

Computer-Assisted Biology Learning Materials

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Computer-Assisted Biology Learning Materials: Designing and Developing an Interactive CD on Spermatogenesis

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Abstract. The purpose of this article is to design and develop an interactive CD on spermatogenesis. This is a research and development. Procedure of development is making outline of media program, making flowchart, making story board, gathering of materials, programming and finishing. The quantitative data obtained were analyzed by descriptive statistics. Qualitative data obtained were analyzed with Miles and Huberman techniques. The instrument used is a validation sheet. The result of CD design with Macro flash MX program shows there are 17 slides generated. This prototype obtained a valid value after a self-review technique with many revisions, especially on sound and programming. This finding suggests that process-oriented spermatogenesis can be audio-visualized into a more comprehensive form of learning media. But this interactive CD product needs further testing to determine consistency and resistance to revisions.

Index term: computer-assisted learning materials, designing and developing, cd interactive, spermatogenesis

1. Introduction

Research trends in technology-enhanced learning (TEL) is divide two great lines of research. The first is related to technology, including virtual learning environments, game-based learning, mobile learning and learning through communication technologies. The second is related to learning content and includes engineering, mathematics, science, reading and writing ^[1]. The utilization of technology for enhancing science learning has gradually become one of the major trends in science education ^[2]. Currently, the use of computer-assisted learning (CAL) terms such as the use of interactive CD or e-learning has been replaced by technology enhanced learning. Although the use of the term technology enhanced learning (TEL) is still debated in learning ^[3].

Currently, learning requires more varied and speculative ways, methods and media. The use of interactive CD for specific learning materials including speculative media. Speculative media in digital education research are needed for researchers to be able to engage precisely in digital education ^[4]. Learning with interactive media can be used with teacher assignments and explanations ^[5]. Results of research on the effect of media multitasking on learning show that the group in the test reading with a tested video shown simultaneously condition performed significantly better than the group of the background condition ^[6]. A highly interactive hypermedia atlas of a rat dissection which allows a student to investigate the relationships between anatomical structures in the body and provides information on the physiological function of many of them ^[7]. The use of interactive multimedia also improves student achievement ^{[8]. [9]}.

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In science education, ICT effect on in two models of a science curriculum are one based on empirical science and one on a model of scientific reasoning^[10]. Computer assisted learning is still indispensable to enhance and to connect knowledge with skills in science education. Computer assisted learning materials, designed to provide experience in decision-making are being used to bridge the gap between theory and practice in the field of biotechnology^[11]. Because there are several processes in learning that can only be shown with computer assist learning. The condition of this learning environment is needed in science learning.

Computer-assisted learning (CAL) still use in biological education. For example the use of computer-assisted and computer-based concept mapping on science education^[12] and teaching and assessment of biological science^[13]. Some research reports using interactive media in biology learning are learning on photosynthesis^[14], practical work of science education^[15], molecular biology^[16], biology cell^[17], mitosis and meiosis^[18], reproduction of animals and plants^[19] and traditional histology instruction^[20].

Learn the material of spermatogenesis requires a media that is able to help convey material messages to students. In spermatogenesis found many processes and facts in learning. The physiological function of spermatogenesis in mammals is to produce spermatozoa^[21]. The mechanisms involved in establishing and maintaining a germ line stem cell population in testes, as well as the factors that regulate their contribution to the pool of differentiating cells^[22]. Spermatogenesis in mammals is achieved by multiple players that pursue a common goal of generating mature spermatozoa^[23]. Spermatogenesis takes place in the seminiferous epithelium of the seminiferous tubule, the functional unit of the mammalian testis spermatozoa^[21]. The developmental processes acting on male germ cells that culminate in the production of the functional spermatozoa are regulated at both the transcription and post-transcriptional levels^[23].

In this study we designed an interactive CD on spermatogenesis, because spermatogenesis became an important process in the human reproductive system^[24],^[25] and spermatogenesis also loads many processes in the formation of sperm that must be visualized with interactive CD media. This is a research and development^[26] which will design CD media, after previous research has been designed cooperative learning device^[27],^[28] used in the application of CD interactive. The purpose of this article is to design and develop a product in the form of CD interactive on spermatogenesis.

