 137 times and assigned as a favorite by 40 users.

Figure 21. Kizer uses live footage of the natural world.

The Rock Cycle

KIZER’S ROCK CYCLE

Stanza 1
1. This is Mr. Kizer
2. And I’m in your classroom
3. And your watching
4. The Bonus Point Podcast (giggling in background)
5. The rock cycle!
6. What it is
7. And why we care
8. On this episode
9. Of the bonus point
10. Podcast
11. In science class
12. You learn about all kinds of cycles
13. Life cycles like the butterfly cycle
14. The frog life cycle
15. Aaaaaannnd
16. Most people know about
17. The water cycle
18. Well the rock cycle is made up of ongoing processes
19. That change rocks from
20. One kind
21. Into another
22. Sedimentary rock is one type of rock
23. That starts out as bits of sediment called sand
24. After those sediments are eroded and deposited
25. They are hardened to form rock
26. This is a sedimentary rock called sandstone
27. You may notice it looks a little bit like compacted sand.
28. That’s what it is.
29. However
30. The pressure in the crust of the Earth
31. Can change this sandstone into quartzite
32. Quartzite is a metamorphic rock that is harder and shiner than sandstone
33. But its made out of the same minerals.
34. If any of these rocks
35. Should get close enough to the mantle to melt it
36. They could become igneous rocks
37. When the melted quarts minerals harden
38. They could form this igneous rock called andesite (spelling?)
39. One interesting thing about the rock cycle
40. Is that it doesn’t have to continue in a circle
41. It can continue
42. From
43. Sand
44. TO sedimentary rock
45. To…..
46. Metamorphic rock
47. To igneous
48. But it doesn’t have to
49. A sedimentary rock like sandstone
50. Can be broken back down into sand
51. Or weathered
52. And form another sedimentary rock again
53. Once the bits are compacted and cemented to form another sandstone
54. It seems to be a never-ending process
55. Rocks just keep on changing (camera switches we are now in his classroom, he is in front of a white board interacting with students, calling them by name, we hear the kids but we don’t see them)
56. What do we call changes to a rock over time?
57. Lane?

LANE

Stanza 2
1. The rock cycle?

2. KIZER CLOSES

Stanza 3
1. And that’s what our show’s about tonight
2. The rock cycle!
3. Hey this is the bonus point podcast and I’m in your classroom!

Kizer’s lesson is one of the few that begins with an explicit reference to what the Next Generation Science Standards are calling “cross-cutting concepts” (Achieve Inc., 2013) by reminding students that they’ve learned about “all kinds of cycles” in their science class (stanza 1, lines 11-17). The video footage of these lines shows a butterfly first and then a frog fountain which eventually pans over to some rocks in the pond, when Kizer announces the rock cycle. The live footage serves as a visual unifier demonstrating cycles in the living and non-living world, underscoring the cross-cutting concept.
Kizer’s video is reminiscent of a documentary rather than the performance we see with Valentine, McCauley, Lee or Edmonds. He uses live outdoor footage and clear, crisp, post-production voice-over. From Kizer’s outdoor footage, we move to a set created with black construction paper. Off-camera, Kizer pours sand from a Styrofoam cup, and pans the camera around the set as he discusses the transition of sand, to sandstone, to quartzite. The black set contrasts with the sand and rocks, making the features of these substances stand out and easy to see. As he does this, the relationship between these substances is apparent, and we get a clear visual of the products of this cycle. The rock types (sedimentary, metamorphic, and igneous) are examined in the context of the rock cycle. This is in contrast to “Rock Cycle Rap” from Mr. Lee. Mr. Lee discusses the rock types, and their definition, separately and toward the end of the song, there is a rushed explanation that the rock cycle has something to do with the rock types.
Kizer pans through the visuals several times, using repetition in illustrating that the substances are related through a process. Similar to McNeil and McCauley, Kizer points out that their common sense observations and understanding are aligned with scientific explanations: (Stanza 1, line 27-28) “You may noticed it looks a little bit like compacted sand….That’s what it is.” Kizer uses vocabulary terms in context and doesn’t draw any special attention to them. This presentation of science as accessible to anyone stands in contrast to Mr. Lee’s music video on the same topic which drew attention to many of these same words as “scary”. Kizer uses the specimen itself as evidence for the process.

Kizer also notes (stanza 1, line 48) that one rock type can become another, but it “doesn’t have to.” Kizer’s use of anthropomorphic language demonstrates a subtle break from the “rules” of talking science (Lemke, 1990, p. 133) but he also breaks the relationship between circle and cycle. Again, in contrast to Lee’s lesson where the rock cycle went “round and round” like the “wheels on a bus,” Kizer co-presents the concept of a cycle with branched outcomes.

