DEVELOPMENTAL AND USABILITY OF DIGITAL COMIC 'MITOFLIP' IN SUBTOPIC MITOSIS FOR FORM 4 BIOLOGY STUDENTS

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THIS FINAL YEAR PROJECT IS SUBMITTED TO FULFILL THE REQUIREMENT OF BACHELOR OF EDUCATION (BIOLOGY) WITH HONOURS

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FAKULTI SAINS DAN MATEMATIK (PERAKUAN KEASLIAN PENULISAN)

Perakuan ini telah dibuat pada 2 November 2024

i. Perakuan pelajar :

Saya, Rubhashini a/p Gunasegaran dengan ini mengaku bahawa laporan projek penyelidikan tahun akhir bertajuk 'Pembangunan dan Kebolehgunaan Komik Digital 'Mitoflip' bagi Subtopik Mitosis untuk Pelajar Biologi Tingkatan 4 adalah hasil kerja saya sendiri. Saya tidak memplagiat dan apa-apa penggunaan mana-mana hasil kerja yang mengandungi hak cipta telah dilakukan secara urusan yang wajar dan bagi maksud yang dibenarkan dan apa-apa petikan, ekstrak, rujukan atau pengeluaran semula daripada atau kepada mana-mana hasil kerja yang mengandungi hak cipta telah dinyatakan dengan sejelasnya dan secukupnya.

Tandatangan pelajar

ii. Perakuan Penyelia:

Saya, Ts. Marina Mokhtar dengan ini mengesahkan bahawa hasil kerja pelajar yang bertajuk Pembangunan dan Kebolehgunaan Komik Digital Mitoflip dihasilkan oleh pelajar seperti nama di atas, dan telah diserahkan kepada JABATAN BIOLOGI bagi memenuhi syarat untuk memperoleh IJAZAH SARJANA MUDA PENDIDIKAN (BIOLOGI) DENGAN KEPUJIAN.

Tarikh: 2/9/2024 Tandatangan Penyelia

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ABSTRAK

Kajian ini bertujuan untuk membangunkan dan menguji kebolehgunaan komik digital 'Mitoflip' untuk subtopik mitosis untuk pelajar Biologi tingkatan 4. Reka bentuk kajian ini adalah pembangunan berdasarkan Model ADDIE dan data kajian ini dianalisis secara kuantitatif. Seramai 35 orang pelajar biologi dari dua buah sekolah menengah di daerah Kinta, Perak terlibat sebagai responden kajian. Soal selidik digunakan sebagai instrumen untuk mendapatkan kebolehgunaan komik digital yang terdiri daripada 30 item dengan skala Likert empat mata. Data kajian dianalisis secara deskriptif menggunakan perisian Statistical Packages for Social Science (SPSS) versi 26.0. Dapatan kajian menunjukkan komik digital 'Mitoflip' mempunyai nilai kesahan muka, kandungan dan item yang tinggi, dengan CVI = 0.97. Nilai pekali Alpha Cronbach juga menunjukkan kebolehpercayaan yang baik iaitu $\alpha = 0.81$. Manakala, dapatan bagi setiap konstruk iaitu kebergunaan, kemudahan pengguna, reka bentuk dan kepuasan memperoleh nilai min (sisihan piawai) masing-masing sebanyak 3.66 (0.40), 3.68 (0.37), 3.68 (0.57), dan 3.68 (0.50), dengan min keseluruhan konstruk adalah 3.68 (0.46), menunjukkan tahap kebolehgunaan yang tinggi. Implikasi daripada kajian ini adalah suasana pembelajaran dalam topik mitosis akan menjadi lebih interaktif dan menyeronokkan dengan menggunakan komik digital 'Mitoflip'. Guru juga boleh menggunakan komik ini sebagai alat bantu mengajar di dalam bilik darjah. Kesimpulannya, komik digital 'Mitoflip' sesuai digunakan sebagai bahan bantu mengajar selaras dengan pembelajaran abad ke-21, kerana e-komik dapat meningkatkan minat pelajar untuk mempelajari subtopik Mitosis.