2. Method

This is a research and development^[26] which uses the procedure of development media^[29]. The steps of the work is making the outline of media programs, making flowcharts, preparation story board, collections of materials, programming and finishing. At the outline of media programs, we identify the title, goal and content that write on media plan. At this stage, we also reconstruct syllabus and unit of learning. At making flowcharts and storyboard, we collect the materials and concept to make flowcharts. Flowchart is guidance of story board, because its description which contains the explanation of visual and audio of each flow in the flowchart. Each one column of storyboard is representation of one slide. Then we collect related picture and sound to programming and packaging of CD interactive. At the end we do self review of CD interactive^[30].

At developing of instrument, we design of instrument of assessment the CD interactive. The indicator of the instrument of assessment are (1) theoretical: specification of objective and content, determination of strategy and time; (2) practicality: demonstration, familiarity, clarity and active learning; (3) characteristics: self instructional and contained, stand alone, adaptive, user friendly, visualization, variation, use, response and type of learning and (4) excellence: creativity, visualization of information and process, student motivation, packaging, novelty. This instrument is test for validity by expert. The result of test validity is

3.00 (valid). We use the statistic descriptive to calculate mean and standard deviation and Miles and Huberman technique to explain the qualitative data ^[31].

3. Result and Discussion

We have identify the aims and content of learning material on spermatogenesis. The result is write on media plan (table 1). We also designed the flowchart of CD interactive and the result is show on figure 1. Then, we also have design a storyboard. Storyboard contains title, visual and audio (table 2). The result of self review ^[30] is shown on table 3.

Table 1. Media plan of spermatogenesis

Aspect	Description
Course	Developmental of biology
Topic	Spermatogenesis
Description	Spermatogenesis learns about the formation of spermatozoa cells and the hormones that govern them.
Main competencies	Students are able to explain the basic concepts and processes of development individual
Title	Cd interactive on spermatogenesis
Supporting Competencies	Students are able to explain the process of spermatogenesis
Sub Topic	Introduction, stage of spermatogenesis and hormonal regulation

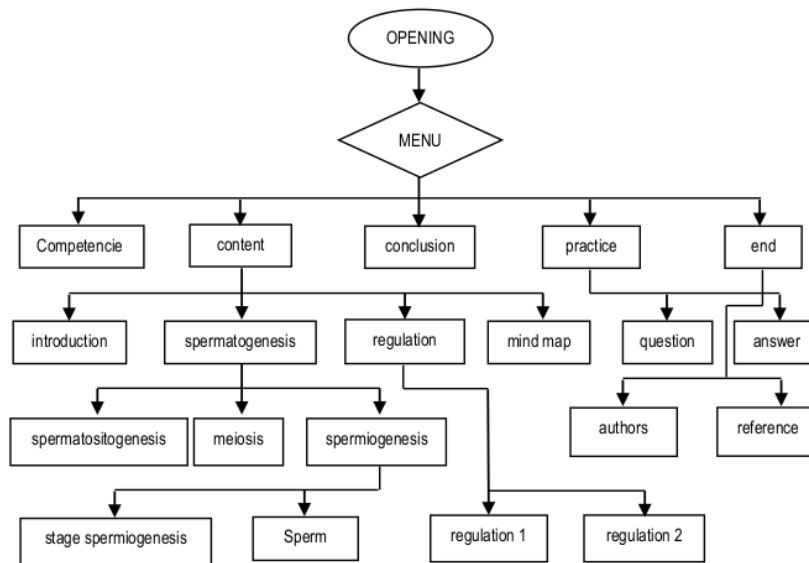


Figure 2. Flowchart CD interactive on spermatogenesis

Table 2. Storyboard of spermatogenesis

Part	Visual	Audio
Opening /Cover	Animation 3D Head : CD INTERACTIVE OF DEVELOPMENTAL BIOLOGY	
	Text: CD INTERACTIVE OF DEVELOPMENTAL BIOLOGY WITH MACRO FLASH MX SPERMATOGENESIS BY M. HAVIZ DEPARTMENT OF BIOLOGY EDUCATION IAIN BATUSANGKAR Image: SPERMATOZOA Panel: STOP, NEXT	sound effect

Table 3. Result of self review of CD interactive on spermatogenesis

No	Aspect of review	Result of self review (Means \pm SD)
1	Theoretical: specification of objective and content, determination of strategy and time	3.12 \pm 0.35
2	Practicality: demonstration, familiarity, clarity and active learning	3.18 \pm 0.09
3	Characteristics: self instructional and contained, stand alone, adaptive, user friendly, visualization, variation, use, response and type of learning.	3.15 \pm 0.71
4	Excellence : creativity , visualization of information and process, student motivation, packaging, novelty	3.12 \pm 0.35

