

# Incorporating Multimedia in Social Studies Instruction: Does it Improve Students' Performance, Interest, and Instructional Effectiveness Attitude?

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**Abstract** This study investigates whether using multimedia-based instructional material in social studies class may enhance students' learning about world issues, elicit their interest in social studies, and generate positive attitudes toward instructional effectiveness, greater than text-based material. The investigation was set in the GlobalEd Project, a web-based international negotiations simulation embedded in the middle school social studies curriculum. The study employed an experimental design with a multimedia group (MG, experimental condition) and a text group (TG, comparison condition). Results provided no direct evidence that multimedia is more effective than text, with regards to our outcome measures. However, although not statistically significantly, students in MG showed larger gains in knowledge and interest as a result of the intervention, as well as more positive instructional effectiveness attitudes. In addition, students in MG used the instructional material more extensively than students in TG.

Students in K-12 often have negative attitudes towards their social studies classes feeling these classes are boring and irrelevant to their lives (Pahl, 1994). They tend to perceive the subject as less interesting and less important than other school subjects (Wolters & Pintrich, 1998). This study sought to investigate whether multimedia-based instructional material may enhance student learning about world issues such as global environment, elicit their interest in social studies, and generate positive attitudes toward instructional effectiveness, greater than text-based material. The investigation was set within the GlobalEd Project, a web-based simulation of international negotiations embedded in the social studies curriculum at several schools across the country. Middle school students (N=359) participated forming a multimedia-group and a text-group. We investigated group differences based on participants' responses in pre and post tests.

## Theoretical Perspectives

The term multimedia has emerged and been used for quite a while, by researches in both industry and academia, to describe the presentation of information multiple forms. Yet, there is little consensus as to what, exactly, the concept includes. Mayer (2001) gave an inclusive definition defining multimedia as the presentation of material using both words (spoken or printed) and pictures (e.g., maps, graphics, animation, diagrams, videos).

There are a number of recent studies on multimedia applications in the areas of second language acquisition (Brett, 1996), math and science education (Najjar, 1996), and medical instruction (Greenhalgh, 2001). Researchers agree that multimedia extends the amount and type of information available to learners. Nevertheless, there is little consensus regarding the effectiveness of multimedia in learning. When multimedia-based learning is compared with traditional forms of instruction or with typical learning materials, the research results are often conflicting. Some

studies have found significant student achievement gains for multimedia over traditional instruction and some have found very little or no differences at all (Jonassen, 2003). Najjar (1996) reviewed empirical studies on multimedia from a wide variety of fields (including biology, chemistry, foreign languages, and electronic equipment operation) and reported that multimedia may help people to learn more information in less time than traditional classroom lectures. Liao (1999), reported the positive effects of multimedia instruction over non-multimedia instruction, based on a meta-analysis conducted on 46 studies from 1996 to 1998. In contrast, Clark (1983, 1994), based on old non-interactive technologies, argued that media are “delivery vehicles” for instruction and will never influence learning. He stated that it is the underlying structure of the subject content and the instructional design of the learning experience that results in effective learning, rather than the medium used to deliver the message. Opposed to Clark, Cobb (1997) argued that the efficiency of a medium can be judged by how much of the learner’s cognitive work it performs; therefore, he suggested, some media do have advantage over other media because they make things easier to learn.

In multimedia learning, Mayer (2001) described potential benefits of multimedia. Given that humans possess visual and auditory information in separate channels, he explained how multimedia takes advantage of both channels at once. He concluded that meaningful connections between text and pictures potentially allow for deeper understanding and better mental models than from either alone, and that “*students who learn from words and pictures perform better on transfer and retention tests than students who learn from words alone*” (Mayer, 2001, p.186). Yet, Mayer discussed that not all multimedia messages are equally effective. For instance, glitzy features of multimedia do not always promote learning efficiency. Based on multiple experiments, Mayer and his colleagues developed guidelines for developing useful multimedia products. They identified the following five principles for instructional multimedia design, which lead to more effective multimedia learning (Mayer, 2001, p.186): (1) Spatial Contiguity: students learn better when corresponding words and pictures are presented near rather than far from each other on the page or screen; (2) Temporal Contiguity: students learn better when corresponding words and pictures are presented simultaneously rather than successively; (3) Coherence: students learn better when extraneous words, pictures, and sounds are excluded rather than included; (4) Modality: students learn better from animation and narration than from animation and on-screen text; (5) Redundancy: student learn better from animation and narration than from animation, narration, and on-screen text. In a follow up study, Moreno and Mayer (2002) also found that student comprehended the material better when the words were presented auditorily and visually rather than auditorily only.