ABSTRACT

This study aimed to develop and test the usability of the digital comic 'Mitoflip' for subtopic mitosis for form 4 Biology students. The design of this study is developmental based on the ADDIE Model and the data of this study is analysed quantitatively. A total of 35 biology students from two secondary schools in Kinta district, Perak were involved as the research respondents. The questionnaire are used as instrument to obtain the usability of the digital comic comprised 30 items with a four-point Likert scale. The study data were analysed descriptively using the Statistical Packages for Social Science (SPSS) software version 26.0. The study findings show that the digital comic 'Mitoflip' has high face, content and item validity values, with CVI = 0.97. The Cronbach's Alpha coefficient value also indicates good reliability, at $\alpha = 0.81$. Meanwhile, the findings for each construct, namely usefulness, ease of use, design, and satisfaction, obtained mean values (standard deviation) of 3.66 (0.40), 3.68 (0.37), 3.68 (0.57), and 3.68 (0.50) respectively, with an overall construct mean of 3.68 (0.46), indicating a high usability level. The implications of this study are that student learning in the topic of cell division will become more interactive and fun by using digital comic 'Mitoflip'. Teachers also can use this comics as a teaching aid in classroom. In conclusion, the digital comic 'Mitoflip' is appropriate to be used as a teaching aid in line with 21st-century learning, as the e-comic can increase student's interest in learning the subtopic of Mitosis.

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KBSM	Kurikulum Bersepadu Sekolah Menengah
KSSM	Kurikulum Standard Sekolah Menengah
ADDIE	Analysis, Design, Development, Implementation, Evaluation
CVI	Content Validity Index
STEM	STEM Sciences, Technology, Engineering and Mathematics
CTML	Cognitive Theory of Multimedia Learning
SD	Strongly Disagree
D	Disagree
A	Agree
SA	Strongly Agree
ERAS	Educational Research Application System
SPSS	Statistical Package for the Social Sciences

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Biology Education in Malaysia has been modified to ensure education in Malaysia is in line with the development of the world of education and comparable to the progress of other countries in the world. Initially in the year 2020, The Integrated Curriculum for Secondary School (KBSM) was replaced by a new curriculum known as the Standard Based Curriculum for Secondary Schools (KSSM). According to Dr. Sariah Abd Jalil; Director of the Curriculum Development Division of the Ministry of Education Malaysia (2016) the new curriculum that has been introduced which is for strengthening and improving KBSM, so that the national education curriculum always meets the current needs and challenges of the 21st century and is in line with the National Transformation Plan.

1.2 Background of the Study

The word biology comes from the Greek word "bios" means life and "logos" means study respectively. Biology is also known as the science of life that teaches humans about the structure and function of every living thing on the face of the earth as well as the interaction between various lives such as interaction with lives with the environment. In addition, biology also study about the growth, origin, evolution and distribution of living things and physiological processes.

According to Ashraf & Safraz (2016) Biology generally means the study of life that tries to unravel the mysteries of living things from the process of protein synthesis used for the growth of organisms from cells and complex ecosystems. Among the target of KSSM Biology is to provide students the opportunity to engage in learning experiences in the process of understanding biological concepts, developing skills, strategies and applying biology with scientific attitudes and values, and students can understand that science and technology which have an impact on the society.

KSSM Biology will better equip students to confront the opportunities and challenges of the 21st century. Through this curriculum, students will be able to make meaningful contributions to the country's development. KSSM Biology provides students with knowledge in the field of Biology. As such, students will be able improve problems solving skills and critical thinking skills as they have learned scientific attitudes and noble values while attending KSSM Biology and they will be able to continue their education and pursue careers in the field of biology.

Malaysia has been focusing greatly in STEM education (Muda et. al, 2023). STEM stands for Science, Technology, Engineering and Mathematics. Science comprises of vast many fields. In Malaysian schools, science is taught from primary school all the way through secondary school. Students whom categorised into science stream they will study the three main fields of study; Biology, Chemistry and Physics.

The biggest challenge faced by students nowadays is they are not interested in studying biology as it is difficult to understand and gaining a good marks in examinations (Mercy & Tobi, 2022). This is due to the terms, complex concepts and physiological processes that should be conquered by the students. In the learning process, students need to have mastery of scientific concepts. Students with good mastery of scientific concepts will more easily develop critical thinking skills (Ismail et. al, 2018). Therefore initiatives should be implemented to attract student's interest and change their perspective that science and mathematics are easy and fun so that many students will choose this STEM package.

Different researches revealed that students fail to have a strong scientific foundation in Biology that causes poor performance of students in Biology. Literatures revealed that students find it difficult to comprehend cell division and genetics (Mae et. al, 2020). It can be seen from the learning activities that are still teacher-centered, the interactive learning media has not been maximized which causes student activities are relatively low, and difficult for teachers to realize students with good critical thinking skills (Ismail et. al, 2018).

Digital learning media are supportive of being used in line with the current times. Electronic teaching materials can be designed using technologies such as e-comics or digital comics. According to Muhoza et. al, (2023) by using an digital comics teachers can present more interesting e-learning material. Habiddin et.al, (2022) commented that digital comics have the ability to help create a more effective learning environment.

