

Investigating Realities and Misconceptions about Multimedia Learning

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Abstract: *This research paper aims to review literature on multimedia learning, analyses misconceptions developed around the use of multimedia in teaching and learning settings, and provides evidence-based understanding of multimedia learning. The study draws on the Cognitive Theory of Multimedia Learning (Mayer, 2003, 2009, 2021). The paper uses Mayer's work on multimedia learning and concludes with multimedia principles useful for EFL teachers in higher education. In the light of Mayer's work, the paper analyses misconceptions commonly found among EFL teachers and suggest recommendations to use multimedia learning effectively in colleges and universities. The paper examines the research evidence for the intuitive assumptions that support the integration of multimedia to provide valuable learning. This view is investigated and questioned in order to come up with recommendations about the use of multimedia in teaching and learning. Through reviewing different research studies, the paper reached the conclusion that the combination of any sort of multimedia does not necessarily secure inestimable learning environment. EFL teachers should use multimedia in their classes following certain principles in order to ensure the effectiveness of multimedia integration. The findings of this research are useful for EFL teachers to improve their teaching practices and improve the learning environment of their EFL classroom.*

Keywords: Multimedia learning, multimedia principles, realities, misconceptions

1. Introduction

Contemporary teaching and learning environment is going through a radical transformation. The change is stemming from increased digitalization of education and development of theories of learning sciences. Increased use of technology in education sector has changed the context and process of learning (Sun, 2017). Current learning context is becoming more and more learner-centred and enhanced by innovative and disruptive technology. On the other hand, the process of learning is shifting from instructivist design to constructivist design in which learners decide their learning process through actions and participation of learners in the learning network (Sun, 2017). The development in theories of learning sciences which can be seen in the form of emergence of new theories of learning such as connectivism, constructivism, and social constructivism is another driving force in education (Sawyer, 2014).

Theories of learning sciences along with exponential growth of technology have changed the scenarios of learning and teaching in a fundamental way. Specifically, theories of learning sciences suggest that when students are engaged in the process of learning, they acquire deep learning which further motivates students into higher order skills such as analysing, synthesizing, and creating new knowledge and equip students with 21ST century skills (Sawyer, 2014). Theories of learning sciences focuses on constructivist learning in which students participate and develop self-regulation and autonomy which is contrary to knowledge-transmission based classes developed around theories of instructivism such as behaviourism, cognitivism, and socio-

cognitivism. One of the greatest contributions of learning sciences is the cognitive theory of multimedia learning. This theory of learning suggests that every human has two learning channels: visual channel and verbal channel; each channel has limited capacity to acquire knowledge, active and effective learning happens when both verbal and visual learning channels are combined making correct process of their cognition. Using this theoretical base, Mayer (2003, 2009, 2021) conducted 201 research studies for 30 years consequently and on the basis of mass-evidence base collected from the research. He established that multimedia materials (a combination of image and texts) improve learning more than when learners receive single-media presentation. Mayer (2003, 2009, 2021) also established that multimedia materials increase the participation of learners in the process of knowledge construction and develop transferable and integrated learning. Viewing significant research base in support of multimedia materials, Mayer (2021) formulated 15 multimedia principles. He divided these principles into three categories based on instructional use of multimedia, if it (1) reduces extraneous processing, or (2) manages essential processing, or (3) fosters generative processing. This research papers makes a review of theoretical basis of multimedia learning, its principals and answers prevailed misunderstanding about multimedia learning among EFL teachers.

2. Objectives and Significance of the Study

The present study has two main objectives: The first is to review Mayer's (2003, 2009, 2021) conceptualization of multimedia learning along with reviewing studies on

multimedia, that is identifying the actual perception of multimedia and its role in learning. The second objective is to propose a set of recommendations to EFL educators to perceive the role of multimedia in learning and to integrate different forms of multimedia effectively to provide learners with autonomous, interactive, and personalised experiences.

3. Research Questions

The paper attempts to answer the following questions:

- 1) What is conceptualization of multimedia in Mayer's work?
- 2) What is theoretical basis of multimedia?
- 3) What are key principals of multimedia? and
- 4) How EFL teachers could benefit from this review towards better integration of multimedia in their EFL classrooms?

4. Literature Review

This section reviews Mayer's definition and perception of multimedia, its theoretical basis, and key principles. It also reviews studies conducted on the role of multimedia in language learning and the impact of integrating multimedia in EFL classrooms.