Kizer’s students play a small role in the video. At the start of the video, we hear them giggling as he introduces the topic and pauses to look at the camera and make a silly face. This happens at the end of the video as well. After his demonstration of the rock types, the video transitions to a shot of Kizer standing at the front of the classroom and asking a summarizing question. He calls on a student, Lane, who appears off camera but his response can be heard. This call-out to students serves to bring them into the video without privacy concerns of having the student images publically available. It also
serves as a way to have a student bring us back to the lesson objective posed at the start of the video.

**Working with Younger Students**

With many of the videos in this analysis focusing on students in upper-elementary grades and older, I wanted to complete the analysis by highlighting videos targeted at the kindergarten through second grade age range. These videos are not driven by music, nor are they lectures in the typical sense. The first video, “A Butterflies Life”, stands out among the analyzed videos in that it is the only learning product featured here. As a collaboration between teachers and students, “A Butterflies Life” is a student assignment as well as a teacher production. That makes this video unique among the corpus. The corpus featured several student assignments, but this one stands out because of how young the students are and the collaboration with the teacher. The final video is an animated video from Mr. Thompson. Mr. Thompson’s animations appear frequently in the corpus and they address a variety of scientific topics. Thompson’s videos are unique because they are teacher-produced animations, and animations are more labor intensive than live video footage. If it weren’t for Mr. Thompson, the content analysis numbers for animated video would be much smaller and I wanted to spend some time looking carefully at what this added work for animation might “get” Thompson in the way of communicating science to younger students.

One of the features that unite these videos is the importance of narrative. Given the importance of narrative on developing early readers, it makes sense that teachers would employ this strategy to discuss science with students. But narrative is not the same
as a scientific argument. Narratives end in a climax or resolution as opposed to a conclusion (Lemke, 1990, p. 108).

**A butterflies life.** The video A Butterflies Life (sic) is unique among the videos I have selected for discourse analysis in that the teacher is completely absent from the video. This is video is also unique in that it is a product of learning or a learning artifact in itself. This is an assignment created as a collaboration of students and teacher. Four students in an early primary grade (kindergarten or first grade) talk through the stages of a butterfly’s life in first person. As they narrate their story, slides of butterfly eggs, caterpillars, pupas, and butterflies are displayed. Very soft, gentle, relaxing music plays in the background. Also in the background is the sound of children talking and playing. This gives the impression that the four narrating students are working in a classroom during an “activity center” (when students are stationed at different activities set up around the classroom). The teachers’ involvement in the video is evident in its sophistication and quality of composition. The students needed assistance in locating the images, drafting a script, assembling them onto an electronic slide show, finding microphones and headphones, setting up the recording software, editing this all together, and eventually uploading it online. It is probable that the teacher helped these students set up the main ideas in the story, and integrate the scientific terms found within the recording (pupa, nectar, proboscises). But the writing of the narration has an unaffected, child-like quality about it, (“we are bored because we can do nothing”) indicating that the students had an important role in writing the story.
Figure 23. A Butterflies Life is comprised of photographs

A BUTTERFLIES LIFE

I. EGGS
Stanza 1
1. Hi my name is (incoherent)
2. And my name is Snowball
3. And we are butterfly eggs
4. We are about to be caterpillars
5. We are bored because
6. We can do nothing

II. CATERPILLARS
Stanza 2
1. We’re glad to be caterpillars now
2. We can’t wait ‘til we...we’re going to shed our skin
3. Look how fat we are
4. We’re going to shed our skin
5. We can’t wait until we’re pupas

III. PUPAS
Stanza 3
1. Now we are pupas
2. We made a new home
3. In ten days, we will be butterflies
4. We can’t wait until we see
IV. BUTTERFLIES

Stanza 4
1. Now we are butterflies
2. We can drink nectar from our proboscises
3. Now we will fly to more flowers with our wings
4. We feel great because we can fly

The language that is privileged here is language that indicates identity, narrative, and stages. The students speak from the point of view of the butterfly, going so far as to take up invent butterfly names to introduced themselves (stanza 1, line 2 “And my name is snowball”). The students integrate scientific facts about the butterfly (what it eats, how it transitions between life stages) with anthropomorphic details (examples include stanza 3 line 4 “We can’t wait” and stanza 4 line 4 “We feel great because we can fly”). The idea of a life cycle is communicated via a narrative. This narrative includes specific, scientific vocabulary terms that are used in context with the story. This is also one of the few videos that focuses on beauty and wonder in science. The images take up the entire screen and are close-up. The relaxing music in the background underscores how we should feel looking at the pictures: happy, relaxed, inspired. In this respect, A Butterflies Life values beauty and joy in science. It also values relatable stories, as is evidenced by the layering of human emotions onto the butterfly experiences (“We feel great, we can’t wait, look how fat we are”).

