

Assessing Outdated Multimedia Instructional Materials in Chinese Higher Education

-- A Multimedia Learning Analysis

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Abstract: This essay explores the profound impact of Richard E. Mayer's Cognitive Theory of Multimedia Learning within the context of Chinese higher education. As more and more multimedia materials are used in lectures, many questions have popped up along the way. Therefore, this essay delves into the challenges of outdated instructional materials in Chinese higher education, highlighting issues such as inappropriate visual materials, reliance on personal experience in design, and unclear teaching objectives. In order to address these problems, the essay provides insights for optimizing multimedia learning in Chinese higher education, emphasizing the need for better multimedia content.

Keywords: Higher Education; Multimedia Instructional Materials; Multimedia Learning Analysis; Teaching Assessment; Assessing Material.

1. Introduction

In the field of education, the intersection of cognitive theories and multimedia learning stands as a heated debate topic. Richard E. Mayer, a pioneering scholar, has redefined the understanding of how learners engage with and benefit from multimedia content. With the rapid development of multimedia technology, Mayer started to explore effective teaching methods that could foster meaningful and enduring learning experiences. This led to the conceptualization of "multimedia learning" (Mayer, 1999), a term he defined as the integration of texts and pictures for better comprehension. Subsequently, his influential works, including the 2001 "Multimedia Learning" and "The Cambridge Handbook of Multimedia Learning", laid the foundation for the Cognitive Theory of Multimedia Learning (Mayer, 2005).

This essay sheds light on his cognitive framework and its implications for the design of multimedia materials. Beyond the theoretical exploration, this essay also examines the practical applications of Mayer's principles in the context of Chinese higher education, shedding light on the challenges posed by outdated multimedia practices and proposing insights for optimizing content, refining the timing of presentations, and fostering innovative approaches to engage learners effectively.

2. Mayer's Cognitive Theory of Multimedia Learning

Richard E. Mayer has made significant contributions to theories of cognition and learning, especially the design of multimedia instructional materials. With the rapid development of multimedia technology, Richard E. Mayer expected to find out teaching methods that could promote meaningful learning for learners, and thus initiated a series of studies on cognitive theories of multimedia learning. Mayer defined the concept of "multimedia learning", and he believed that "multimedia learning refers to meaningful learning through the integration of a series of texts and pictures" (Mayer, 1999). He published the book "Multimedia Learning",

in which he clarified the dual-channel hypothesis, the capacity-limited hypothesis and the active-processing hypothesis (Mayer, 2002). In his work *The Cambridge Handbook of Multimedia Learning*, Mayer developed the Cognitive Theory of Multimedia Learning to explain how multimedia learning works and how we can best use it (Mayer, 2005). In 2011, he published the book "Applying of Learning Science", which, from the perspective of the cross-fertilization of learning sciences and instructional sciences, instructs people on how to turn the multimedia learning theory into practices (Mayer, 2011). It can be seen that for a long period, Mayer and his team have been insisting on refining and developing the theory, and injecting vitality into it.

According to Mayer, he defines multimedia instruction as the presentation of material using both words and pictures to promoting learning. Words refer to presenting information verbally, using text either in print or speech, while pictures refer to depicting information visually, utilizing still images like illustrations, graphs, photos, or maps, as well as moving visuals like animations or videos (Mayer, 2002). There have been three representative views in the field of multimedia learning---first is the response strengthening metaphor, in which learners are passive recipients of rewards and punishments. The second is the viewpoint of information acquisition, which believes that multimedia is essentially adding information to memory and learners are passive information receivers. Last but not least, differing from the first two views, the knowledge construction view builds a coherent mental structure, and learning occurs only when they truly understand the meaning of the presented material and integrate the content into a coherent mental representation (Mayer, 2009). This also explains why individual learners learn differently when presented with the same material for different learners.

Mayer supports the view that multimedia learning is a process of knowledge construction. Since the essence of learning lies in human self-reception and active construction, the role of multimedia is not only to present information, but also to play its own unique value to guide learners, by

improving the directionality of the information, strengthening the internal logical clues, linking the knowledge before and after the vein and so on. Based on this idea, Mayer constructed his multimedia learning theory, which is based on dual channels, a working memory model, limited capacity and active processing theory (Mayer & Anderson, 1991).

3. Outdated Multimedia in Chinese HE

As information technology develops rapidly, multimedia technology has been widely used in the field of teaching and learning. The most prominent change is that educators are intentionally taking full advantage of visual materials in the classroom, such as images, videos and PowerPoint, etc. Based on my personal experience, when I was an undergraduate in China, I realized that even though it was obvious that schools were trying to use multimedia in their lectures, the multimedia content was very outdated. It is no exaggeration to say that some of the materials in class were made more than ten years ago. This discouraged students from learning to a certain extent. Strangely enough, teachers and students know that these PowerPoint or videos have been used for years, but they just don't bother to actively update these. From my perspective, there are three aspects of the current situation of outdated multimedia in Chinese higher education.

