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MULTIMEDIA PRINCIPLES AND ITS USAGE IN GEOMETRY TEACHING

Abstract. Nowadays multimedia offers exciting possibilities both for learners and teachers. To get the educational benefits of new educational technologies such as multimedia learning tools it is important to study principles of multimedia learning and to use them for designing multimedia instructional messages. The purpose of this article is to acquaint the reader with principles of multimedia learning which has been popularized by an American educational psychologist Richard E. Mayer. An idea of that principles is organization of sound, text and images on the screen. There are some examples of mistakes that geometry teachers can make on their multimedia lessons in the article and it shows how they can be corrected. It may be useful for geometry teachers to make their multimedia presentations more effective. Each principle of multimedia learning for designing presentations for geometry lessons is subject to further research. All beliefs about benefits of multimedia must be supported by research.

Keywords: cognitive theory, multimedia learning, multimedia principles, multimedia learning tools, geometrylessons, visual information, aural information, selecting, organizing , integrating.

Gauss stated«Mathematics is a science for the eyes, not for the ears»[1], so it's important to prove that multimedia learning has its own place in teaching of mathematics. One of the major questions of pedagogy is improving the quality of education by using the multimedia learning tools.Also, the teachers' main duty in the teaching process is to teach students to searching, processing, understanding and using new information by themselves [2], even in this case the multimedia learning tools can be very useful.

There is an interesting question whether principles of multimedia learning are universal, which means they can be used for any subject (there is no matter if it is math or history). What if they are not universal and the multimedia principles must be adapted for a certain subject? For instance, would the ratio of animated pictures and narration on multimedia lessons for literature be the same also for math? In order to answer such questions we have to analyze scientific researches and to make a conclusion.

First of all we need to define what multimedia learning tools are. Mass communication media such as books, TV, radio, papers also can be used as instructional media in learning process. Most of researchers have argued that multimedia learning tools could be defined as a mix of various mass media.Especially multimedia learning tools are good for delivering visual and aural information to learners.

Richard E. Mayer and other researchers developed the cognitive theory of multimedia learning. According to their research, people learn more deeply from words and pictures than words alone, this statement is known as the multimedia principle and it is one of 14 principles that were defined by Mayer [3]. Researchers of multimedia learning consider multimedia as a connection of text and pictures. They assert that multimedia learning takes place when learners build mental representations from these words and pictures [4]. Words can be written or they can be spoken, visual information can be represented as pictures.The goals of researchers of multimedia learning is to define the best ways for combining words and pictures to make learning process more effective.

The cognitive theory of multimedia learning, introducing by Mayer, is based on such several cognitive theories as Baddeley's model of working memory[5], Paivio's dual coding theory[6], Sweller's cognitive load theory[7], Wittrock's generative theory[8].

The cognitive theory of multimedia learning can be considered as a model which is consisted of sensory memory, working memory, and long-term memory. According to this model, the students in multimedia learning engage in three cognitive processes like selecting, organizingand integrating.In the firs process, working memory selects verbal and visual information from sensory memory. In the second process, selected words and sounds converted to pictorial model and verbal model. In the third process students build connection between corresponding parts of the verbal model and the visual model, also with prior knowledge. Figure 1 is a representation of how memory works according to Mayer's cognitive theory of multimedia learning.

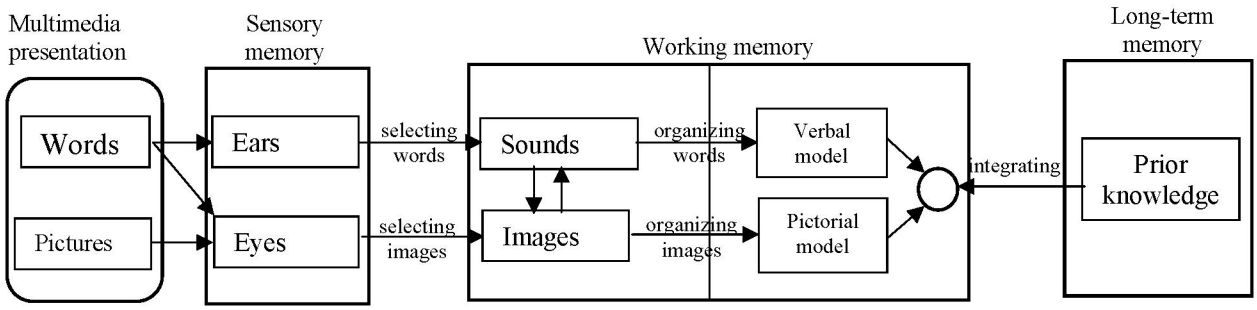

Figure1 - Mayer's Cognitive Theory of Multimedia Learning

Mayer introduces the nextbasic principles for designing effective multimedia presentation that will help people learn more deeply:

- Coherence Principle –deeper learning happens when extraneousmaterial is excluded rather than included.
- Signaling Principle –people learn better when important information on the presentation is highlighted.
- Redundancy Principle – people learn deeper from images with narration than from imageswith both narration and printed text.
- Spatial Contiguity Principle –deeper learning happens when corresponding words and pictures are presented near rather than far from each other on the page or screen[9].
- Temporal Contiguity Principle –deeper learning occurs when corresponding words and pictures are presented simultaneously rather than in successively.
- Segmenting Principal – People learn better when a multimedia lesson is presented in learner-paced segments rather than as a continuous unit.
- Pre-training Principle - People learn more deeply from a multimedia message when they receive pre-training in the names and characteristics of key components.
- Modality Principle - People learn better from graphics and narration than from graphics and printed text.
- Multimedia Principle - People learn better from words and pictures than from words alone.
- Personalization Principle - People learn better from a multimedia presentation when the words are in conversational style rather than in formal style.
- Voice Principle - People learn better when the words in a multimedia message are spoken by a friendly human voice rather than a machine voice.
- Image Principle - People do not necessarily learn more deeply from a multimedia presentation when the speaker's image is on the screen rather than not on the screen.
- Individual Differences Principle: Design effects are stronger for low-knowledge learners than for high-knowledge learners.
- Interactivity Principle: Deeper learning happens when learners can control the presentation rate than when they cannot.

We are going to show how we don't have to design presentation for geometry lessons based on Mayer's principles.

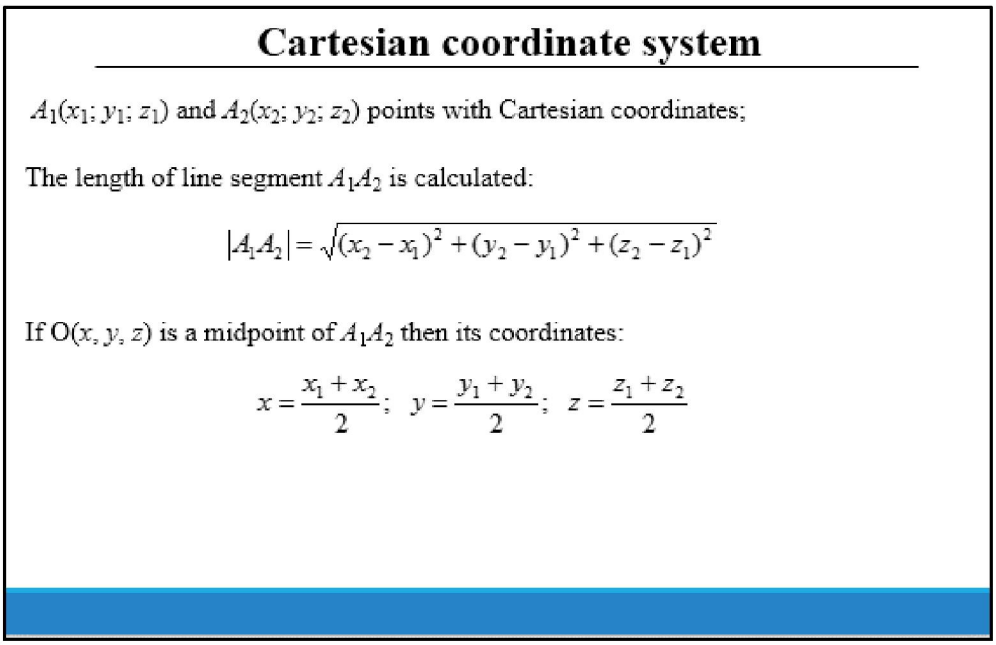

Figure 2 -Example, Contradiction to Signaling Principle

The slide on figure2 contradicts to Signaling Principle, because most important information is not highlighted. It would be better if the formulas were framed and corresponding words "length" and "midpoint" were highlighted. For highlighting it can be used bold text, arrows, circling, voice emphasizing and etc. Highlighting helps learners to pay extra attention to the relevant information.

We usually can see slides like on figure 3 in geometry classes[10].

