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Research Article

Application of Cognitive Psychology in Multimedia Courseware

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Abstract

Multimedia courseware is often in the form of power point slides containing multimedia information from text, graphic, animation, audio, and video contents. It offers the students with "teaching manipulation" that has comprehensive sensory stimuli. In daily teaching, we find that the courseware tends to be simple adaptation of text and graphics, which undermines the advantages of multimedia courseware since it only transfers the contents from the blackboards to the slides. Therefore, in preparation of the courseware, it is necessary that we take into consideration of the cognitive patterns with the help of cognitive psychology in order to make good multimedia courseware that can stimulate learning efficiency in students, and achieve satisfactory classroom teaching results.

Keywords

Manipulation of Teaching • Cognitive • Results the Operation • Information Processing • Visual Perception

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There are two external factors to the teaching process: teaching manipulation on the side of teachers and result manipulation on the side of learners. By "teaching manipulation", it means the stimulating environment and enhancement methods (e.g. teaching content, teaching method, and teaching behavior), and by "result manipulation", it means the external expression by the learner after stimulation (e.g. test scores or application of the knowledge from the course study). (Frederiksen, 2014; Chen & Ye, 2012; Garner *et al*., 2009)

The teaching theory on cognitive psychology adopts the insight learning theory of the Gestalt psychology and the rational core of the S-R paradigm of behaviourism, consuming that a complete teaching process involves at least 5 factors (Eitel & Scheiter, 2015). In addition to two external factors of "teaching manipulation" and "result manipulation", there are three internal factors in learners: cognitive structure of learner, meaning the learner's existing knowledge base and the memory system; learning process meaning the cognitive processing and process when learning is undergoing, such as how the learner establishes linkage between the existing knowledge and the new acquired knowledge; learning result meaning the knowledge preservation in the brain or cognitive change of the memory system. Among the factors, "cognitive structure" and "learning process" are direct factors to determine "learning result" and "result manipulation". Though "teaching manipulation" plays a part, it is an indirect factor to the teaching results. The relations of "teaching manipulation" and "result manipulation" from the perspective of behaviourism and the perspective of cognitive psychology are shown in Fig 1.

An important base to the cognitive psychology in teaching is that the "cognitive process" and "learning structure" of the learner, their suitability and identity to "teaching manipulation", are two key factors affecting "learning results" and "result manipulation". Many have conducted research on "cognitive structure" and "cognitive process" to analyze mathematic education, English language education, modern education, and quality education. But few psychologists have analyzed or discussed how "teaching manipulation" influences the internal cognition process of the learners (e.g. attention, coding, memory, and recollection), and furthermore affects "result operation" (Chen *et al*., 2015).

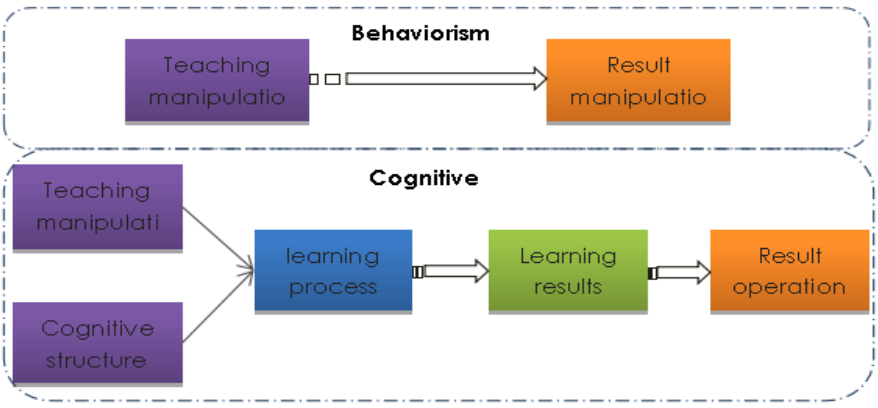

Figure 1. Teaching operation process.