First of all, inappropriate visual materials affect the learning process of students and make it inconvenient to understand knowledge. Some colleges and universities still use outdated textbooks, which may expose students to information that is not in line with the trends of the times (Guo, 2005). In today's rapidly updating information, the use of outdated materials tends to cause students to lag behind in their fields. In addition, many colleges and universities may use visual materials that are not clear or well-qualified enough for multimedia teaching, which has some negative influence on students' learning process. Inappropriate visual materials may make students feel confused and inconvenienced in understanding the points, which hinders them from accurately grasping the knowledge (Chen & Liu, 2012). For example, unclear diagrams, poor image quality, and poorly designed presentations may affect students' learning experience. Interestingly, however, in our school, the school seems to have put a lot of effort into updating its equipment and hardware measures, while still maintaining a rather bad quality of multimedia materials. Therefore, the author believes that it is the faculty members who lack of the motivation to update the content.

Moreover, some designs of multimedia teaching rely on educator's personal experience. In other words, when producing multimedia materials, educators haven't taken advantage of some unified design ideas and principles in Chinese higher education setting (Chen & Li, 2011). Taking the reading class as an example, it is well-acknowledged that the reading class generally follows the framework of "introduction - overall perception - intensive reading of the text - summarization - expansion and improvement" (Reiser, Krajcik, Moje & Marx, 2003). On this basis, teachers can adjust and innovate according to the specific learning situation, reflecting their own thinking. Admittedly, there is no one-size-fits-all formula for teaching. However, it is worth recognizing that some frameworks do provide teachers with certain thinking angles for designing multimedia materials. But in reality, many teachers are intended to rely more on their own experience and feelings. For instance, they tend to add some interesting images to attract students' interest; they tend

to add videos because of significant audio-visual effects, etc (Mayer, 2005). This kind of design does not work well, and even fails to stimulate students' effective learning. Moreover, designs that rely on personal experience are difficult to evaluate and adjust, because when reflecting on the quality of teaching, teachers seldom reflect on whether the multimedia materials used have served their intended purpose.

Last but not least, the objectives of multimedia learning are not clear enough. Teaching objectives are the requirements made by teachers to realize certain teaching purposes, which indicate the content of students' learning and the specific level they should achieve after learning, and play a vital role in the whole teaching design (Biggs, 2003). However, after multimedia learning becomes usual, teachers often have deviations in dealing with teaching objectives and technical elements. The achievement of teaching objectives are sometimes neglected by educators with too much emphasis on multimedia materials (Raths, 1971). For example, many multimedia learning is filled with inappropriate information resources, which hinder the students' organization and processing of key content; and some multimedia materials are very valuable in the eyes of the teachers, but in the actual teaching deviate from the teacher's expected teaching track. These problems centrally reflect that some teachers are not precise enough to grasp the objectives of multimedia teaching.

Mayer also proposed that multimedia is not an accessory to teaching, but to promote effective cognitive tools to achieve teaching goals; multimedia learning is not the process of adding new information, but the process of knowledge construction by learners. Therefore, multimedia materials are supposed to be well-designed, so as to achieve clear teaching objectives.

4. Insights for Multimedia Learning in Chinese HE

4.1. Optimizing Content

Multimedia learning content refers to the specific materials displayed by teachers in multimedia courseware, software and platforms, including textual materials, images, videos, audio materials, etc. As mentioned above, for all kinds of multimedia materials teachers have collected from various channels, they tend to try their best to display plenty of them in the classroom without giving a second thought to the use of these materials or technologies (Clark & Mayer, 2023). However, too much random information is not conducive to highlighting the theme, and sometimes it may even cause problems for students in receiving the information. Therefore, teachers need to fully take the content and objectives of each lesson into account, retaining key content and deleting unimportant information. At the same time, it is also necessary to create ideas, so that the multimedia teaching materials can stimulate authentic learning, and that students can construct learning in a meaningful way.

It is very important to note that dual channels can be used to design specific instructional content. Mayer's principle of dual channels suggests that everyone possesses a verbal channel for processing verbal materials and a visual channel for processing pictorial materials, each of which is independent and of limited capacity (Mayer, 2009). Making full use of the two channels can not only focus students' attention in a shorter period of time, and also help students process the new learning content, thus realizing the combination and integration of the old knowledge with the

new one. Therefore, teachers need to deal with the relationship between "picture" and "text" in the multimedia content, coordinate the amount of information in the two channels, and guide students to double-code the multimedia information (Mayer, 2005). Students' visual and auditory channels carry a certain amount of information, which is conducive to double coding and to integrate new information into their original knowledge structure.

Alternatively, it is also a wise choice to design cue structures to enrich the classroom hierarchy. According to Mayer, the main challenge of multimedia materials design is to ensure that learners engage in appropriate cognitive processing while simultaneously ensuring that this processing does not overload the cognitive load, which satisfies the redundancy principle (Mayer, 2003). This requires teachers to minimize cognitive processing that is not related to the achievement of the teaching objectives of the lesson to avoid ineffective learning. Experimentally tested, in multimedia learning, appropriate marking structure can highlight the key materials and achieve better learning results. The main form of marking suggestive structure is to make an outline, as well as the conception of subheadings for each part of the content.