Recently, a number of researchers have sought to investigate how the features of the environment (classroom, media, computers, internet, and textbooks) can generate situational interest for learners, which may then lead to personal interest (Pintrich, & Schunk, 2002). In most studies, positive attitudes towards the learning activity are reported following multimedia-based instruction, and the use of multimedia materials is often regarded as motivating (Liao, 1999). Cradler and Cradler (1999) reported that student’s motivation for class assignments and interest in the content was increased when multimedia was incorporated into classroom instruction. Moreover, Janda (1992) examined the use of multimedia instruction in an introductory college-level political science course. While no significant learning differences were found, more positive attitudes were reported by participants in the multimedia group compared to the traditional lecture group. Within this framework, we would expect the multimedia-based instruction to reinforce students’ social studies interest, positive attitudes, and potentially their performances, greater than text-based instruction.

## **Method**

### **The GlobalEd Project**

The investigation was set within the GlobalEd Project at the University of Connecticut, an online problem-based learning environment simulating international negotiations for middle school students. The six-week simulation is embedded in the social studies curriculum at several schools across the country. Prior to the simulation, each class is assigned a country (e.g., France, China) to represent during the negotiation simulation. Within each class students are placed in groups to research one of five issues: conflict and cooperation, international economics, global environment, human rights, and world security. This grouping allows students to narrow their focus on one topic, during the preparatory phase; however students are still responsible for all five topics covered in class. Online instructional materials, designed to assist students and teachers on these issues, are made available to the students before and during the simulation. During the simulation students interact with participants from different countries who are focused on the same topic area, through weekly conferences and e-mail. The simulation lasts five weeks and the goal for each country is to negotiate a treaty, concerning all the five issues, with at least another country in

the simulation. Since 2001, multiple GlobalEd simulations have run with middle and high school students participated. Previous studies have examined among other issues: gender differences, academic and technology self efficacy, knowledge, attitudes and behaviors as they relate to international studies, leadership, digital divide, and social perspective taking (e.g., Brown et. al., 2006; Johnson et. al, 2003; Lima et. al., 2004).

### **Instructional materials**

Before the simulation begins, participants need to research themes including their assigned country's history, foreign policy regarding the issue, and relations with the other countries involved in the simulation. Students (and teachers) participated are provided with online instructional materials designed to assist their preparation. It is essential for students to study the materials to be able to effectively represent their country. For each issue the instructional materials include the scenario (statement of the problem and issues to be addressed), resources (summary of each issue and related topics), conference agendas (questions to help students guide their research), countries' profiles (e.g., population, political and economic system), and country's policy stance on each issue.

The present investigation focused on the online instructional materials for the Global Environment which specifically referred to "The Need for Clean Energy." Issues presented in the instructional materials, included: renewable vs. non renewable forms of energy, the global warming problem, energy supply and demand, and the political aspect of energy. These materials were designed in two different versions: the text-based and multimedia-based. The two versions included the same variety of information; the difference was in the way the information was presented. The text version included mostly text and a couple of pictures. The multimedia version made use of pictures, diagrams, charts, and animated graphics, along with text. For instance, regarding the global warming problem, in the text-based version we verbally described how some of the sun radiation is absorbed and re-emitted in the atmosphere, because of the increased amounts of greenhouse gasses in the atmosphere. In the multimedia version, we had an animated graphic showing sun's heat being radiated back into space under normal conditions, versus being absorbed and re-emitted in the atmosphere under not normal conditions. Narration was also provided whenever reading (as perceived by the designer) was long and dull. For instance the countries policy positions were presented both auditorily and visually in the multimedia version, versus only visually in the text version. We developed the material using low costs multimedia software (e.g., macromedia flash, fireworks, and dreamweaver), and we also used pictures and animated graphics from the web. We made efforts to address the five instructional design principles identified by Mayer and his colleagues, about multimedia products; however the produced website was not formally evaluated based on these principles.

Students (and teachers) had online access to the instructional materials for all the five topics, through the GlobalEd Project website ([www.globaled.uconn.edu](http://www.globaled.uconn.edu)), about three weeks prior to and during the negotiations simulation. For the purposes of the study, the two versions of the global environment materials were password protected. Countries associated with of the multimedia group shared the login information for the multimedia version of the global environment instructional materials, and vice versa. In order to have a better sense of how frequently the GlobalEd participants visited the online global environment materials, a counter code was inserted into the html pages for both multimedia and text-based websites.