This mix of narrative and scientific fact, and the use of anthropomorphic actors, is reminiscent of the types of stories young children read and television shows they see. Shows such as Dinosaur Train on PBS introduce young children to ideas and vocabulary words about dinosaurs via anthropomorphic dinosaurs whose stories you can follow on
television, via video games, and in books. To this end, “A Butterflies Life” displays a

type of intertextuality that relies on genre knowledge. The intertextuality and use of genre
knowledge seen in “A Butterflies Life” isn’t as explicit as what we see in “Rock Cycle
Rap”, but it is present. We know that most children can watch this video and understand
that the eggs, caterpillars, and butterflies are not actually speaking and that there is an
element of “pretend”. In this respect, the students who produced the videos are
integrating fact and fiction the way that child actors on Sesame Street might when they
interact with the Muppets.

Phases of the moon. The user “mrtee073” has uploaded 140 videos on
TeacherTube, with 12 videos appearing in the corpus. According to some of his slides, his
full name is Mr. Thompson, so that is how I refer to him in this analysis. This particular
video, “Phases of the Moon” is the fourth most viewed video of the corpus. All of the
corpus videos from Mr. Thompson are animated illustrations. By using illustrations and
animation, Mr. Thompson is creating something akin to popular media in cartoons that
his students are likely familiar with. In this video, an anthropomorphic cat is howling at a
full moon when the cat pauses to ask why the moon looks different at different times. A
face appears on the moon. The cat asks the moon (Stanza 3, line 9) why it is that from
one night to another it looks “completely different?” The moon chuckles and provides an
in depth explanation of its phases, explaining that during its orbit around Earth, sunlight
is illuminating different parts of it. During the explanation, Mr. Thompson animates the
moon’s orbit and later the phases of the moon with the terminology printed prominently
on the screen.
The Phases of the Moon by Mr. Tee
Instrumental introduction

CAT INTRODUCTION

Stanza 1
1. Oh solo meow-oooooh
2. Why, why oh why is it
3. Sometimes I look at the moon
4. And it looks one way
5. And other times I look
6. And it looks other-way
7. Whyyyyyyyy
8. Meow-oooooooh
9. Well
10. I don’t know that
11. But I do know
12. There’s nothing finer than
13. Wrrrrrreuuuuuing at the moon
14. Mreooooow-oooooooh woooo!

MOON INTRODUCTION

Stanza 2
1. Hey there!
2. Hey down there!
3. Pipe down
4. Down there!
5. What’s a moon gotta do
6. To get a little sleep around here!

CAT ASKS 2

Stanza 3
1. Oh, it’s you Mr. Moon, meeee-owwwww
2. owwww I’m sorry
3. I didn’t mean to wake you up
4. Rrrrow
5. Can you tell me why
6. Why is it
7. That some nights you look one way?
8. And then another night
9. You look completely different?
10. I don’t understand
11. Rrrrow…

MOON ANSWERS
Stanza 4

1. Huh huh huh
2. Well you see
3. Little kitty
4. That’s what’s called the phases of the moon (animation transitions here)
5. I
6. Mr. Moon
7. Go around
8. The Earth
9. This is called an orbit
10. And while
11. I orbit
12. The Earth
13. The light from the sun
14. Reflects off of me
15. In different ways
16. And
17. You see
18. Me
19. Looking different
20. From the Earth
21. I don’t change
22. But
23. The part of me you see
24. Is different (change in animation again)
25. You see
26. Little kitty
27. Sometimes
28. My whole self is blackened out
29. I’m still there
30. But you can’t see me that’s called
31. The New Moon
32. Then
33. As I move a little further along
34. In my orbit around
35. The Earth
36. You’ll see just a little sliver of me
37. This
38. Is called
39. The crescent moon
40. Then
41. A few nights after that
42. You’ll look up and you’ll see
43. Half of one of my sides showing This
44. Is called
45. The first quarter moon
46. And then halfway through my orbit around the Earth
47. You’ll see
48. All of one side of me
49. And the night is very bright
50. This
51. Is called
52. The full moon
53. And then in the second half of my trip
54. Around the Earth
55. You’ll see
56. The last quarter
57. And then
58. A crescent
59. And then it starts all over again
60. With a new moon
61. And another trip
62. Around the Earth

CAT UNDERSTANDS

Stanza 5
1. Oh wow
2. That happens
3. Every month? Wow-meeoww
4. So
5. It seems like you get bigger
6. And then you get smaller
7. How-meeow meow meow

