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Appropriate media choice for e-learning effectiveness: Role of learning domain and learning style

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ABSTRACT

As the number of online education and training programs increase, researchers and practitioners are interested in investigating ways to design and develop effective e-learning programs. One of the major design decisions that affects learning effectiveness is the choice of media to present the contents of such programs. The prevailing tendency seems to be to use "richer" medium, in the progression from text to graphics to audio to video, for designing and developing e-learning programs. It is not clear, however, if a "richer" medium provides proportionately higher learning effectiveness. To investigate this gap in our understanding, we developed an integrated research model and tested it empirically. Our results showed that the relationship between media choice in an e-learning program and the effectiveness of that program is moderated by the learning domain of the program and the learning styles of learners.

1. Introduction

Significantly improved capabilities of information technology (IT) in accommodating multimedia contents have encouraged applications of IT in numerous activities such as self-learning and also blended with the traditional instructor-led teaching. Increasing portions of education and training budgets have been, and will continue to be, allocated for e-learning. Establishment of Massive Open Online Courses (MOOC) by universities, such as edX and Coursera, and the popularity of e-learning products (such as those from Khan Academy) are examples of this trend. As a result, designing and developing cost-effective e-learning programs has been of great interest to researchers and practitioners.

There has been substantial progress in understanding the complex set of parameters that influence the effectiveness of e-learning programs in education and training. However, there are gaps in our understanding of the causes of variations in learning outcomes, and further investigation of subject matter characteristics, participant characteristics and technology characteristics seems warranted (Arbaugh, Desai, Rau, & Sridhar, 2010; Zhang & Nunamaker, 2003).

Design and development of e-learning programs requires many decisions, such as pedagogy and learning environment. Our study focuses on one specific decision, namely selection of an appropriate medium to present the contents of an e-learning program for increased learning effectiveness, and the role of subject matter and participant characteristics in making that selection. This decision has significant impact on the cost of design and development of an e-learning program which increases substantially when the choice of medium to present the contents is enhanced from text and graphics to sound to video. Nevertheless, the prevailing perception appears to be that choosing a higher medium to present the contents will result in more effective learning. So, the practical question we address is – does choosing a medium to present the contents of an e-learning program that costs more necessarily increase learning effectiveness?

The research model and empirical evidence presented in this paper explain how variations in effectiveness of e-learning programs are dependent on media choice, subject matter characteristics, and learner characteristics. Our findings can be summarized as media choices that cost more do not necessarily provide higher learning effectiveness for all combinations of subject matters and learners. We believe that

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our research model forms an effective framework for future research and will also be useful to practitioners in choosing an appropriate and cost-effective medium to present contents of an e-learning program.

The rest of the paper is organized as follows. The next section reviews the relevant literature and provides the theoretical foundations for our research model. The subsequent section describes our research model and provides the rationale for the hypotheses. The research methods we adopted for empirically testing the research model are described in the next section. The subsequent section covers the analysis of empirical data and presents the results. The final section provides a discussion of the research results and potential extensions of this research.

2. Literature review

The academic discourse on the use of IT for learning spans a wide spectrum from those who assert that media has no influence on learning effectiveness to those who believe that decisions made regarding media will have a major influence of learning effectiveness. Clark (1994) emphatically stated that media will never influence learning effectiveness, but agreed that media choice may influence the cost or speed (efficiency) of learning. Kozma (1994 and 2000), on the other hand, advocated that technology, symbol systems and processing capabilities ought to be studied for their influence on learning effectiveness. These differing views provide the motivation for a deeper look at the relationship between choice of media and learning effectiveness.

Early influential work by Daft and Lengel (1986), Daft, Lengel, and Trevino (1987) had proposed an appealing theory of media richness which defines richness of a medium as its ability to reduce uncertainty and equivocality of information in order to achieve acceptable level of performance. However, other studies since then have questioned the applicability of their theory, primarily because it dealt only with technology-task fitness and did not factor in the characteristics of the individual performing those tasks (Campbell, 2006; Carlson & Davis, 1998; Dennis & Kinney, 1998; El-Shinnawy & Markus, 1992, 1998; Trevino, Lengel, Bodensteiner, Gerloff, & Muir, 1990).

