

Introduction

Multimedia technology has advanced with the widespread availability of the Internet and production of digital media. This has provided the opportunities for new forms of educational and training material to be developed. Recent research has investigated the effect on knowledge retention and understanding through the use of three modes of presentation: animated graphics, sound and text. It is important to review the learning outcomes of multimedia training, so that future multimedia training material can be efficiently developed.

Dual Processing Theory

The dual processing theory of multimedia learning suggests that learners have two channels in working memory, an auditory channel and a visual channel.¹ The synchronised presentation of narration and text may enhance learning. Each channel in working memory, however, has a limited capacity, so educational material must be presented in a way that prevents cognitive overload.

When students see text on the screen and simultaneously hear the narration, they are able to integrate the two channels of working memory. This coordinated delivery of redundant information tends to enhance learning.

The addition of a third mode of presentation, such as graphics or animations, may lead to split attention, because the visual channel in working memory needs to process both the text and the diagrammatic material. The material needs to be presented in an efficient sequence to reduce the effects of split attention on learning.

Understanding Motivation

Educators need to find a balance between intrinsic factors of motivation and extrinsic factors. It would be difficult to find students that are continuously motivated to complete structured courses.

Students may identify with an external goal and complete part of their program of study for that purpose, such as the completion of a recognised tertiary qualification. The student needs to believe that the study will lead to a

desirable result and that they possess the competence to complete the tasks, otherwise the student may take a more negative attitude to motivation.

Motivation Theories

There are several theories of motivation, such as those that focus on the educational goals of students.² The achievement goal theory explores both the social and cognitive factors that influence a student's attempts to either perform well or engage in work avoidance.

A student that participates in academic activity in an attempt to perform better or to become more competent may be regarded as having a *mastery goal orientation*.

Performance goals are educational goals that are generally measured against external criteria. These include normative standards, such as grades and the ranking of performance relative to other students.

Students with *work avoidance orientation* may act as if they are incompetent so that they will have an excuse to disengage from the tasks. Similarly students may ask unnecessary questions in an attempt to delay participation in academic activity or seek assistance, which will reduce the requirements for their personal cognitive engagement.

Implications

The design of multimedia learning material needs to consider the contiguity of the three modes of presentation. The simultaneous presentation of auditory and matching text on the screen leads to enhanced learning. Similarly, the simultaneous presentation of graphics and narration has a positive effect on learning. Excessive text on the screen while animated graphics are displayed, however, may cause split attention, which has a negative effect on learning.

¹ R. Moreno and R.E. Mayer, *Verbal Redundancy in Multimedia Learning: When Reading Helps Listening*, Journal of Educational Psychology, 2002, Vol. 94, No. 1, 156-163

² M. Dowson and D.M. McInerney, *Psychological Parameters of Students' Social and Work Avoidance Goals: A Qualitative Investigation*, Journal of Educational Psychology, 2001, Vol. 93, No. 1, 35-42