1.3 Problem Statement

Biology is considered as the hardest subject in science. According to Salleh et. al (2021) the achievement of students in Biology is in unsatisfactory level. Although biology consists of topics related to plants and animals, cell division is considered the hardest topics among students (Nadzirah & Mustafar, 2024).

A study conducted Mae et. al, (2020) that shows cell division 22.80% is the least mastered topic by students followed by genetics 27.22% in the second place. This is supported by the study by Salleh et. al (2021) to identify hardest topics in Biology (KBSM) from the point of view of teachers and students in a secondary school, Selangor. The study reveals the cell division topic is hardest with a highest frequency of 88 students and 9 teachers among topics such as nutrition and nervous system. There are still many students who experience confusion and do not understand the concept of mitosis. (Salleh et. al 2021).

This situation is in line with the study by (Nadzirah & Mustafar, 2024) who claim that cell division got a highest percentage as the hardest topic 96% in Biology. Despite learning from primary, secondary and tertiary education, biology educators finds that the understanding level of student on mitosis topic is still incomplete (Conner, 2024).

Among the problems faced by students for the topic of cell division is hard to differentiate between mitosis and meiosis, difficult to visualize and understand the process involved in it (Lham & Sriwattanarothai, 2019). This is because the process of cell division is hard to visualise by mental activity. As a result, most of the students tend to memorize the contents of cell division (Nadzirah & Mustafar, 2024). Memorizing a content without a proper understanding of the process will result with forgetting it (Wai & Khine, 2020). This will eventually affects the performance of students.

Mitosis need to be mastered by the students as it is the fundamental for other topics such as meiosis, genetics and more. If students failed to master the topic, they will suffer in higher level education makes learning challenging especially enrolled in science stream (Salleh et. al 2021). Even though various efforts to solve this issue, the topic cell division remained unsolved (Salleh et al, 2021).

The factor caused the cell division to be difficult for students are low interest with 68.54% in cell division (Salleh et. al, 2021). Yessa & Marna (2022) states that one of the main factors are the lack of learning aid that reduces the interest of students.

Learning aids help students to engage in a class more effectively. In order to grab student's attention an attractive learning aid must be produced by the teachers (İlhan et. al, 2021).

Contrarily, the usage of learning media in for cell division is low because some schools are still applying teacher-centred learning method (Aswanti & Isnaeni, 2023). Teachers tend to use common learning aid like textbooks and powerpoint slides must be changed as it does not follow the demands 21st century learning style which student centered. (Xezonaki, 2023) and (Habiddin et. al, 2022).

The biggest challenge encounter by the teacher is insufficient time to prepare the learning aids (Muhoza et. al, 2023). In addition, teachers are less interested in developing learning media (Astuti et. al, 2019). This may due to the heavy workloads of teachers nowadays. Nevertheless, using multimedia to develop a simple yet effective learning aid is possible (Astuti et. al, 2019). Learning aids or media is important in learning process these days to enhance students understanding and keep them interested for a long time (Widodo et. al, 2023).

This situation encourages the researcher to develop an attractive digital learning media in the topic mitosis to help students learn mitosis effectively that saves cost and time.

1.4 Objective of the Study

i. To develop a digital comic 'Mitoflip' for subtopic Mitosis.

ii. To identify the validity of digital comic 'Mitoflip'.

iii. To identify the usability of digital comic 'Mitoflip'

1.5 Research Questions

i. What is the validity of the digital comic 'Mitoflip'?