4.1 Definition of Multimedia

Multimedia learning is comparatively a new form of pedagogy originated from learning sciences that proves with wide research base that if words and pictures are combined together in a principled way, they will have higher impact on learning than if they are presented alone or not combined in the principled way. Though the term multimedia learning has been widely used by many people but here the research deals with the term multimedia learning as given by Mayer (2003, 2009, and 2021).

According to Mayer (2001), multimedia is defined as the multiple introduction of a material with text or picture. Mayer (2003) indicated that information can be presented to learners either in single-medium presentation (i. e. words or pictures alone) or multimedia (i. e. words and pictures together). Based on wide review of research collected from 201 studies in 30 years' research, Mayer (2021,) established what he called almost a fact that "multimedia learning offers a potentially powerful way for people to understand things that would be very difficult to grasp from words alone", but his claim is conditioned with certain multimedia principles which should be applied during instructions (p.414). This means that if EFL teachers use multimedia in their classes without following these principles, the effectiveness of multimedia and their benefits will be tapped. He also clarified that his theory of learning is specifically concerned

with proper application of principles, no matter they are presented in digital format or in printed format.

The common misunderstanding among EFL teachers is that multimedia materials is necessarily digital materials presented at electronic LMS (i. e. Learning Management Systems) or platforms such as Blackboard or YouTube. Mayer's (2021) concept of multimedia learning has nothing to do with digital platforms or non-digital platforms (i. e. printed format). It is purely related with using image and text in the principled way and being in electronic or printed presentation does not affect their effectiveness (Mayer, 2021). Clarifying this misconception, Mayer (2021) stated that when the 'multimedia' is used as a noun, it means it refers to a kind of technology used to present visual and verbal materials. If the word 'multimedia' is used as an adjective for example multimedia instruction, it refers to pedagogical value obtained by combining words and pictures together. In this research paper, the term multimedia is used as theory of learning which helps in getting effective learning by combining words and pictures together.

Many researchers have contributed to the definition of multimedia in education. As defined by Asthana (2008), multimedia incorporates five essential types of media into the learning environment. These include text, sound, video, animation, and graphics. According to this definition, multimedia is perceived as a digital tool that provides learners with a powerful personalized learning experience. For Maddux et al. (2001), multimedia is represented as a computer software that comprises "text along with at least one of the following: audio or sophisticated sound, music, video, photographs, 3-D graphics, animation, or high-resolution graphics" (p.253). Similarly, Dinç (2000) introduces multimedia as the synthesis of digital platforms including text, graph, audio, visual aids, video, and animation. Schwartz and Beichner, however, indicated that multimedia is "the use of multiple forms of media in a presentation" (1999, p.8). In summary, it could be stated that multimedia is perceived by many researchers as computer platforms where text, visual and audial media are presented along with the employment of animation media and graphs.

This review of the definition of multimedia is contrasted to the view presented by Mayer (2003, 2009, 2021) about multimedia learning as not inescapably an integration of digital tools in the process of learning.

4.2 Cognitive Theory of Multimedia Learning

Multimedia learning is based on the cognitive theory of multimedia learning (2009). This theory is composed of three assumptions derived from dual channels, limited capacity, and active processing.

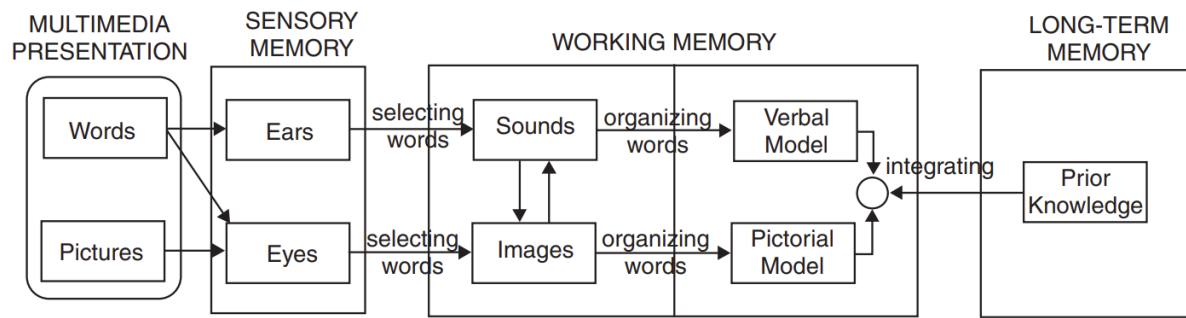


Figure 1: Cognitive Theory of Multimedia Learning, Mayer (2009)

According to Mayer (2009), when words and pictures are combined together, it is called multimedia presentation which comes from outside to the learners' cognitive processing shown in three boxes. First, multimedia presentation is received by eyes and ears into sensory memory where pictures and words are held as images into visual sensory memory for a short period of time. Similarly, spoken words and other kinds of sounds are held in an auditory sensory memory for a brief period of time. The arrow from words to ears shows it is going to be registered into spoken category while the arrow from words to eyes indicates words are going to be a part of visual category. Similarly, arrow from pictures to eyes shows it corresponds to visual category (Mayer, 2009).