4.2. Timing of Presentation

Timing refers to the point where teachers choose to present the processed multimedia materials in class. Meaningful learning occurs through a rigorous process that Meyer describes as "selection," "organization," and "integration". "Selection" means that students notice relevant words and images; "organization" refers that students process the noticed information into working memory; "integration" means that students combine the newly acquired knowledge with their previous knowledge and incorporate it into their original knowledge structure (Mayer, 2005). "Optimizing multimedia content" mentioned above is actually to reduce the cognitive burden of students in the process of "selection" and help them concentrate on the key contents of learning effectively and efficiently. The discretion and choice of presentation timing is to help students improve efficiency in the "organization" and "integration" processes. Teachers can choose to present certain multimedia materials at the most appropriate time through experimentation and pre-planning, so that the materials can facilitate information processing.

The timing of the multimedia presentation should be based on the specific situation of the students. Teachers should not only consider the role of multimedia materials in each teaching session, but also pay attention to the learning effect of students, so that information technology can maximize its effectiveness (Faraday & Sutcliffe, 1997). It is no exaggeration to say that the timing of the presentation of multimedia materials can affect the efficiency of students' understanding. Here are two typical problems, one is that the multimedia material is presented too early, having damage on the students' aesthetic experience; in the other case, the multimedia material is presented too late, which will make students miss the best timing to understand. At the same time, the use of any multimedia technology must be in the role of serving teachers' teaching activities and teaching language. It is difficult for students to combine these materials with the content of their learning by simply displaying certain videos and pictures, which requires teachers to actively create a space for reflection, induce students to absorb valuable information and creatively interact with the text, so as to improve their cognitive level.

One of the important goals of teaching is to promote the generation of cognitive processing. In order to achieve this goal, teachers need to rationally arrange the materials in the teaching and learning, coordinate the planning, and stimulate the students' motivation to process the information in depth. Only in this way can the student fully utilize them for generative learning after they have enough knowledge storage.

4.3. Innovative Presentation

Multimedia information presentation refers to the details or forms of the use of multimedia materials in learning.

It includes the presentation of multimedia elements, but also involves the combination and arrangement of teaching content. Multimedia learning environment, teachers and students can obtain high-quality information about the course through Internet without regard to the limits of time and space. This way of learning greatly broadens the horizons of teachers and students and changes the effect and mode of learning. The cognitive thinking, abstract thinking and logical reasoning ability of college students have been developed to a large extent, but it does not mean that the design of the classroom can be disregarded. On the contrary, teachers need to consider not only what content they choose to present in the classroom, but also the form in which it is presented. Although monolithic multimedia presentation can output effective information, it is difficult to stimulate students' independent and creative thinking. Even worse, students will become dependent on multimedia learning. The use of material deformation, virtual reality, interactive simulation and other advanced technological innovations in the presentation of information should be taken full advantage of, so that it can refresh the quality and vitality of college lectures (Kotias, Shevchuk, Borysonok, Matviienko, Popov, Terekhov & Kuchai, 2022).

There are several emerging multimedia technologies that can be adopted in the college classroom. To begin with, Interaction Design was proposed by Bill Moggridge at a design conference in 1984. It is through the design and comprehensive display of the product that the product and the user can establish an organic relationship (Kolko, 2010). At present, this technology is mainly used in the fields of product introduction and product promotion. What is more, the rapid development of Virtual Reality Technology (VR) also provides many inspirations for multimedia learning. Virtual Reality Technology (VR) can give students a strong sense of immersion and interaction, making the learning process active and lively (Ardiny & Khanmirza, 2018). Teachers can utilize the advantages of Virtual Reality Technology in a meaningful way that cannot be realized by paper-based resources, and build an immersive learning situation for students.

It should be noted that, although the Interaction Design and Virtual Reality Technology has greatly changed the traditional way of presenting information, adding new vitality to multimedia teaching. However, teachers should fully consider the cognitive level and learning situation of students, and reasonably plan the process of usage. For example, the visual display should be accompanied by teachers to explain, so that the students' visual channel and auditory channel have a certain capacity of processing information; then, teachers should be clear about the learning objectives, so that the students can learn with some certain questions consciously; in the process of learning, educators should summarize, and contribute to the generation of student cognitive processing in time, to ensure the learning efficiency of the classroom.

5. Conclusion

Although there are still some debates on the pragmatics of integrating Mayer's Cognitive Theory of Multimedia Learning into classes, it is no doubt that it is of great importance to level up the outdated instructional materials in Chinese higher education. This essay points out the current situation and impact of the outdated materials in Chinese universities straightforwardly, which includes inappropriate visual materials, designing materials relying on personal experience, and overlooking the teaching objectives. Thus, some measures to address this problem should be taken urgently. The essay offers insights for effective multimedia learning in Chinese higher education, by underscoring the importance of optimizing multimedia content, choosing the right timing of presentation, and making full use of innovative methods to present.

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