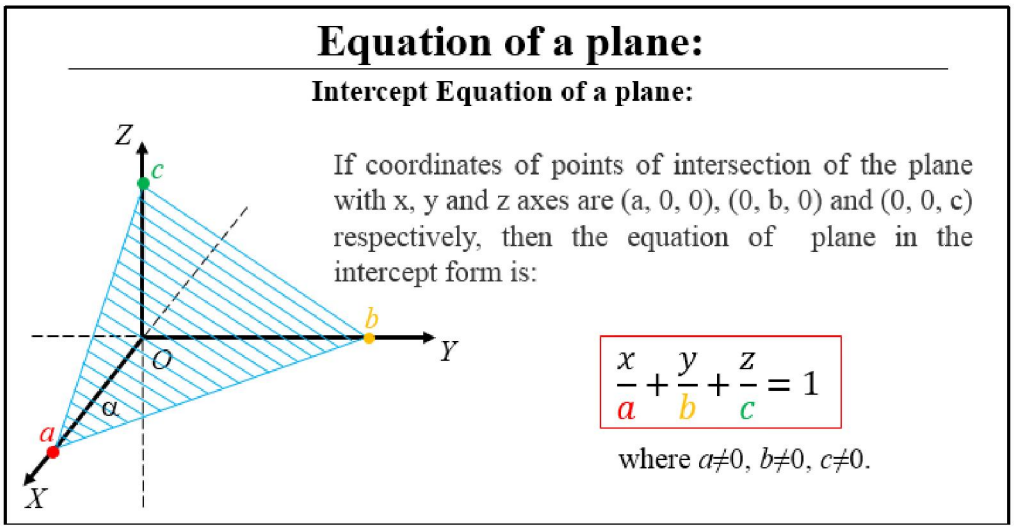

Figure 3 - Example, Contradiction to Modality Principle

If a teacher reads the text from the slide on figure 3 it will contradict to Redundancy Principle. According to this principle, if there isa text and images on the screen the teacher does not have to read the text from the screen. However, even if the teacher does not read thetext form this slide it is also in contradiction with Modality Principle. In accordance with Modality Principle, it is better to use narration for explaining graphical information instead of using a printed texton the screen[11].

There is the same information on figures 4 and 5, but they have different organization of that information. The slide on figure 4 contradicts to Spatial Contiguity Principle.

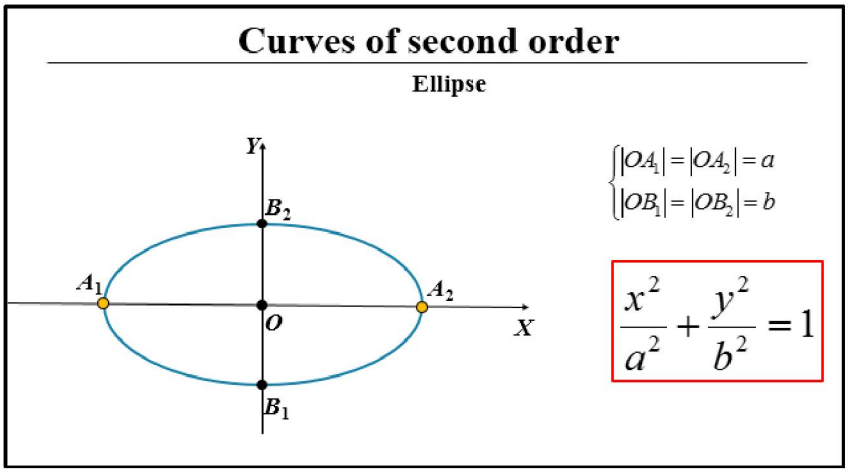

Figure 4 - Example, Spatial Contiguity Principle is not used

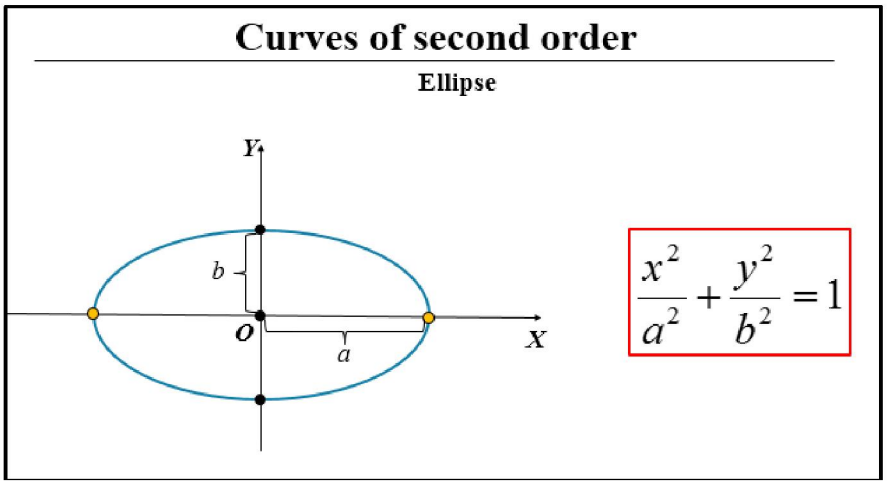

Figure 5 - Example, Spatial Contiguity Principle is used

In the example on figure 4, learners have to mentally make connections between corresponding words (letters) and objects (axis of the ellipse), so that when Spatial Contiguity Principle does not work,it is a bit difficult for learners to comprehend the message on the screen.