Working memory is the place where the processing of information happens with active consciousness. When learner receives exposure to multimedia materials, they look at the information, select some piece of information and manipulate it depending on how multimedia materials is are organized. Working memory has two boxes in which left side boxes process raw materials into visual images of pictures and sound images of words while right side are the boxes for two modes of representation: pictorial and verbal. Long-term memory is the last stage in knowledge formation in which learners store large amount of information and retrieve necessary information to further process the information in working memory (Mayer, 2009).

Mayer asserted that "active learning occurs when a learner engages in three cognitive processes – selecting relevant words for verbal processing and selecting relevant images for visual processing, organizing words into a coherent verbal model and organizing images into a coherent visual model, integrating corresponding components of the verbal and visual models" (2001, p.3).

4.3 Multimedia Principals

Mayer (2009) formulated 15 multimedia principals. These principals are based on the cognitive theory of multimedia learning and findings of grounded research. Multimedia principals can be divided into three categories: principles for reducing extraneous processing, principles for managing essential processing, and principles for fostering generative processing.

4.3.1 Principles for extraneous processing

1) Coherence Principle

According to this principle, irrelevant materials are extraneous materials affecting learning negatively. It may be in the form of irrelevant words and pictures, or irrelevant sounds and music, or unneeded words and symbols, and no matter how interesting and pleasant they are. For example, a learner is given a presentation which has photos along with irrelevant data, music, and other details. Data, music, and other details are extraneous when they consume potential cognitive resources in working memory and consequently affect teach negatively (Mayer, 2009).

2) Signalling Principle

This principle suggests that arrows, highlights, or signals are used to reinforce the organization of the essential material. For example, when a narration is divided and indicated with arrows, it focuses on meaning and keywords for the reader and hence makes learning easy and effective (Mayer, 2009).

3) Redundancy Principle

According to this principle, people learn better when there is a balance between pictorial and verbal materials. If any of them is increased unnecessarily, it will add extraneous processing and consequently it will have negative effect on learning. For example, a message with graphics and narration is more effective than a message with graphics, narration, and printed text. In this example, printed text and narration are verbal materials and they are being repeated twice in the message (Mayer, 2009).

4) Spatial Contiguity Principle

Words and pictures together make effective learning when they are arranged near to each other. If they are kept far from each other, they will start losing their effectiveness. When words and pictures are placed together or nearby, this saves cognitive resources of the learners and when they are kept far from each other, searching and connecting them consume extra cognitive resources and hampers teaching (Mayer, 2009).

5) Temporal Contiguity Principle

This principle refers to presenting words and pictures simultaneously rather than successively. For example, there are two situations. In one situation, animation on any topic is presented and its narration is also played simultaneously. In another situation, animation is presented, and its narration is given separately. The first situation is better than the second

one because when they are presented simultaneously, the learner holds mental representation of both at the same time which saves cognitive resources. If they are kept separately, it will consume more cognitive resources (Mayer, 2009).

4.3.2 Principles for managing essential processing

1) Segmenting Principle

According to this principle, if students are facilitated to access multimedia materials at their pace, they learn better than if they are presented the multimedia materials in a continuous flow. For example, if students are given a video of 25 minutes to be seen in one stretch, it will be less effective than if the video is divided into 5 videos 5 minutes each. When learners see a video continuously, it lowers their processing of comprehension but when they have 5 minutes video each, it is easy to process in the working memory (Mayer, 2009).

2) Pre-training Principle

According to this principle, if learners are given an outline of main concepts and characteristics before they are introduced to main materials of learning; it helps students to acquire deep learning from multimedia messages. For example, if students are going to learn about how a car's braking system works and they are given key terms, concepts, key parts in multimedia messages, after that they are given details about the topic, students acquire better learning than without pre-training materials (Mayer, 2009).

3) Modality Principle

This principle suggests that when multimedia materials combine sounds with words, it makes learning more effective and deeper than when it combines pictures with words. For example, if an animation is combined with narration, it will be more impactful and have deeper effects on learning than when animation is combined with words on screen. The reason is that when sounds are combined with words, they go to cognitive system through ear while images with text goes to cognitive system through eyes and cause overload in the visual system (Mayer, 2009).