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The information processing model of cognitive psychology and learning

Cognitive psychology, first emerged in the 1950s, is the second revolution in the arena of psychology. It is on a high-tech starting point with the integration of technologies in this information age (e.g. the best results of information theory, control theory, system theory, and computer sciences). On the other hand, the cognitive psychology studies the cognition process as a subject and inherits strict experimental standards of behaviorism in studying the psychological process. In the area of education and teaching, cognitive psychology has contributed new ideas and concepts, and brought a new revelation to today's education society (Chujfi & Meinel, 2015). The psychological phenomenon and their features are included in Fig 2.

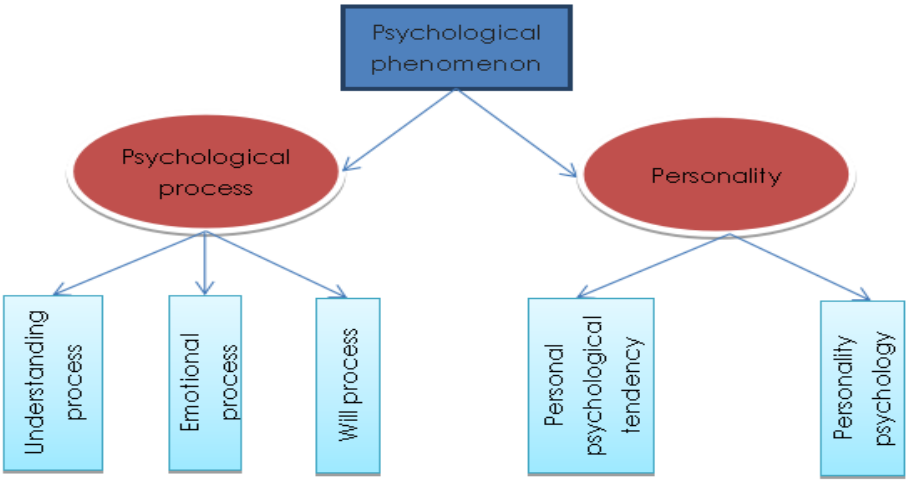

Figure 2. The characteristic types of psychological phenomena in cognitive psychology.

Cognitive psychology, also known as information processing psychology, is developed around the theory of information processing. It treats human as information processing system, which includes the process to obtain, store, process, and utilize information. And in line with the cognitive process, it studies the psychological process of perception, attention, presentation, memory, thinking, speech, reasoning, and problem solving. Cognitive psychology believes that the learner receives stimuli from the environment, and turns them into neural information for sensory register and storage (only those noted information will be recognized by the model)

(Kennedy *et al*., 2015). The registered information is soon processed as short-term memory, where a stream of information can be maintained for 15 to 30 seconds in a limited amount before being replaced by new information, namely being "forgotten". When the information becomes part of the long-term memory, a fundamental change takes place by collecting and organizing information through information coding into permanent information storage to facilitate activation and extraction of information. When information is needed, information sought out through search is directly reflected back to the environment through reactors (such as hand or eye), or transformed to short-term memory before the reactors. The process is illustrated in Fig 3.

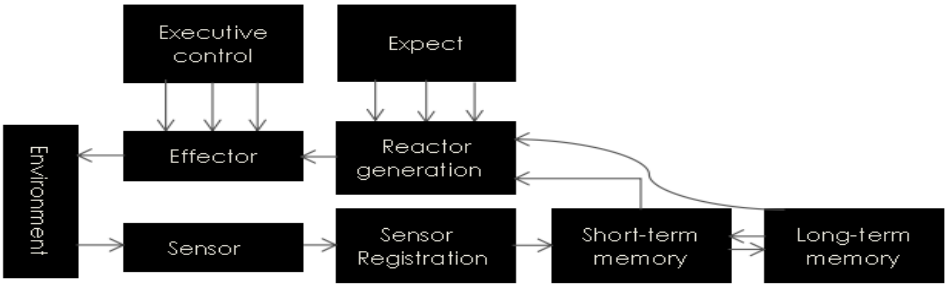

Figure 3. The pathway of the brain memory performs.

