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Media, Culture, and Curriculum
Purpose: Devoted to critical inquiry and pedagogy on the use of media within cultural settings in schools and other institutions.
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Evaluating User-Generated Educational Multimedia in Web2.0 Environments:
The Case of TeacherTube

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Abstract

Multimedia instructional materials have taken on added significance in educational systems worldwide. Simultaneously, Internet technologies and advancements in video capture and editing have democratized the production process, thereby increasing the number of content makers and accelerating the pace by which these materials are created and distributed. However, there is a lack of research to address the issue of evaluating the effectiveness of these user-generated multimedia instructional materials. In this study, the researchers analyze a set of Science, Technology, Engineering, and Mathematics (S.T.E.M.) multimedia content in TeacherTube—a video sharing website for educators—for the purposes of developing a rubric for assessing user-generated educational multimedia content. Specifically, we examine various aspects of S.T.E.M. multimedia (e.g., runtime, content focus, pedagogy) in order to highlight common themes among instructional materials deemed "effective" by members of the TeacherTube community.

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Purpose

Scholars such as Marchionini (2003) and Shephard (2003) have written extensively about the potential benefits of multimedia instructional materials to support learning and teaching. According to these researchers, multimedia can be an effective way to engage learners around a particular topic (e.g., Hurricane Katrina). For instance, Marx and Frost (1998) argue that video can serve an important motivational function in the classroom by providing context around historical events. Simultaneously, researchers have found that some multimedia do not consistently enhance individual learning experiences (see, for e.g., Bartscha & Cobern, 2003). Some research even shows that multimedia actually decreases learning performance (see, for e.g., Mayer et al., 2001). The relative ease by which individuals can produce multimedia content—coupled with Web2.0 network environments that accelerate multimedia distribution (Mitchell, 2001; Essex & Hallett, 2002)—only further escalates the need to develop systems for evaluating the value of user-generated multimedia instructional materials.

In this study, we analyze a set of user-created multimedia content in the areas of Science, Technology, Engineering, and Math (S.T.E.M.) in order to look for similarities and divergences among "effective" instructional materials within and across the four disciplines. Specifically, we analyze S.T.E.M. multimedia that has been uploaded into "TeacherTube: Teaching the World" (http://www.teachertube.com/). "TeacherTube" is an online video sharing system directed toward educators and students. According to their website, their goal is:

> *... to provide an online community for sharing instructional videos. [They] seek to fill a need for a more educationally focused, safe venue for teachers, schools, and home learners. It is a site to provide anytime, anywhere professional development with teachers teaching teachers. As well, it is a site where teachers can post videos designed for students to view in order to learn a concept or skill.*

TeacherTube presents an interesting research opportunity in the context of this study because the system allows any individual to upload any content considered to be instructional. As a result, many of the materials are generated and posted by teachers and students, and not professional instructional designers. Additionally, like other Web2.0 applications (e.g., Wikipedia, YouTube, Digg) TeacherTube relies on the "wisdom of crowds" (Surowiecki, 2004) to determine "good" and "bad" content. Based on this information, we analyze "powerful" S.T.E.M. multimedia content—as defined by members of the TeacherTube community—to identify seemingly effective characteristics of educative multimedia (e.g., runtime, content focus, pedagogy). We then use these elements to develop a rubric(s) for assessing the value of user-generated multimedia materials in the S.T.E.M. areas.

Theoretical Perspective(s)

As computing and Internet technologies have become more ubiquitous in our society (Weiser, 1991), user-generated multimedia has taken on added significance in educational systems worldwide. Concurrently, many educators have mixed feelings about the relative value of these multimedia resources in online and face-to-face classrooms. However, contemporary students, particularly Net Generation learners, encounter these resources almost daily and look to them to enhance their educational experiences. Consequently, it is important to define and/or identify characteristics of effective multimedia content to guide development and/or utilization of these resources.

The two primary perspectives that inform our analyses are media richness theory (MRT) (Trevino, Lengel, & Daft, 1987) and multimedia learning theory (Mayer, 2001). According to MRT, "communication efficiency between people is affected by the fitness of the media and the characteristics of the communication task" (Sun & Cheng, 2007). Forms of communication (e.g., videos, emails) that are able to effectively facilitate understanding of a topic are referred to as media rich. Conversely, communication formats that fail to clarify ambiguities in a timely manner are considered to be low in media richness. The emphasis in MRT research is choosing or developing appropriate media formats that facilitate the flow of information for the purposes of enhancing understanding of a topic.