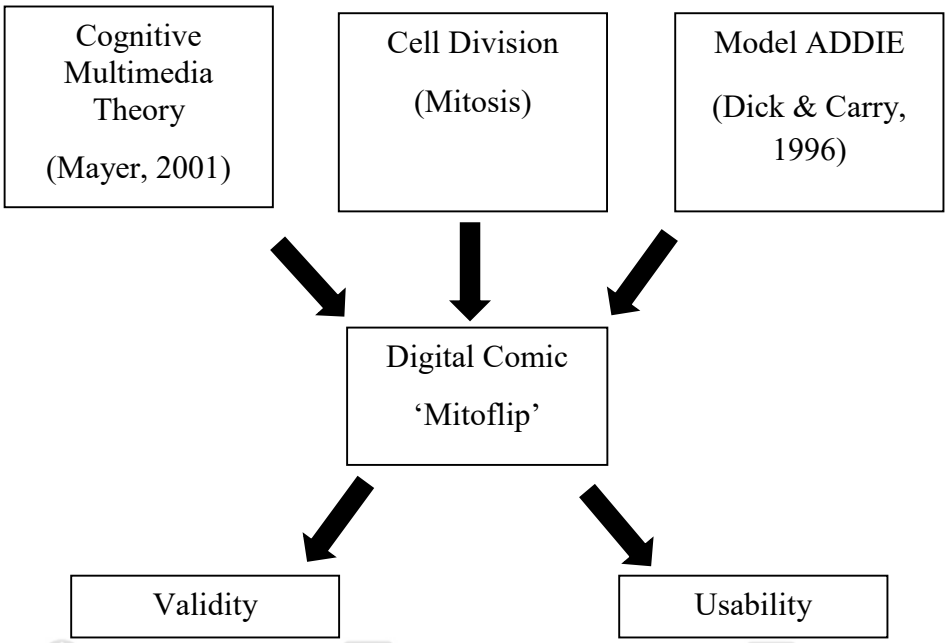
ii. What is the usability on the digital comic 'Mitoflip'?

1.6 Conceptual Framework

The conceptual framework guides the researchers by providing clear directions throughout the research. Therefore, conceptual framework is made up of concepts and theories that form the basis of the research (Tabuena, 2021). A conceptual framework describes the researcher's understanding of the study's components and variables, including their interactions with one another in a research (Luft et al., 2022). The purpose of the conceptual framework is to guide the researcher throughout the research until the data collection.

Figure 1.6

Conceptual Framework for the Research.



Cognitive Multimedia Learning theory by Mayer (2001) and ADDIE model by Dick & Carry (1996) were used in this study too develop the digital comic 'Mitoflip' in the subtopic Mitosis in cell division. The validity and the reliability of the digital comic will identified.

1.7 Limitation of the Study

Researcher has set a few boundaries in this research. Firstly, this study only involves two secondary schools in Kinta district, Perak. Secondly, the sample of this research are form 4 students from science stream whom taking biology subject. Thirdly, the

subtopic focused is only mitosis in topic cell division. Thus, the result of this research is not a representative of all the form 4 students in Malaysia.

1.8 Significance of Study

1.8.1 Teachers

This study will be beneficial for teachers as teachers can use digital comic 'Mitoflip' when teaching the topic cell division. Although the comic is in soft copy, this comic can be printed as hardcopy and given to the students. The usage of digital comic 'Mitoflip' helps to implement student- based learning which is important in teaching strategy in 21st century. This comic may also encourage the teacher to produce more comics in other topic in Biology as the development of this comic is simple.

1.8.2 Students

The digital comic 'Mitoflip' developed in this research can use as a learning aid by the students. Unlike most of the resources such as Textbook or other media, using comic as a learning aid can increase student's interest in learning Biology. This comic also contain glossary for mitotic terms to help students easily differentiate the terms such as chromosomes, chromatids and more. Students can also use this comic and role play in the classroom as the characters of the comic to learn mitosis happily and effectively.

1.9 Operational Definition

1.9.1 Developmental research

Beram et. al (2020) states that development research is based on Richey and Klein (2007) approach who describes that a development study is suitable to develop a product in education and can be used to test usability of a product. In this research, a digital comic is developed, using ADDIE model.

1.9.2 Mitosis

According to Abdullahi & Mohammed (2019) mitosis is a predominant and a fundamental topic under cell division and its necessary to acknowledge advance topic such as reproduction and growth and developmental. In this research, mitosis defined as the division of nucleus by parent cell into two nuclei called the daughter cells. These daughter cells are identical to are identical to parent cells in terms of genetic content and the number of chromosomes. This process only occur in somatic cells.

1.9.3 Usability

According to Weichbroth (2020) usability is the extent to which specified users can use a product to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use. In this context, the usability of digital comic 'Mitoflip' will be discovered in the aspect of usefulness, ease of use, design and user satisfaction.

1.9.4 Digital Comic

The combination of images, text, and symbols in digital comics is organized in a specific sequence to communicate information, utilizing technology for creation and layout (Fitria et. al, 2023). In this context, a digital comic named 'Mitoflip' is developed on the subtopic mitosis. The genre of this comic is fantasy due the imaginary characters involved such as hair cell and nail cell. This comic is also contain glossary to about mitotic terms such as spindle fibres, chromatids, chromosomes and more.

1.10 Conclusion

This chapter mainly discusses about the significant need for the research such as problem statement, objective of the study and research question. This chapter also contain the background of the study, conceptual framework, operational definition, and significance of the study and research limitation. These details will help the readers to see the overall picture of the research.