MOON CONTINUES

Stanza 6
1. Huh huh huh
2. You see, little kitty,
3. What happens is
4. More light from the sun is reflecting off of me
5. So you see more
6. When I’m getting bigger
7. I’m said to be waxing
8. A waxing moon
9. And when I seem to be getting smaller
10. It’s called
11. A waning moon
CAT REVIEWS

Stanza 7
1. What were the names of those phases of the moon again, Mr. Moon?
2. Meeee-owwwwww

MOON REPEATS

Stanza 8
1. Huh huh huh
2. I can tell you again
3. They were called
4. (corresponding animation) The new moon
5. The waxing crescent
6. The first quarter
7. The full moon
8. The last quarter
9. The waning crescent
10. And then back to the new moon once again
11. Oh and I almost forgot to tell you
12. Some people name the moon
13. When its almost full
14. They call that
15. The waxing gibbous moon
16. And some name the moon just after I’m full
17. They call that the
18. Waning
19. Gibbous
20. Moon

CAT GRATITUDE

Stanza 9
1. Oh gee
2. Thanks Mr. Moon a-oooo
3. Thank you for teaching me about the phases of you
4. Meee-oooowww

MOON EXT

Stanza 10
1. Oh-ho-ho
2. You’re welcome
3. My furry little friend
4. So much fun to teach you
5. About the phases
6. Of the moon
(Music for closing)
The dialog here is similar in structure to McCauley and Barbie, where the cat plays the role of Simplicio. While the cat’s initial question states that the moon looks “completely different” from night to night, the cat later clarifies a pattern. In stanza 5 lines 4-6 the cat notices, “So it seems like you get bigger And then you get smaller”. The moon takes this opportunity to layer in the vocabulary words “waxing” and “waning” in addition to adding the term “gibbous” to describe the mostly full moon. The relationship between the cat and the moon seems to be that of teacher and student. The cat’s voice is high-pitched, almost screechy, and somewhat child-like. He refers to the moon as “Mr. Moon” and the moon refers to the cat using a diminutive “little kitty.” The moon’s voice is deep and booming. The moon frequently responds with Santa Clause-like chuckles at the cat’s questions, which came across as though the moon found the questions to be naïve, innocent, or trite. Nonetheless, the moon tells the cat it was “so much fun to teach you (stanza 10, line 4).” While the teacher, Mr. Thompson, is not visually represented in this video, he is present in the role as the moon, the cat’s teacher.
Figure 24. The cat learns about the phases of the moon.

Like “A Butterflies Life”, this video uses an anthropomorphic cast to illuminate a cycle. The scientific discussion is carried out by an alley cat and the moon. Unlike “A Butterflies Life”, Mr. Thompson goes one step further in describing not only the steps of a cycle, but also emphasizing that cyclical nature, that this is something that happens over and over again. One of the primary values on display here is to explain a natural, observed phenomenon. The cat serves as a proxy for the students. He notices something that puzzles him. However, the cat does not seek an explanation himself, he obtains it from an authority. The cat does articulate his detection of a pattern, and imply that this pattern can be used to predict figure moon behavior. He asks questions and clarifies and takes the moon’s responses as the final word. In other words, it is important to know why the moon appears as it does, but the answer is handed down from an authority. How the knowledge was originally constructed or obtained is not mentioned.
Mr. Thompson uses illustration and animation to build visually interesting characters, but to demonstrate concepts as well. His production of this animated video is more labor intensive than, for instance, delivering a similar lesson by looking at the camera and drawing on a white-board, or even handling props, as we’ve seen in the videos from McNeil and McCauley. It stands to reason that Mr. Thompson believes that the animation is getting him something, presumably student interest and attention that a live action video would not. To this end, his voice acting, animation, illustration, and use of anthropomorphic characters are an effort to create a socially recognizable pattern of popular children’s entertainment to deliver a lesson.
Revisiting the Research Questions

In the above analysis, we saw that teachers used a variety of personas to communicate science in their videos. Physical science is by far the most popular science topic with 46.5% of the corpus followed by Earth and space science (26%) and life science (20.5%). The nature of science, history of science, and current topics in science all together barely comprise 4% of the corpus. These videos are, by and large, created to cover and communicate particular areas of content, not to explain science as argumentation and discourse. Given that the most viewed video (by far) is the Frog Dissection Instructions video (at 41,285,554 views), I would hypothesize that videos are often used to supplement under-resourced learning objectives. Frog dissections can be a costly activity, so videos about the activity provide a free alternative.