Multimedia learning theory (MLT), which "builds upon cognitive learning theory by assuming active construction of knowledge modified by prior knowledge, implies a cognitive system with limited capacity" (Grimley, 2007, p. 467). Given these cognitive limitations, Mayer (2001) suggests five stages for multimedia development: "(a) selecting relevant words for processing in verbal working memory, (b) selecting relevant images for processing in visual working memory, (c) organization selected words into a verbal mental model, (d) organizing selected images into a visual mental model, and (e) integrating verbal and visual representations as well as prior knowledge" (p. 54). The implication is that there is a set of best practices for presenting information in multimedia formats. Consequently, the MLT literature focuses on the evaluation of multimedia content through the lens of information processing.

Methods and Modes of Inquiry

Data mining from the TeacherTube website was the primary mode of inquiry in this study. This technique is a "process for examining databases to discover and display previously unknown interrelationships, clusters, and data patters with the goal of supporting improved decision-making (Benoit, 2002)" (Dringus & Ellis, 2005, p. 143). In the context of this study, data mining enabled the researchers to first classify all the videos in TeacherTube according to content area (i.e., Science, Technology, Engineering, Mathematics). In some instances an instructional piece occupied more than one area.

Then, each of the videos within a particular content area were coded according to the following attributes:

- Run Time
- Views
- Channels
- Average Community Rating
- Comments
- Pedagogy (e.g., lecture, demonstration)
- Content Focus (e.g., Pythagorean Theorem, the Solar System)

This data was available for every multimedia piece.

Next, the videos within each content area were sorted by the following metrics:

- Most Viewed
- Most Discussed
- Top Favorites
- Top Rated

These metrics allowed the researchers to determine which multimedia pieces were "useful" based on website activity and community feedback.

Afterwards, the researchers conducted a content analysis of the "Most Viewed" items in each S.T.E.M. area, differentiated by most views, most discussed, top favorites, and top rated. Since new videos were constantly being added to the site, it was not possible to analyze every single S.T.E.M. video. This multimedia was then coded and analyzed to clarify the content focus (e.g., fractions, polynomials) and pedagogy (e.g., lecture, simulation) for each item. This information was then used to identify common and divergent characteristics of effective multimedia, as defined by members of the TeacherTube community.

Data Sources

All data for this study come from the TeacherTube website (http://www.teachertube.com). This dataset is composed of all multimedia content tagged and/or associated with the terms: a) Science, 2) Technology, 3) Engineering, and 4) Math.

Preliminary Results

In this section, we present the initial findings of our investigation. This preliminary review of data served to test the viability of this study and pilot the methods described in the Methods and Modes of Inquiry section.

From March 6, 2007 (the date TeacherTube was launched) to March 24, 2008, there was a total of 4,467 S.T.E.M. multimedia content in the system.

Science	Technology	Engineering	Math
1,943	720	60	1,744

Fig. 1

Of this total number, 2,285 videos (52 percent) were analyzed. The number of videos analyzed in each category is shown in Figure 2.

Science	Technology	Engineering	Math
826	416	46	997

Fig. 2

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Math
Within the Math multimedia content there was great range in the various characteristics:

Multimedia Attribute	Numeric Range
Runtime	8 seconds to 59 minutes
Views	0 to 103,373
Comments	0 to 34

Fig. 3

Of the 997 Math multimedia analyzed, 759 (76 percent) were "Not Yet Rated." The remaining content was rated on a scale of one to five Apples, with five being the highest rating an item could receive.

# of Math Multimedia Content Receiving **one (1) Apple**	# of Math Multimedia Content Receiving **two (2) Apples**	# of Math Multimedia Content Receiving **three (3) Apples**	# of Math Multimedia Content Receiving **four (4) Apples**	# of Math Multimedia Content Receiving **five (5) Apples**
8	17	21	64	128

Fig. 4

Our preliminary analysis of the Math multimedia content yielded the following results:

1. The longest runtime for Math multimedia that received five Apples was 57.18 minutes. The average runtime for these videos was 5.6 minutes. The median runtime was 3 minutes. The total range was 32 seconds to 57.18 minutes.

2. Of the 128 Math multimedia receiving five Apples, only six were in the top 10 percent of Most Viewed items.[1] The content foci of these multimedia materials were multiplication, division, problem solving, word problems, arithmetic, algebra, calculus, SAT, graphing, probability, and measurement. The average runtime of these items was 10 minutes. The median runtime was 2.6 minutes.

3. The pedagogy in the multimedia items that were highest rated and in the top 10% of Most Viewed can best be described as enhanced individual lecture. Each of these items featured an individual utilizing some supplementary

[1] Twelve videos receiving 5 Apples were in the top 25 percent of Most Viewed items.

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visual (PowerPoint) or audio (music) content to explain a topic (e.g., reducing fractions) or demonstrate a task (e.g., creating a bar graph).