The application of cognitive psychology in making multimedia courseware

Perception theory

Cognition is comprehensive reflection of human brain upon attributes, parts and correlations of objects. Through the sensory organs, it senses differences between the cognitive objects and the background. The greater the difference, the easier it is to distinguish the object from the background. From this, we should note the relation between content information and background when preparing multimedia courseware. For example, the background should be neat and simple, while the content information can be highlighted in colors or fonts. For business use, we can use a dark tone such as black, dark blue, or dark green in the background, and write the texts in white or yellow (Yagci, 2018; Lundberg *et al*., 2018). The color tone can alter, but the slides should be able to engage the students with pleasant background and sharp color contrasts so that they give more attention to the information and tell the information easily from the background. It is noted that sometimes teachers use plain white backgrounds and bold black texts in the slides for the sake of convenience. Though with sharp contrasts, these slides are too plain for the students to develop interests in or initiate a cognitive process. So, we should select a simple power point template with proper color setting as in Fig 4.

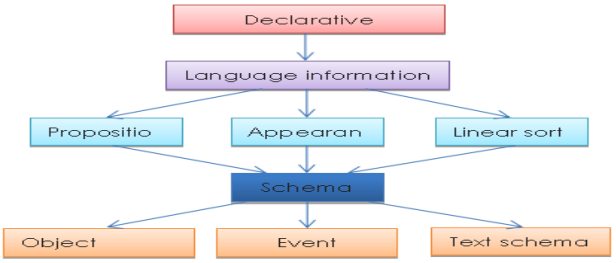

Figure 4. The order and content of graphics.

Table 1.
A Phased Introduction Indicates the Purpose of the Information.

The first stage Pre-organizational concept presentation		The second stage Presentation of learning tasks or materials	The third phase Enhanced cognitive organization
1. Explain the purpose of this lesson.		1. Make the organization obvious: Keep students' attention	1. Use the principle of harmonization: Fixing new materials to existing cognitive structures.
2. Presenting the organization concept:	Confirm the attributes being clarified, Give examples,	2. Make the logical sequence of learning materials explicit:	2. Promote positive acceptance of learning.
3. Promote awareness of relevant knowledge.		3. Make students understand the interrelatedness of ideas	3. Principles and Methods for Drawing Textbooks

Table 2.
Learn the Function of Various Parts of The Brain in Working Memory.

Recognition function	Approximate positioning	Test items
Carried out	Frontal lobe, left occipital gyrus, middle temporal gyrus and bilateral parietal lobe	Alternate connection, clock test, digital breadth
Plan	Frontal lobe	Draw a cube
Notice	Prefrontal lobe	Alertness, continuous reduction 7, retelling
Calculation	Biparietal and frontal lobes, left frontal lobe, left angled back	Continuous reduction 7
Visual space	Double top leaves	Draw a cube and draw a clock test
Visual perception	Right top occipital lobe	Draw a cube, name it
Visual integration	Frontal occipital lobe	Draw a cube and draw a clock test
Semantic understanding	Forehead loquat	Name, word fluency, abstract thinking
Instant memory	Prefrontal lobe	Number breadth, continuous minus 7, retelling
Delayed memory	Double Papez	Delayed memory
Memory retrieval	Frontal lobe	Delayed memory

Pay attention to the theory

It is pointed out by cognitive psychology that the learning process does not begin with reception of external stimuli, but rather the learning initiative and selective attention on sensory information by the subject. Here "attention" has below featured:

Selective. The themes should be highlighted on the main features when displaying teaching information with slides. At the same time, we can also set "custom animation" to the knowledge points and information to tailor the way information is displayed on the screened through a click of the mouse (such as "chess board", "blinds" or "fly") and show them by parts. The concentration of attention on the content is discussed in Table 1.

Extraneous. To engage the students, the design of the courseware does not necessarily adopt brand new stimuli. It works as long as there is clear contrast and difference in the slides. For example, a segment of text is bolded, in italics, flickering, or underlined, an audio is varied in volume or tone, or the slides has new windows, arrows, or frames or shades in various colors. When two objects are similar, we should amplify the contrasts to show the differences, which can be realized through colors, fonts, or symbols on the differences or through magnifying the differences for easier understanding. Please see Table 2.