From the sage and Simplicio, crooner, rapper, 80s music video star, and green-haired scientist, one thing the personas from the qualitative analysis all had in common is that they were male and all of the men who appeared on camera were white. Four of the content producers examined in the qualitative analysis have, between them, uploaded 893 videos. The user “kvanderveen” is likely a woman and while she has uploaded 230 videos, only one of those videos is in the corpus. The teacher-author behind “A Butterflies Life” is unknown, but the video was posted by a user named
“Keith_Erickson.” The only woman in the videos was Valentine’s wife, who had a supporting role in both of his videos, and figures more prominently in other videos in the corpus. Otherwise, the only other representation of a woman we have in the discourse sample is that the naïve Barometric Barbie. Women and girls are co-present with men or boys in 23.6% of the videos. Females are exclusively present in only 13% of the corpus. I was not expecting this large of a disparity in visibility of female teachers and therefore did not construct the content analysis to take into account how many present females were either students or voice-over narrations. When it came time to select videos for the qualitative analysis, it was difficult to locate meaningful examples featuring female teachers. Female teachers were not absent, but they were in very few videos. Two videos with female teachers in particular were very specific in describing a class assignment and their focus on process meant there was little in terms of science education to analyze. In this study, science on TeacherTube is overwhelmingly male, and overwhelmingly white. Given the effort traditional curricula has made to overcome this under-representation, it is discouraging to see that what should be a more democratic media has not brought with it a more democratic representation of people. I don’t know if this is the case for videos in other subject areas. I also don’t know if this would be different if I had sampled science videos on TeacherTube in general, instead of selecting three different vectors for getting at the most successful and popular science videos. Children and students appear occasionally, but rarely together with teachers. I suspect that this is due to ambiguities surrounding the privacy rules of posting student images. When it comes to posting images of children, 13 is the age at with the COPPA (Children’s Online Privacy
Protection Act) laws no longer require parent consent to post on the internet. If I were to design another content analysis like this in the future, I would try to take better account of present students’ ages to get a sense of whether COPPA is, in fact, impacting the types of students we see on TeacherTube. Both McCauley and Valentine explicitly addressed this issue as limiting the types of videos they shared publically.

Many teachers looked to entertainers and entertainment in developing their personae. This is very much a phenomenon observed and criticized by Juhasz (2011) wherein she observed that YouTube is used to spoof mainstream media. Valentine and McCauley explicitly name television shows and comedians. This demonstrates that Anderson’s cross-pollination of ideas does occur, but it occurs across professions and media, rather than within the practice of science teaching. In the qualitative portion of the analysis, the only visible scientist is the poster of Albert Einstein in McCauley’s classroom. Scientists appear in only 1.4% of the total corpus and they are represented exclusively through the featured videos. These are the videos selected by TeacherTube often to represent professional partnerships. These are not the most viewed videos nor are they the most favorite. Likewise, Derrick McNeil’s lecture on nuclear stability is in the sample because it is a video featured by TeacherTube, not because the users of TeacherTube put him there.

Viewer participation in TeacherTube is largely passive, and there are no apparent “cheerleaders” in TeacherTube. While many YouTube videos generate hundreds and thousands of comments, there are very few comments on any of the TeacherTube videos. Viewers and users make their presence known primarily by viewing, sharing,
downloading, or marking videos as favorites. Even numbers of Facebook likes or Tweets are relatively low with only one or two likes or shares for those videos are not at zero. There are a few exceptions, with a student lab safety rap being liked on Facebook 419 times and other professionally produced videos (such as They Might Be Giant’s “Meet the Elements”) securing dozens of likes on Facebook, with Facebook being the most used social media sharing site. Anderson’s trendspotters and super-spreaders might be present on TeacherTube, but the interface makes it so that they fly under the radar. They are not as apparent as they might be on YouTube.

At the time data for these videos was collected comments on videos were sparse and typically encourage or expressing gratitude for sharing. The community of critics that drove Anderson’s crowd accelerated innovation does not exist on TeacherTube. In fact, during the update of the TeacherTube that occurred in the middle of my study, comments disappeared from the interface all together. This system of commenting was not a part of the TeacherTube culture, even when commenting was an option back when I began this study. Despite the role UGVs may play in collaboration and innovation, this type of peer learning is not apparent in TeacherTube. With only a small handful of teachers producing so much of the content, TeacherTube works much in the way Ito (Ito et al, 2010) described youth participation on websites, with a select few individuals acting as Anderson’s mavericks or Ito’s “geeking out” and driving content creation. As for other types of participation, such as the 19% critics” found elsewhere by (van Dijck, 2009) are absent, and during the course of the study, TeacherTube disabled the comments feature. The future of online videos in education appears to be more of the same. Websites such
as watchknowlearn don’t even let teachers upload directly, and content is even more strictly policed.