### **Participants**

Students (N=359) in 15 classes (countries) from 10 middle schools in five states across the United States (CA, CT, NE, NH, and PA) participated in the GlobalEd project during the winter of 2005-2006, as part of their social studies curriculum. Students participated in the study because their teachers agreed to be involved. Five countries (181 students) were randomly assigned to the Multimedia -Group (MG) and received the multimedia version of online instructional materials for the global environment issue. The remaining 10 country teams (178 students) formed the Text -Group (TG) and received the text version of materials for the global environment issue.

During the analysis, four sections of the sample were created to investigate differences between groups, based on their exposure to the instructional material. Students assigned to the Global Environment (GE) issue area were examined separately, as one sample, given that they had studied the global environment instructional materials more extensively than students in other issue groups. Therefore, within this sample there were those who received the multimedia version of materials (GEMG; n=41) and those who received the text version (GETG; n=36). In a separate analysis the students from other issue groups were examined. Therefore, there were those who received the multimedia version of materials (NEMG; n=140) and those who received the text version (NETG; n=142). Because students in NEMG and NETG might have not studied the materials for the global environment, in this study we only examined those who reported doing so at least some times (frequency > =3 on a 5-point Likert scale).

## Instrumentation

We used online instruments to collect data. This study focused on the following four measures: (a) Student Information in pre format. (b) Social Studies Knowledge Instrument in pre/ post format, comprised of 27 multiple-choice questions (five or six questions on each topic). In this study, we only focused on the six questions related to the Global Environment issue; a *global environment knowledge score* was computed for each student by taking the mean on the six items. (c) Social Studies Interest Scale in pre/ post format, composed of six 5-point Likert scale items such as “Overall, how interesting do you find your social studies class?” and “How interesting do you find learning about other countries?” (d) Attitudes toward the Instructional Effectiveness Scale in post format, composed of seven 5-point Likert scale items such as “How effective were the online materials in presenting the information in an understandable way?” and “How effective were the online materials in informing you about the issue?”

## Results and Conclusions

Student demographic information was collected from 268 consented participants who completed the student information instrument. The sample represents students from grades five through eight; 135 males (50.4%) and 133 females (49.6%). The majority were White students (72.5%), citizens of US (96%). Over 96% of students indicated that they have access to a computer at home and 90% of them reported having Internet access. The majority of participants (64%) reported that they plan to finish at least some graduate school, and 63% indicated that they usually receive either A+'s or A's on their report card. About one third (33%) of students reported that they speak/read foreign languages (other than English). More than 40% of students indicated that they access the news from the Internet at least some times. Almost half of the students also reported that they read a daily newspaper (40%) and a news magazine (35%), at least some times. Moreover, the majority of the students reported that they watch the local (70.6%) and national (59.5%) television news, at least sometimes. Approximately 40% of the students reported that they spend on average 1-5 hours weekly using the Internet (either in school or at home), and another 36% reported that they spend on average 5-10 hours online.

Analysis of the data collected from the counter on the websites showed that the multimedia website had a total of 150 visits while the text website had 31. A closer examination of these visits showed that the multimedia website was extremely popular during the week before the simulation begun and during the first week of the simulation (100 visits), with the majority of these visits being during school time (9:00 AM – 2:00 PM). In general, the multimedia website had more visits than the text website every week.

We first investigated whether there were any significant differences in performance across time, between: (a) GEMG and GETG; and (b) NEMG and NETG. For part (a) a Repeated Measures Analysis of Variances (RMANOVA), with global environment knowledge score as the within subjects variable, and group as the between subjects variable, was conducted on 40 students (18 in MG, 22 in TG) who provided complete pre-post data set. The analysis provided no evidence (no interaction) that multimedia-based instruction is more effective than traditional text-based instruction, with regards to student knowledge gains ( $p > .005$ ). Students in the multimedia group ( $M_{pre} = 59.3$ ,  $M_{post} = 82.4$ ) experienced slightly larger knowledge gains than students in the text group ( $M_{pre} = 62.9$ ,  $M_{post} = 75.6$ ) from pre to post testing, although not statistically significant. The analysis showed a significant main effect for learning from pre to post ( $F[1,38] = 25.06$ ,  $p < .001$ ), partial  $\eta^2 = .4$ ). That is, students in both multimedia and text groups experienced, on average, significant knowledge gains on the global environment issue, over time. For part (b) a RM-ANOVA was conducted on 54 students (20 in MG, 34 in TG) who provided complete pre-post data set, and reported that they had used their online instructional material, at least some times. Again, the analysis revealed a significant main effect for testing ( $F[1,52] = 5.61$ ,  $p = .022$ , partial  $\eta^2 = .1$ ). Students in the multimedia group ( $M_{pre} = 58.3$ ,  $M_{post} = 69.2$ ) experienced slightly larger knowledge gains than students in the text group ( $M_{pre} = 53.4$ ,  $M_{post} = 60.8$ ) from pre to post testing, although not statistically significant.