4.3.3 Principles for Fostering Generative Processing

1) Multimedia Principle

Multimedia is also used to refer to a specific multimedia method in which words are combined with pictures. According to this principle, students learn better when words are combined with pictures than when only words are presented as learning materials. This method is useful because a combination of words and pictures help learners to build verbal and visual mental models and connections between both models but when only words are presented as learning materials, it only constructs verbal mental models without any visual mental models, and thus it has less effect on learning (Mayer, 2009).

2) Personalization Principle

Using words and tone that give a feeling of personalization also makes learning materials effective. For example, if learning materials has conversational style or has personal pronoun such as 'you' or 'your', it connects readers emotionally and socially and will have positive impact on

learning. It builds a partnership of the reader with the text and involves him or her with the materials or the given messages.

5. The Impact of Multimedia Integration in Learning Facilitation

Many researchers investigated the positive impact of the integration of multimedia in the learning process. Issa et al. (1999) proposed that multimedia-based learning can be efficient for three reasons. First, it promotes the learner's interaction since it includes video/audio production. Second, it allows the learner to be more autonomous in the learning process and shifts the responsibility of learning from the teacher to the learner. In this way, the integration of multimedia empowers the learner and enhances the learner's responsibility. Second, it is self-paced learning which enables the learner to follow the learning instructions on his or her own pace. In a similar indication, Otts et al. (1999) asserted that multimedia enables the students to take control of their own learning. In this way, students take the direction which suits their needs and follow their own pace in learning.

Moreno and Mayer (2000) found that students achieved high score on a transfer test after being exposed to a narrated animation about lightning formation. The narrated multimedia presented the information in conversational personalized style where the first and second person pronouns were used while directing instructions to the learner. This indicates that personalization increases the learner's involvement and interest in the learning process. Moreover, it encourages the learner to use the cognitive skills during learning. Emphasising the fact that the eye is one of the most important data acquisition devices, Tufte (1990), illustrates why visual aids (i. e. pictures, graphs) are the most effective presentation methodologies used by instructors to convey information, rather than focusing on verbal presentation (i. e. words) alone (p.31). For this reason, the integration of multimedia including visual aids accelerates the learning process.

6. Recommendations

It is recommended for EFL teachers to be aware of the positive cognitive impact of the potential multimedia on students while integrating different forms of multimedia in the learning process. Instructors should perceive that multimedia can be integrated even if technology is not. In addition, instructors should encourage different learning styles efficiently supported with multimedia learning. Learning styles theories emphasize the unique cognitive approaches preferred by variant learners. Moreover, educators should take advantage of the fact that various multimedia applications target different forms of learning styles such as visual, auditory, reading/writing (Sternberg, 1997). Nevertheless, the effective integration of multimedia depends on its appropriate selection and utilization. Multimedia can emphasise the individualized pace of learning towards breaking down the group instructional settings if properly selected and integrated. It also promotes

the learner's interaction with the course material and increases involvement, creativity, motivation and autonomy.

Multimedia learning, moreover, increases the opportunities of problem-solving through collaboration, self-exploration and effective participation. It also encourages peer learning as well as individual innovation (Malik & Agarwal, 2012, p.468).

The aforementioned potential privileges of multimedia learning should be thoroughly investigated by instructors through practical studies including assessments of students' achievements when multimedia is involved in the learning setting.

7. Conclusion

In this research papers, the notion of multimedia, its theoretical basis and principles are investigated. The proper engagement of students in the learning process and the enhancement of critical thinking, problem-solving skills, personalized learning and creativity were found to be effectively achieved with the integration of multimedia in learning. In sum, multimedia is a purely pedagogical concept. It has its own theoretical basis and well-grounded principals to be used in teaching and learning professions. Multimedia and its effects on learning has been investigated in this research, and this investigation, is best endeavoured from the cognitive psychology (Mayer, 2003, 2009, 2021). The work of Mayer is considered an example of well-grounded multimedia research that yields interesting findings. This study indicates that the use of multimedia is not dependent upon the use of technology or to be used without technology. Multimedia requires teachers own efforts and imagination to use it creatively to enhance the learning process. Increased use of technology or fancy use of digital tools does not make any learning content multimedia. It is an art of combining learning materials effectively for ears and eyes; visual and spoken, keeping in mind that the learners have limited capacity to learn, and learning should be well designed so they can process multimedia materials effectively and can enhance their learning.

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