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ABSTRACT

In the increasingly interesting topic of e-learning, there is a tendency among practitioners to use “richer” media (such as full-motion video) that cost significantly higher than other media choices (such as sound only) without any clear and justifiable estimates of incremental learning effectiveness. This paper presents the current results of a research in progress to link the choice of media (not choice of delivery technology) with learning effectiveness. Our research model hypothesizes that the link between choice of media for contents and learning effectiveness is moderated by the characteristics of the subject matter, learning styles of the learners and the learning objectives. The research, operationalized as a series of quasi-experiments based on the Solomon’s four group design method, is also described. The results from the initial quasi-experiment will be presented at the conference.

KEYWORDS: e-learning, multimedia, learning effectiveness, choice of media

INTRODUCTION

There is increasing interest in e-learning, defined as the use of new multimedia technologies and the World Wide Web, to improve the quality of learning by facilitating access to resources and services as well as remote exchanges and collaboration. Providing e-learning opportunities, whether for education or training, is a multi-faceted activity with multiple stakeholders. Aggarwal (2003) provides a valuable guide for e-course management from the three principal stakeholders’ perspectives, namely the student (or learner), the faculty (or instructor or subject matter expert), and the technical personnel. The universal but unwritten overall objective for any e-learning activity from the perspective of all these stakeholders, but especially from those who provide resources, is that the e-learning opportunity be as cost-effective as possible.

The topic of choice of media and its effect on learning has been studied for many years with contradicting results and opinions. There does not seem to be any supporting theory, only varied opinions. The interest in the topic has increased recently again with the proliferation of information technology (computers, Internet, etc.) as a delivery mechanism. The prevailing perception appears to be that “richer” the media used to deliver contents, the “more effective” the learning outcome will be. With increasing capabilities of communication and computing technologies, there is a tendency among practitioners to adopt richer media (such as full-motion video) that cost significantly more than other media choices (such as sound only) without any clear and justifiable estimates of incremental learning effectiveness. Our study aims to investigate the link between the choice of media for the contents of e-learning products and their learning effectiveness, and the factors (such as learner characteristics, subject characteristics, etc.) that moderate that link.

BACKGROUND

The uses of the terms medium or media in the literature primarily seem to refer to delivery technology, such as CD-ROM or the World Wide Web, but the contents could be presented on these technologies in any combination of text, audio, pictures, animations or full-motion video. Clark (1994) emphatically stated that media will never influence learning effectiveness, but agreed that media choice may influence cost or speed (efficiency) of learning. He seems to define media as a delivery mechanism. This definition is similar to that used in marketing, namely print, radio, television, etc. However, a commercial (an advertisement) to be shown on television, as the delivery mechanism, may be designed to show its contents in text only, text plus voice-over, or text plus pictures or full-motion video. Kozma (1994) defines the relevant capabilities or attributes of media as technology, symbol systems and processing capabilities. The definition, we have used, for choice of medium for contents is closer to Kozma’s (1994) symbol systems to represent information, and perhaps a part of instructional methodology in Clark’s (1994) approach.
More recent studies have reported anecdotes on effectiveness of choice of media for contents. Wisher and Curnow (1999) reported that showing video images of the instructor in a course on information operation to Army reservists did not have any effect on learning. Rose-Folts (2001) reported that, in a distance-learning environment, delivery method (namely two-way audio with one way video, CD-ROM, and a combination of the two) did statistically significantly influence the performance of a group of military and civilian participants. Passerini and Granger (2002), presenting the results of applying their evaluation methodology for choice of instructional media in project management teaching, reported that using multimedia contents (on CD-ROM) would be slightly more effective than face-to-face instruction, and either one would be much better than textbooks. Jones (2002) reported that there was no statistical significance to show subject video or online text to be more effective. Blank, et al (2003) reported that, in computer science and software engineering courses, students getting multimedia contents scored higher.

These anecdotal results suggest the need to look deeper to see why choice of media, within multimedia, has different influences on learning effectiveness. Daft and Lengel (1986) proposed a model as a rational explanation of media richness. Although the concept of “richness” of media has great appeal, the model incorporates parameters, such as language and interaction, which make the model difficult to apply for choosing appropriate media. Subsequent studies (Dennis and Kinney, 1998; Huerta et al., 2003) have also questioned the application of that model for choosing media.

Given the lack of consensus, our aim is to devise a framework that provides information on limits of effectiveness for different media choices. The actual effectiveness will, of course, depend of the quality of design and the availability of appropriate technology to support the choice of media.