Temporal Contiguity Principle similar to Spatial Contiguity Principle. Spatial Contiguity Principle mainly concerned with the distance or spatial gaps but Temporal Contiguity Principle concerns with timing or temporal gaps. For instance, if we say "let's ***a*** be length of the semi-major axis of an ellipse" then at the same time we need to show it on the screen.

We show examples for some principles and some mistakes which we can make when we design slides for our lectures. It is not right to use multimedia learning tools like a paper. The multimedia learning tools have own advantages to use them we need to further test this principles for geometry.

In the conclusion we would like to give the quote. The President of the Republic of Kazakhstan N.A. Nazarbayev said: "It is important to continue work on developing **digital educational resources**, connecting to broadband Internet and equipping our schools with video facilities.It is necessary to **strengthen the quality of teaching mathematical and natural sciences** at all levels of education" [12].The multimedia learning tools as a part of digital educational resources can be useful to achieve these goals. That is why we need study principles of multimedia learning deeply.

УДК323.3

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МУЛЬТИМЕДИЯЛЫҚ ОҚЫТУДЫҢ ҚАҒИДАЛАРЫ ЖӘНЕ ОЛАРДЫҢ ГЕОМЕТРИЯНЫ ОҚЫТУДА ҚОЛДАНЫЛУЫ

Аннотация. Бүгінгі таңда мультимедия білім алушылар мен оқытушыларға таңқаларлық мүмкіндіктер ұсынуда. Мультимедиялық оқыту құралдары секілді заманауи білім беру технологияларының оқытуда пайдасы болу үшін мультимедиялық оқытудың қағидаларын және оларды мултимедиялық оқыту хабарламаларын жасауға қолдана білу керек. Мақала мақсаты – оқырманды американдық психолог Ричар Е. Мейер жасаған мультимедия қағидаларымен таныстыру. Ол қағидалардың негізгі ойы экрандағы дыбыстың, мәтіннің және бейнелердің тиімді үйлесімін анықтау болып табылады. Сондай-ақ, мультимедиялық сабақтарда геометрия пәнінің оқытушылары жасайтын қателерге мысалдар келтірілген және оларды түзету жолдары көрсетілген. Бұл қағидалар геометрия пәндерінің оқытушалырына мультимедиялық сабақтарының тиімділігін арттыруға септігін тигізе алады. Мультимедиялық оқытудың әрбір қағидасы геометрия сабақтарының аясында призентациялар жасау үшін жете зерттеуді талап етеді. Мультимедиялық оқытудың артықшылытары туралы көзқарастар нақты пәнге қатысты, соның ішінде геометрия үшін де ғылыми зерттеулермен негізделуі тиісті.

Түйін сөздері: когнитивтік теория, мультимедиялық оқыту, мультимедиялық оқытудың құралдары, қағидалар, геометрия сабақтары, визуалды ақпарат, дыбысты ақпарат, таңдау, ұйымдастыру, байланыстыру.

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ПРИНЦИПЫ МУЛЬТИМЕДИЙНОГО ОБУЧЕНИЯ И ИХ ПРИМЕНЕНИЕ ПРИ ОБУЧЕНИИ ГЕОМЕТРИИ

Аннотация. В настоящее время мультимедиа предоставляет большие возможности как для учащихся, так и для преподавателей. Чтобы получить максимальную пользу от новых образовательных технологий, таких как мультимедийные средства обучения, важно знать принципы мультимедийного обучения и уметь использовать их при создании мультимедийных учебных презентаций. Цель этой статьи - познакомить читателя с принципами мультимедийного обучения, которые были предложены американским психологом Ричардом Э. Майером. Идея этих принципов заключается в сочетании звука, текста и изображений на экране. В статье приводятся примеры ошибок, которые учителя геометрии могут допускать на мультимединых уроках, а также указаны пути их исправления. Эти принципы могут быть полезны для учителей геометрии, чтобы сделать их мультимедийные презентации более эффективными. Каждый принцип мультимедийного обучения для разработки презентации,относительно предмета геометрия, является предметом дальнейшего исследования.

Ключевые слова:когнитивная теория, мультимедийное обучение, мультимедийные принципы обучения, мультимедийные средства обучения, уроки геометрии, визуальная информация, звуковая информация, отбор, организация, интеграция.

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