Note: $\chi > 3.20$ is highly valid; $2.40 < \chi \leq 3.20$ is valid; $1.60 < \chi \leq 2.40$ is valid; $0.80 < \chi \leq 1.60$ is valid; $\chi \leq 0.80$ is invalid; SD = Standard deviation

In the programming stage, interactive CD programming is categorized into two forms: technical specification analysis and program work analysis. Analysis technical specifications illustrate that to be able to run this interactive CD required windows 98, ME and XP operating system with processor 128 MHz. The software needed in the design of the CD is macro flash MX 2004 as the main program. The supporting programs used for picture editing used Microsoft office power point 2007 and adobe Photoshop. Packing a CD using Ahead Nero 6.6. The hardware used to run this medium is a single computer unit. Computer equipped with CD Rom used to play and read media, S-VGA monitor to display program, keyboard and mouse standard windows for navigation purposes

Analysis of the program work done to determine the effectiveness of navigation media that has been designed. Program work is designed with instructions and navigation buttons that will guide users to interact with media content. Interactive media that has been designed has 17 slides in the form of flash document and flash movie. Media that has been designed stored in flash movie format in CDR media with a maximum capacity of 700 Mb. The CD media consists of 3 sections: opening (2 slides), contents (13 slides) and cover (2 slides).

The result of the research is show that this research is categorized to research and development type 1, because the research focus on developing program, design process, evaluation, technique, organizing of content ^[32]. The finding the research also similarity with other research such developing material on science education ^[33], usability testing of a web site ^[34], interactive curriculum ^[35], physical education ^[36], financial system ^[37], and video teletraining ^[38].

The finding the research also show that the designing and developing is differ with the simple learning material. Because designing and developing is a study of systematics about design, develop, evaluation of product that meet the internal of consistency and relevancy ^[39]. Research and development is a study of effect of using of product, process and evaluation of product in learning ^[32].

The research findings show that the processes and facts present in spermatogenesis can be audio-visualized into a more comprehensive media of learning. As at spermatogenesis, sperm maturation process occurs in the epididymis^[40], that its very typical cell, the core is packed so densely with acrosome found in the apical region near the nucleus and mitochondria are arranged in a spiral shape around the base of the flagellum^[41]. There is a change in the topography of the spermatid cells consists of four phases, Golgi complex, cap, acrosome and maturation^[42]. Spermatozoa maturation process is also accompanied by the series of changes in the composition, for example, changes in the number and presence of particular proteins in the membrane of the sperm head. This process is call polarization protein that it needed in changes in morphology and function of spermatozoa^[43]. In this process, the protein is segregated from the anterior head domain or posterior head domain and found when spermatozoa momentarily left testes.

Furthermore, the result of content analysis on fact was done in the following section. The results research showed that the membrane before it mixes with ejaculated, the spermatozoa still have an important component when in the caudal epididymis. The results of the study show the structure of the sperm membrane^[44] is covered by proteins, carbohydrates, lipids and other materials, that its release from the surface of the sperm membrane is an important part of capacitation^[40]. The epithelial cells actively secrete fluid needed spermatozoa while in the epididymis^[45] as changes in sperm surface associated with epididymis transit^[46] and preventing the acrosome reaction early in the epididymis and shortly after ejaculation^[47]. The others show that the material facts produced in the tubules; it will undergo a series of maturation process in the epididymis^[48]. Mass, there is interaction between spermatozoa and it to the epithelial cells of the epididymis^[46]. At maturation, sperm acquire the ability to move, and the ability to fertilize from epididymis protein is sperm-egg binding proteins^[49] and proteins that play a role in the agglutination between spermatozoa^{[50],[51]}. Agglutination effect decreased in the caudal epididymis before sperm are ejaculated^{[52],[53]}. This is presumably due to the presence of other protein components that act as anti-agglutinin^[54]. All of these explanations show that the many physiological processes that occur in the body during spermatogenesis.

This study has many limitations. The product of this study has not been tested for validity at next level such as expert review and small-large group test^[30] and the product is also less have relevancy and consistence. So this product is not resistant to revision.

4. Conclusion

Based on the findings and discussion, it can be written that has produced a valid of interactive CD on spermatogenesis. The results show that the products that have been produced require a lot of revisions, especially on sound and programming. This finding suggests that process-oriented spermatogenesis can be audio-visualized into a more comprehensive form of learning media. But this interactive CD product needs further testing to determine consistency and resistance to revisions.

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