**CONTEXT FOR A FRAMEWORK**

In a typical learning situation, information flows from an instructor (or a source) to a learner, from the learner back to the instructor (or source), and between learners. Appropriate choice of media for the contents of each of these information flows is likely to influence the effective transfer of (or creation of) knowledge and skills by the learners. There may be other factors, such the process of learning, which may also influence learning effectiveness. (Benbunan-Fich, et al 2002) It is also quite possible that choices of media for these different information flows may interact to influence learning effectiveness. For example, text-only communication (via e-mail) from a learner to the instructor may limit the effectiveness of using full-motion video for information flow from the instructor to the learner. However, the focus of our research, at present, is limited to the choice of media for one of those information flows, namely from the instructor to a learner, controlling for the other factors.

This research responds to the fact that managers are aware of the restrictions in learning assessment that limit their attempts to demonstrate e-learning’s contribution or value (Beamish et al., 2002). This research also contributes to theory by separating the effects of the medium from the message in the context of e-learning. The results from this research will be equally valuable for practitioners in making appropriate choices of media and thereby resulting in potentially huge saving of resources. The phenomenal economic and social assets that will be invested in e-learning (Roosendaal et al., 2003) make this study all the more important.

Our overall objective is to develop and validate a framework that will assist in choosing an appropriate medium for contents given the subject, learner population and learning objectives.

**RESEARCH FRAMEWORK**

Based on anecdotal evidence, it appears that the impact of choice of media on learning effectiveness depends on three factors, namely subject matter characteristics, learner characteristics and learning objectives. Figure 1 contains the schematic for our research model. The model shows that the hypothesized relationship between the choice of the medium and learning effectiveness is moderated by the three factors that we have identified above.

The choice of media would lie on a continuum from text only → text and graphics → text and voice → text and voice and graphics → text and animation and voice → text and voice and full motion video.

For the first moderating factor, we define subject matter as the substantive content that is often referred to as the domain of learning for the learner and domain of expertise of a human instructor. Subject matter can be categorized based on the field of instruction (physics, history, biology etc.) or based on depth and nature of coverage (which typically results in a discourse on
education versus training). We operationalize this dimension using the need for visualization. For example, intuitively it seems that a training program for CPR or for the Heimlich maneuver would benefit from full-motion video, whereas a training program on Microsoft Excel would not benefit from full-motion video.

![Research Model Diagram](image-url)

**Figure 1. Research Model**

Learner characteristics, the second factor, have to do with categorizing the recipient of the subject content. They can be defined based on behavioral, psychological, or preference-based dimensions. For this study, we have chosen to employ a pre-validated measurement scale inventory based on learning styles. According to the Learning Style Inventory (Kolb, 1985), a learner's preferred learning style could be based on observation, doing, thinking or experimentation. It could also be a combination of the above, with one dimension being dominant. We will focus on the dominant preferred style to categorize our learners. For example, those who learn more by observation, when learning about flow of water through irrigation canals, would be more interested in seeing videos of eddies being formed due to imperfections in the canals rather than simply working on equations in fluid dynamics.

Learning objective, the third factor, is essentially the answer to the questions, such as, "why do you want to learn xyz?" and "what do you plan to achieve?" The response is ideally an open-ended one that covers a rich mix of utilitarian as well as practical motives. However, since we needed to restrict the users' responses to meaningful categories, we decided to address the continuum between conceptual knowledge and working knowledge. Conceptual knowledge has more to do with abstractions and theory, while working knowledge is much more application-oriented with a focus on practical and hands-on activity.

Kirkpatrick (1994) has defined a four level model of evaluating the effectiveness of any learning activity, namely (1) reaction, (2) learning, (3) behavior and (4) results. We plan to measure effectiveness initially at level 1 (reaction) and subsequently at level 2 (learning).

**RESEARCH METHODOLOGY**

We have planned a sequence of quasi-experimental designs to operationalize the research model shown in Figure 1. In the first group of experiments, in the planned sequence, we will study one moderating factor at a time. In the second group of experiments, we will vary two factors, and we vary all three factors in the third group of experiments. Each experiment will be based on the Solomon Four Group Design shown in Figure 2.
Group 1 will be administered the stimulus (e-learning) and tested both pre and post. In other words, students in group 1 will undergo in-class lectures as well as e-learning. Group 2 will be pre- and post- tested but without any stimulus. In other words, members of group 2 will undergo in-class lectures but will not use the e-learning system. Group 3 will be administered the experimental stimulus without a pre-test and group 4 is subjected to the post-test only.

For our first step, we have identified two courses that we teach (“Introduction to Management Information Systems” and “Operations Management”) to administer the experiments. In these courses, e-learning (the intervention of interest used to deploy the choice of medium) will be operationalized using the Blackboard® learning system. In this step, subject matter and learning objectives are held constant. The initial cohorts of students will be exposed to text-only contents. This will be followed by the text contents annotated with voice. The third in the series of e-learning interventions will be full-motion video of the instructor explaining the concepts that will include computer screen images and what the instructor does on the whiteboard.

NEXT STEPS

We are commencing the first quasi-experiment, mentioned above, on the courses the authors are currently teaching to validate framework. We plan to present the results of that first step at AMCIS 2004.

REFERENCES