This poses several questions. Is it possible to create a scalable social media network that fosters professional development communities? Will that effort always be hindered by a need and desire to monitor student access to content of does it run counter to the culture of this lonely profession? As new generations of teachers, teachers who grew up with online affinity spaces, come into the profession, will we see a change in in this culture? Right now, TeacherTube is not serving as such a space and the role of social media in the teaching profession remains an open question.

**Beyond Lectures for the Flipped Classroom**

One of the focal issues in my conceptual framework was the popularity of the “flipped classroom” model of education. This model interrogates what value is added by classroom time when didactic knowledge is so readily available online. The popularity of The Khan Academy exemplifies this. A successful venture capitalist with an affable personality offers lectures on hundreds of difficult, quantitative topics. Why should students have to come to class to watch their professor do the same?

The flipped classroom model encourages teachers to make their lectures available for students to watch at home so that class time can be spent collaborating, getting assistance, or giving assistance. Derrick McNeil’s physics lectures exemplify this approach and to be sure, he explicitly uses these videos for this purpose. Given the extensive discussion of the flipped classroom in discussions of educational technology I had anticipated finding many videos like McNeil’s. Instead, his video was one of very
few videos that seemed to map well onto the model of the flipped classroom.
TeacherTube features McNeil’s videos as well. I interpret this as TeacherTube’s attempt
to make McNeil’s work an exemplar or inspiration to other teachers who might do similar
work. There are a handful of other videos that are somewhat similar to McNeil’s.
Conversational but strictly focused on more advanced content they don’t have much in
the way of post-production, they don’t joke around, they don’t use music or branding.
But these types of videos are the minority and they don’t appear to be what teachers are
looking for when they go to TeacherTube. And to be sure, McNeil no longer uses
TeacherTube as home base. For him, YouTube has been far more advantageous, and he
has not shared McCauley’s concerns regarding the other content students encounter on
YouTube. This is to say that TeacherTube certainly has the potential to be a flipped-
classroom platform, but that is not its current function for science teachers.

McCauley’s videos, with their silliness and McCauley’s naturally gregarious and
humorous persona, are viewed and accessed by viewers of TeacherTube. But McCauley’s
purpose for the videos has more to do with accessibility for a mobile and often absent
student population. Much of McCauley’s teaching is driven by laboratory experiences,
and these videos were his attempt and keeping students up to speed when their frequent
absences interfered with performing labs. He is not adopting the sort of self-paced
approach endorsed by McNeil and other flipped classroom advocates. McCauley’s videos
serve a very specific, local purpose while finding a national audience.

Video is a one-way medium and by its nature, it suggests didacticism.
Nonetheless, an array of creativity and variety is apparent in the videos. Cartoons, songs,
“commercials,” music videos, co-productions of talking butterflies and painstaking, time-consuming post production editing can be seen throughout the corpus. These videos are far more than talking heads and even when the heads are talking, they address students directly, referencing local issues and classroom concerns. In this respect, the teacher-content-producer adds value beyond something that students might find on The Khan Academy. In addition, McNeil, McCauley, and Valentine all spoke of the home-school connection that occurs due to their videos. Parents get an understanding of what their children are learning and see their teachers “in action”. The extent to which parents utilize these resources and the impacts that makes on student learning would make for an interesting follow-up study. Likewise, the content analysis reveals that for teachers, TeacherTube is also a platform for sharing student work. Students appear to have produced 18.5% of the videos in the corpus and they comprise 30% of the most viewed sample. Student video production is another area that warrants further investigation.

The teachers in this corpus are creative and resourceful, but the numbers from our content analysis point to the fact that the science knowledge conveyed is rather shallow. The problem of a curriculum that is a “mile wide and an inch deep” follows science education into social media (Carlowicz, 1996).