Cheng (2011) and Liu, Liao, and Pratt (2009) applied the Technology Acceptance Model to determine antecedents that influence acceptance of e-learning programs. Cheng (2011) reported that individual factors (such as computer self-efficacy, internet self-efficacy, cognitive absorption and learning goal orientation) and systems factors (such as functionality, interactivity, response and content quality) positively influence perceived usefulness and perceived ease of use. Liu et al. (2009) went deeper to study the influence of different media for contents of e-learning programs, namely text, audio and video, on a user's acceptance of e-learning and also the influence of user concentration on acceptance of e-learning. They found that richness of the content positively correlated to user concentration, but had mixed results when correlated with perceived usefulness. The mixed results suggest possible interaction between media choice and some other variables in influencing not only perceived usefulness but learning effectiveness of e-learning programs.

The need to investigate additional variables, other than media choice, is articulated well by Zhang and Nunamaker (2003) suggesting the need to examine the impact of learner characteristics and learning content on e-learning effectiveness in general. Arbaugh et al. (2010) suggested similar needs particularly for management education. The need to cast a wider net for explanatory variables is also supported by a number of other papers (see Table 1). Each of these studies addressed a complex network of factors that influence e-learning effectiveness in different contexts. Taken together, the findings from these studies suggest that there is a need to investigate the combined the role of IT, learners and learning context.

In order to combine the role of IT, learners and learning context, we found three theories of learning which provide the requisite theoretical background. Perception, insight and meaning are key contributors to learning in the Cognitivist Theory of Learning (Merriam & Caffarella, 1999). According to that theory, learning is a cognitive phenomenon where a learner interprets the data acquired through the senses and gives meaning to that data. The Socio-Cultural Learning Theory (Merriam & Caffarella, 1999) posits that people learn from observing others and then visualize self-generated consequences. For something to be learned, it must be modeled and symbols from such models must be amenable templates for the learner to self-generate the appropriate experience. The Constructivist Theory of Learning (Jonassen, Peck, & Wilson, 1999; Merriam & Caffarella, 1999) posits that learning is a process of helping learners construct their own meaning from experiences by providing them those experiences first hand and guiding the meaning making process. According to this theory, knowledge about the topic of learning has to be conveyed to the learner, but the actual learning will depend upon the learner's ability or preferences to construct that knowledge within him or her. These three learning theories point out that the outcome of a learning program depends on the match between the capability and preferences of who is learning (a learner), the use of symbols or models that are appropriate for what is being learned (domain of learning), and the media used to present that domain.

Table 1
Studies that focus on use of IT for learning.

Reference	Description
Leidner and Jarvenpaa (1995)	provide a theoretical foundation for using IT to improve learning processes, particularly for instructor-led blended e-learning, instead of simply automating existing processes that may be ineffective. They provide a framework for fit between technologies for different electronic classroom types with learning models.
Alavi and Leidner (2001)	call for greater depth and breadth of research in technology mediated learning. They suggest potential research avenues that require explicit consideration of relationships among technology capabilities, instructional strategy, psychological processes and contextual factors involved in learning.
Piccoli et al (2001)	proposed a research framework for investigating effectiveness of web-based virtual learning environments that combined technology, learning models, learners, instructors, and contents. They also presented a preliminary assessment of effectiveness of Web-based virtual learning environment for one course in basic IT skills training.
Arbaugh (2005a)	hypothesized that e-learning in subjects for which Ph.D.s are offered will have higher grades, higher student perceived learning and greater student satisfaction than subjects in which Ph.D.s are typically not offered. He concluded that the focus should be on course level rather than on the discipline of the course.
Arbaugh (2005b)	looked at student perceived learning and student satisfaction with e-learning and investigated the notion of media variety on e-learning effectiveness and concluded, among other things, that using a variety of media positively influences learning effectiveness.