Using all pre-post matched data sample ( $N = 198$ ), a Principal Axis Factoring (PAF) with Varimax rotation was performed on the six Likert-type items of social studies interest scale. As hypothesized, one 6-item subscale emerged (variance explained 51.4% for pre, 54% for post), with acceptable Cronbach alpha reliability ( $\alpha = .86$  for pre and  $.87$  for post). Another PAF was conducted on the seven Likert-type items designed to measure instructional effectiveness attitude. The subscale also emerged as hypothesized (variance explained 51.5%) with acceptable Cronbach alpha of  $.88$  (post only).

We went on to investigate whether there were any significant difference in social studies interest across time, between: (a) GEMG and GETG; and (b) NEMG and NETG? A RM-ANOVA was conducted with social

studies interest subscale score as the within subjects variable. The complete pre and post data-set, for part (a) included 17 students in MG and 25 students in TG. The analysis indicated statistically significant main effect for group ( $F[1,41]=6.22$ ,  $p=.017$ ,  $\text{partial } n^2=.1$ ), with students in GEMG having higher levels of interest in social studies than students in GMTG. Although approaching statistical significance ( $F[1,41]=3.9$ ,  $p=.055$ ) there was no testing main effect. The group by testing interaction was not significant either ( $p>0.05$ ). For part (b) another RM-ANOVA was conducted on 67 students (21 in MG, 46 in TG) who reported that they had used their online instructional material, at least some times. The analysis revealed a significant main effect for testing ( $F[1,65]=6.20$ ,  $p=.015$ ,  $\text{partial } n^2=.02$ ); that is, for the 42 students in this analysis, there was a statistically significant difference in their social studies interest scores from pre to post testing. The interaction term (group by testing) was not significant, although it approached statistical significance ( $F[1,65]=3.76$ ,  $p=.057$ ). Finally, concerned with mean differences on instructional effectiveness attitude between groups, a one-way ANOVA was conducted on 42 cases (17 in MG, 25 in TG). The analysis revealed no statistically significant difference in the mean attitude score, between the groups ( $F[1,40]=0.56$ ,  $p=.459$ ); although a careful consideration of the means showed that students in MG ( $M=3.5$ ) scored slightly higher than students in TG ( $M=3.3$ ) in the attitude scale.

These results provide evidence that multimedia-based instruction is more effective than traditional text-based instruction, with regards to student learning, interest, and attitude toward instructional effectiveness. Significant gains were observed in knowledge about global environment and interest in social studies, over time. Gains occurred for both group (MG and TG), but were more increased for students in the multimedia group. However, statistically the two groups did not significantly vary in gains in either of the variable examined. The results need to be interpreted and evaluated with some caution, considering the limitations of the study that might have inhibited these findings.

## Limitations and Future Directions

The relatively small sample of the study reduced the power of the research and made it difficult to determine statistically significant findings, as well as to produce generalizable results. Practical concerns, such as matching pre and post data, made this specification difficult to fulfill for part of the study. Potential follow-up studies should be conducted to replicate this study, using a larger sample.

Along with the power limitations of the study, there were also limitations in the measurement of the constructs. In other words, the contrasts of knowledge, interest, and attitudes were only partially measured. Regarding the knowledge test, it was composed of six questions on the global environment issue, which was the focus of the experiment. It may be that the small number of questions were unable to sufficiently assess students' knowledge on the issue. Moreover, the test only examined students' ability to recall verbal information from what they had read in the instructional materials (retention). The test lacked to assess students' comprehension of the issue, as well as their ability to apply the new knowledge learned (transfer). Future studies should attempt to assess students' comprehension of the issue, as well as their ability to apply the new knowledge learned, consistent with Mayer's (2001) investigations on the ability of multimedia to promote better understanding, retention, and transfer. A similar consideration is that students' social studies interest and instructional effectiveness attitudes have been measured quantitatively through entirely through self-report scales. Practical considerations constrained measurement of these constructs to this format; however, interesting results could arise if, for instance, we had observed students demonstrating their interest during the simulation, or students' attitudes as they interacted with their instructional materials, or if we had collected some qualitative data from student interviews. Finally, measuring interest more directly, referring to the specific content of the instructional material (global environment and the need for clean energy), may affect our results. Perhaps, students experienced situational interest regarding "the need for clean energy" issue; however this was not reflected in general social studies interest, as measured in the study.

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