**Standardized Tests and “Fun” as Driving Forces**

The final research question I want to return to has to do with the types of explanatory models we see on TeacherTube. The short answer is “very few”. The longer answer takes me to the ultimate conclusions of the study. Let me start with this: What can we infer about the reasons teachers are creating these videos from the video content?
Several features of these videos suggest two primary underlying objectives, objectives which fit well with some of the reasoning that several of the video creators offered in interviews. The first is administrative. In the case of Valentine, he created Dr. Loopy in direct response to a request from an administrator to prepare students for the Texas Assessments of Skills and Knowledge, which are also explicitly referenced in the names of many of his videos. Other teachers mention standardized tests in their videos as well. We heard state standardized tests invoked as a rationale for videos in Mr. Lee’s Rock Cycle Rap as well as national tests in the case of McNeil’s Advanced Placement and International Baccalaureate exams. Content analysis results demonstrate that the type of content most readily assessed on multiple-choice, standardized tests is more widely represented in the corpus. Only 2.8% of the videos are designed to model inquiry, 2.4% videos ask open-ended questions while 26% of the videos define vocabulary. To look at it another way, explanations that are at the covering law level are a type of definition (a barometer goes down as air pressure goes up, for instance) and only 22.8% of videos get beyond this definition-level of explanations. The nature of science is a primary topic in only 1.2% of videos, current science topics are the purpose of 1.6% of videos and science methods, that is to say, actually doing science, is a primary topic of only 9.4% of the videos.

A second evident reason for decisions in the design and is an idea of what teachers think students will find fun and engaging. This too is apparent in what the teachers themselves said during correspondence as well as via analysis of the videos. Teachers were trying to reach out to students, to assist students in accessing content on
demand, to be accessible to students, to get students attention, to reach students using the
type of media they are used to, and to entertain and amuse the students. The attempt to
entertain students uses a variety of approaches: music, hip-hop, cartoons, jokes, and silly
costumes are all employed. This is observation is more difficult to ascertain via the
content analysis, though it stands out in the case of content delivered primarily via music.
The corpus sees only 13.4% of videos of this type, but among the most viewed and most
favorite, music videos comprise a fifth of the sample. This indicates that viewers of
TeacherTube, as well as TeacherTube creators, value musical delivery.

In most of these cases, fun acts as a kind of wrapper around the content of the video. A
wacky scientist delivers straightforward lesson content, a teacher makes use of a
contemporary hip-hop song to deliver a set of facts (which he apologizes for) which
student’s will need to be able to summon to perform on a test.

One underlying goal that is almost completely absent is that of communicating the
process or nature of science. By this I mean that there is no explicit or implicit attempt to
represent the Discourses of science. The videos do not spend time talking about evidence
and argumentation. Science topics are represented as narratives with resolutions rather
than logical arguments with conclusions. There is no theory development, no discussion
of discrepant data. Authentic inquiry, as established in frameworks such as Chinn and
Malhotra (2002) or Windschitl (2008) is absent. Likewise absent are the more
sophisticated models of scientific explanation or argumentation found in contemporary
science education scholarship (Braaten & Windschitl, 2011; Ryu & Sandoval 2012;
Immersion of students in the nature of science and scientific practices has long been an important priority among scientific organizations and science education researchers (AAAS, 1994; National Research Council, 1993; Achieve, Inc. 2013) but this priority is not evident in the most successful videos on TeacherTube. Little contemporary scholarship in science education was relevant in contextualizing what I observed in the corpus. This is not to say that the videos are not bereft of pedagogy. Strategies from the conceptual change literature was apparent, as teachers such as Kizer, McCauley, and McNeil made rhetorical appeals to their audience about whether concepts were intelligible (do the words even make sense?), plausible (does the explanation seem reasonable?) and fruitful (does the explanatory model prove to be useful?) (Posner, Strike, Hewson, Gertzog, 1982). With that said, all of these strategies were used to scaffold students into an understanding of what science says about the world, not how we know what we know about the world.

As for the funny costumes, jokes, rap songs, cartoons, and all the other trappings that serve to make the videos (and implicitly, learning about science), more fun, these serve an important pedagogical function as well. These are techniques teachers invoke to interrupt student expectations. By interrupting student expectations, teachers get the students’ attention. Lemke (1990) addresses the tension between communicating science and being a good communicator:

The norms of scientific language veto most of the techniques that all good communicators know are necessary for engage in the interest of an audience…Because of
this, all good science teachers find it necessary to break the rules and violate these stylistic norms, humanizing science as they communicate it. (p. 134).

In considering the need teachers have to be good communicators, we can better understand some of potential rationale of various videos. Consider Mr. Lee, who I was rather critical of during the analysis. Lemke reminds us that science is not limited to one culture or one dialect of English, but science teaching is. Those who succeed in science tend to be like those who have defined the appropriate way to talk science “male rather than female, white rather than black, middle and upper-middle class…standard dialect speakers” (p. 138). Lee attempts to break this and “raps science” so that it seems less unfamiliar or unlike what “they have been taught to find interesting and valuable” (Lemke, 1990, p. 139).