Simplicity. Simple presentation facilitates attention. Delete as much as possible un-relevant background or excessive details. Teachers should try not to use slides as a replacement of blackboards by piling up information, which discourages the students' interests and diverges their attention. According to the memory theory, it is easier to memorize information with meanings than abstract or meaningless information. For example, the below sentence expresses meaning as "the late adult birds are the newly hatched birds, which are featherless with closed eyes, can't stand or eat on their own, and have to be fed by the mother bird".

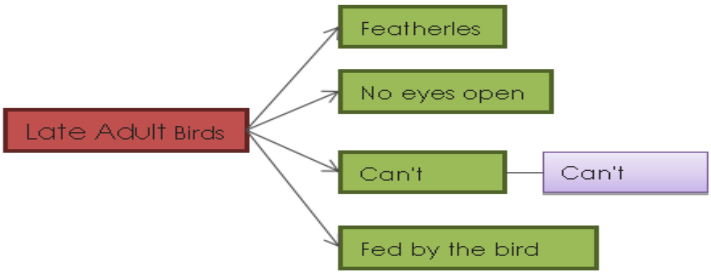

Figure 5. Analysis of Behavioural Characteristics of Late Adult Birds.

Expectation. Expectation of the learners can have strong implication on the attention. Before displaying the teaching content, it helps with stimulating expectation, concentrating attention, and leaving impression on the follow-up stimuli by proposing the teaching goals and questions to be addressed. So, we should prepare an Outline page at the beginning of the slides to brief the learners on the main topics and the structure of the course. When learners are in the class, they have a clear expectation of the class and tend to stay focused on the content

to be covered. In this way, we can avoid the lags with the learners due to improper understanding of the topics even after a long time into the session.

Table 3.
Teachers' Recognition of multimedia

Contents	Options	Number of people	Percentage
The scope of application of multimedia courses	All courses	28	11.82%
	Some necessary courses	**187**	**78.90%**
	Available without	15	6.33%
	Totally unnecessary	7	2.95%
The main purpose of multimedia teaching	Intuitive teaching	117	49.37%
	Solve the difficulties	53	22.36%
	Improve learning interest	48	20.25%
	Help students learn independently	19	8.02%
Multimedia teaching should pay attention to the content	syllabus	47	19.83%
	Teaching content	21	8.86%
	Combination of theory and practice	169	71.31%
Middle school students pay more attention to multimedia teaching	Courseware content	45	18.99%
	Animation and video	65	27.43%
	Telling about the cooperation with courseware	127	53.58%

Create a good learning atmosphere

For many years, the domestic teaching theory is subject to dominating influence of behaviourism, which only values the teaching content and test scores. The teaching method overall is a traditional classroom teaching mode with teachers giving explanations, students taking notes from blackboards and homework after class. The class rooms, as podium of the teachers, are overall featured with dullness. For a long time, the students are subject to passive cognitive development environment, which has resulted in negative influences on learning interests and initiatives in students. So, we need to alternate the traditional teaching approach and take advantage of multimedia for a better learning atmosphere for the students. With the help of playing soothing music, pictures, and poem-reading, we can regulate their state of consciousness, relieve them from inferiority or exhaustiveness and then start with the teaching content. Or we can encourage students involve in preparation of multimedia courseware to develop their capacity, stimulate interests, and develop speech-giving capability, giving them a main role in classrooms.

Conclusions

The cognitive psychology, stressing the cognitive structure and cognitive process, has contributed to the modern teaching with a number of research results and theoretical ideas on the teaching mode, approach, methods, evaluation, and management. It is a learner-oriented theory that shows how psychological process stimulates learning initiative and motive. When teachers are preparing multimedia courseware, we should

follow the guiding principles of cognitive psychology and adopt the cognitive patterns so as improve the courseware quality for better teaching results.

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