Science

Within the Science multimedia content there was great range in the various characteristics:

Multimedia Attribute	**Numeric Range**
Runtime	3 seconds to 57 minutes and 11 seconds
Views	156 to 13,474
Comments	0 to 16

Fig. 5

Of the 826 Science multimedia analyzed, 561 (68 percent) were “Not Yet Rated.” The remaining content was rated on a scale of one to five Apples, with five being the highest rating an item could receive.

# of Science Multimedia Content Receiving **one (1) Apple**	# of Science Multimedia Content Receiving **two (2) Apples**	# of Science Multimedia Content Receiving **three (3) Apples**	# of Science Multimedia Content Receiving **four (4) Apples**	# of Science Multimedia Content Receiving **five (5) Apples**
13	12	28	46	166

Fig. 6

Our preliminary analysis of the Science multimedia content yielded the following results:

1. The longest runtime for Science multimedia that received five Apples was 57 minutes and 11 seconds. The average runtime for these videos was 5.45 minutes. The median runtime was 4.2 minutes. The total range was 8 seconds to 57 minutes and 11 seconds.

2. Of the 166 Science multimedia receiving five Apples, 40 were in the top 10 percent of Most Viewed items. The average runtime of these items 5 minutes. The median runtime was 4.75 minutes.

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Technology
Within the Technology multimedia content there was great range in the various characteristics:

Multimedia Attribute	Numeric Range
Runtime	5 seconds to 59 minutes
Views	6 to 111.459
Comments	0 to 23

Fig. 7

Of the 416 Technology multimedia analyzed, 316 (76 percent) were "Not Yet Rated." The remaining content was rated on a scale of one to five Apples, with five being the highest rating an item could receive.

# of Technology Multimedia Content Receiving **one (1) Apple**	# of Technology Multimedia Content Receiving **two (2) Apples**	# of Technology Multimedia Content Receiving **three (3) Apples**	# of Technology Multimedia Content Receiving **four (4) Apples**	# of Technology Multimedia Content Receiving **five (5) Apples**
2	2	11	20	65

Fig. 8

Our preliminary analysis of the Technology multimedia content yielded the following results:

1. The longest runtime for Technology multimedia that received five Apples was 11.8 minutes. The average runtime for these videos was 3.5 minutes. The median runtime was 2.6 minutes. The total range was 3 seconds to 11.8 minutes.

2. Of the 65 Technology multimedia receiving five Apples, 13 were in the top 10 percent of Most Viewed items. The content foci of these multimedia materials were blogs, book project, interwrite, digital natives, digital immigrants, technology pedagogy, Google docs, diabetes, and Power Points. The average runtime of these items was 4.1 minutes. The median runtime was 3.5 minutes.

3. Ten of the 13 Technology videos that were highest rated and in the top 10% of Most Viewed can best be described as short documentaries or student performance. These media focused on describing a class specific project or a particular educational issue (e.g., young girls and technology). Three of the 13 media were expository (e.g., What is Google Docs).

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Engineering
Within the Engineering multimedia content there was some range in the video characteristics:

Multimedia Attribute	Numeric Range
Runtime	11 seconds to 31 minutes and 28 seconds
Views	182 to 3,548
Comments	0 -1

Fig. 9

Of the 46 total Engineering videos, 44 (96 percent) were "Not Yet Rated." The two videos that were rated received the highest possible rating: 5 apples. The rating for each of these videos was based on the vote of one individual.

Our preliminary analysis of the Engineering multimedia content yielded the following results:

1. The longest runtime for Engineering multimedia that received five Apples was 9 minutes 30 seconds. The average runtime for these videos was 9 minutes 24 seconds. The total range was 9.3 minutes to 9.5 minutes.

2. Neither of the 2 Engineering multimedia receiving five Apples were in the top 10 percent of Most Viewed items. However, they were in the top 20 percent of the most viewed items for the Engineering content. The content foci of these two videos were "students in engineering competition."

Additional analyses of other S.T.E.M. content areas— disaggregated by content focus and pedagogy—over the one-year time period will help further clarify those elements of multimedia content that individuals find useful. These results will function as the foundation of a framework for assessing the value of user-generated multimedia instructional material.

Educational Significance

Multimedia materials play an important role in educational systems at all levels of instruction. Simultaneously, Internet technologies and advancements in video capture and editing have vastly increased the number of user-generated multimedia content and accelerated the pace by which these materials are distributed. This study contributes to the multimedia instructional content literature by underscoring similar and divergent characteristics of effective user-generated multimedia content as deemed by members of a Web2.0 user community. The findings of this study can help teachers to think about the educative potential of user-generated multimedia content and make decisions about their integration in the curriculum. The resulting framework can also serve as a guide for development of educational multimedia materials for content producers.

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