Pedagogical practices outside of science education play a role in TeacherTube videos as well. Narrative is a foundational model in educational psychology (Bruner 1990, 1991). Narrative and dialog, were, after all, good enough for Galileo to communicate his argument and they were effective enough to get him into monumental trouble with the church. An epigraph from the Symposium on Narrative Learning reads, “The universe is made up of stories, not atoms” (Mott, et al., 1999). Such tensions put science teachers in a troubling position, and science education scholarship has little to say on the subject. Other techniques from literacy education scholarship are evident in the TeacherTube corpus such as rhyming (particularly in the musical videos) (Høien et al., 1995) and repetition (Bromage & Mayer, 1986). In short, the pedagogical techniques evident in this corpus of the most successful videos from science teachers on
TeacherTube focus on getting students to better remember the content they will be assessed on.

**Call to Study Science Teacher Vernacular**

The pedagogy of science education on TeacherTube is heavily influenced by standards and teachers’ efforts to make the content in those standards relatable and memorable to their students. In these attempts to relate to students, teachers borrow from pedagogies outside of science education or look to popular culture to better help them understand student engagement. The scholarship on science education however, does little to bridge this understanding. Why is Bill Nye such an enduring and inspiration figure for science educators? Is there anything science educators can learn from television shows like MythBusters to engage students in scientific practices? Is there room for understanding student engagement with popular culture, and what that means for science educators? Scholars such as Henry Jenkins and James Paul Gee have begun exploring these connections for education in general, but there is little work in this area when it comes to science education in particular. The depiction of science and scientific practices in popular culture shape the perceptions of the non-scientific community in a way that science education scholars cannot ignore. This is true for students, but it is true for teachers as well. Bill Nye, *Mr. Wizard*, and *Mythbusters* comprise the conceptual landscape of science teachers and, and least in this study, shape their approaches to communicating science. These are the cited as the inspiration for teachers’ work on TeacherTube, not scholarly or practitioner journals. Science education scholars should
work to better understand how some of these popular culture approaches to science can more effectively communicate science using Discourses inherent to science.

Scholarship in media and communication offers opportunities to contextualize these findings in a way that current science education scholarship cannot. Howard (2008) offers the idea of the “vernacular web” as a rejoinder to Jenkins’ participatory cultures. Howard identifies the one possible understanding of the vernacular web as those websites or web artifacts that offer “local agents” an opportunity to express themselves not necessarily in opposition to institutions, but as a hybridized local/ institutionalized interest. In this respect, the content producers on TeacherTube are offering localized answers to things like The Khan Academy or any variety of test preparation programs. These content producers also serve as “local agents” in hybridizing the institution of science education research. They demonstrate how localized issues and interests push up against the issues and interests that dominate science education scholarship.

During my study I kept writing the note to myself, “Fun is important, but why not wonder?” Trying to make science fun is a noble goal, but in my own experience wonder at the inherent mysteries of the world fits in well with the natural curiosity of children. TeacherTube is not about asking questions, and Chinn and Malhotra’s (2002) observations about the dearth of authentic inquiry in more traditional curricula is evident in TeacherTube as well. This approach is not without precedent in the popular media. There are certainly personalities in science who defined their role as popularizers by appealing to wonder and the curiosity prompted by the mysterious nature of the universe. In discussing my puzzlement with this issue, a colleague summarized the issue well: “I
wonder why we see so much Bill Nye rather than Carl Sagan.” (Owens, T. personal communication, April 12, 2013). This intersection of science in popular culture, “fun”, wonder, and teachers’ pedagogies is an area warrants further investigation. It is worth noting that even Bill Nye has changed his approach and focus. The 2006 reboot of his Bill Nye the Science Guy show, rebranded as Eyes of Nye, focused explicitly on shifting from covering laws and scientific facts to track the process of scientific knowledge development. Given that this wonder/inquiry/nature of science approach has its own popular science media modes for communication that are themselves absent it seems all the more likely that the pressures for covering content on tests are the most pressing forces that are shaping the challenge teachers are rising to in the creation of these videos. Maybe what we are seeing in these videos is less an attempt from teachers to make science fun, but rather to make preparing for tests about science more “fun” and engaging. Science education scholarship has little to say about these issues. In this respect it should not be much of a surprise that the “old” Bill Nye and possibly even Dr. Loopy are more relevant to the work done by the average teacher than research coming from science education scholars.
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BIOGRAPHY

Margaret (Marjee) Chmiel graduated from Maine South High School in Park Ridge, IL in 1994. She received her Bachelor of Science from Marquette University in 1999 and her Masters of Arts in Educational Policy and Leadership from Marquette in 2003. She has worked as a high school science teacher and school technology specialist and has taught science methods at the graduate and undergraduate levels. She has also worked at the intersection of digital media and education for a number of organizations including Public Broadcasting Services, National Geographic, and the Smithsonian Science Education Center.