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International Teaching Aid

Reconnoitering Innovative Ideas in Postnormal Times

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2023

itac 2023 INTERNATIONAL TEACHING AID COMPETITION E-PROCEEDINGS

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Published by : Universiti Teknologi MARA Cawangan Kedah, 08400 Merbok, Kedah, Malaysia.



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PREFACE

iTAC or International Teaching Aid Competition 2023 was a venue for academicians, researchers, industries, junior and young inventors to showcase their innovative ideas not only in the teaching and learning sphere but also in other numerous disciplines of study. This competition was organised by the Special Interest Group, Public Interest Centre of Excellence (SIG PICE) UiTM Kedah Branch, Malaysia. Its main aim was to promote the production of innovative ideas among academicians, students and also the public at large.

In accordance with the theme "Reconnoitering Innovative Ideas in Post-normal Times", the development of novel ideas from the perspectives of interdisciplinary innovations is more compelling today, especially in the post-covid 19 times. Post-pandemic initiatives are the most relevant in the current world to adapt to new ways of doing things and all these surely require networking and collaboration. Rising to the occasion, iTAC 2023 has managed to attract more than 267 participations for all categories. The staggering number of submissions has proven the relevance of this competition to the academic world and beyond in urging the culture of innovating ideas.

iTAC 2023 committee would like to thank all creative participants for showcasing their innovative ideas with us. As expected in any competition, there will be those who win and those who lose. Congratulations to all the award recipients (Diamond, Gold, Silver and Bronze) for their winning entries. Those who did not make the cut this year can always improve and join us again later.

It is hoped that iTAC 2023 has been a worthy platform for all participating innovators who have shown ingenious efforts in their products and ideas. This compilation of extended abstracts published as iTAC 2023 E-Proceedings contains insights into what current researchers, both experienced and novice, find important and relevant in the post-normal times.

Best regards,

iTAC 2023 Committee Special Interest Group, Public Interest Centre of Excellence (SIG PICE) UiTM Kedah Branch Malaysia



FLIPPED LEARNING IN SCIENCE EDUCATION: USING HORMONE IN ACTION (POULTRY EDITION) AS A LEARNING TOOL

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ABSTRACT

Endocrine system in science education is one of the five most difficult topics to learn other than matter cycles, aerobic respiration, cell division, and genes and chromosomes. There are few reasons that lead to learning difficulties such as students' learning habits and students' negative perceptions and attitudes towards the topic. Hence, to address this issue, Hormones in Action are developed. This educational



comic e-book series explains the mechanisms of action that happen in organisms. The hormones are visualized as different characters such as humans and robots. The characters carry different roles in various situations and places to achieve a mission assigned to them. Each episode focuses on a different hormone and its specific role in the human body. There is also a special edition that educates about hormones in other organisms such as plants and animals. The latest episode of Hormone in Action covers current issues on poultry eggs. It explains how hormones like GnRH, FSH, and LH play a vital role in egg formation for laying hens. Using a waterpark theme, the reproductive tract is depicted as thrilling slides, taking viewers on an exciting journey of the ovum. This engaging episode combines scientific knowledge with a fun and relatable approach, making it easier for readers to understand the complex hormonal processes involved in poultry reproduction. By presenting the information in a visually appealing and adventurous way. Hormone in Action comic e-book series provide an enjoyable learning experience for students or public with low interest in reading long text and helps them to retain information as it is easier to remember visual graphics.

Keywords: Endocrine system, educational comic book, visual literacy

INTRODUCTION

The endocrine system is a complex network of glands and organs in the body that produce and secrete hormones and perform the function of chemical signaling. Hormones are chemical messengers that maintain homeostasis and regulate various physiological processes. In animals, hormones are secreted into extracellular fluid, circulate in the bloodstream, and transmit regulatory massage to all parts of the body. Each hormone binds to a distinct set of receptors in the body. Despite the fact that a given hormone can reach every cell in the body, only certain cells have receptors for that hormone. A hormone induces a response in a targeted cell, such as a change in metabolism. Without a receptor, the hormones will have no effect on the cells.

There are three major chemical classes of hormones: polypeptides (GnRH, LH, FSH), steroids (oestrogen), and amines (thyroxine, triiodothyronine), with varying solubility in aqueous and lipid-rich environments. Their response pathways will be determined by their solubility properties. Since they cannot diffuse through the plasma membrane, water-soluble hormones use cell-surface receptors to induce changes in cytoplasmic molecules and sometimes alter gene transcription. In contrast, lipid-soluble hormones

diffuse through plasma membranes to bind to receptor proteins in the cytoplasm or nucleus, thereby initiating alterations in gene transcription. Endocrine organs in the brain of a wide variety of animals integrate the endocrine system with the nervous system. In vertebrates, the hypothalamus is the primary coordinator of endocrine signaling. It receives information from the nerves and initiates neuroendocrine signaling in response to the surrounding environment. Oftentimes, neuroendocrine pathways involve hormone cascade. In succession, multiple endocrine organs, hormones, and signals to specific cells occur. For instance, the brain stimulates the hypothalamus to secrete a hormone, which in turn stimulates another endocrine gland to secrete a hormone, which ultimately affects the specific target cells. Due to its intricate interplay of hormones, feedback mechanisms, and diverse physiological effects, the endocrine system is therefore difficult and confusing for science students.

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For science teachers to effectively convey complex scientific narratives on the topic in a comprehensible manner has posed challenges in the teaching and learning process. This situation is evident especially when the teacher's aim is to engage students who are with different levels of scientific knowledge. Past research showed that the inability to relate concepts and the misconception of the endocrine system are the main cause of teaching and learning difficulties among teachers and students respectively. As stated by Howard (2017, May), it is evident that difficulties in learning concepts and topics in biology will have an impact towards students' enthusiasm and acquisition of biology learning outcomes.

Flipped learning approach is a learning strategy that enhances meaningful learning experience with the help of technology (Rahman et al., 2020). This learning approach has been reported to promote students' self-regulation, sense of responsibility and engagement in classroom activities (Bakis, 2012). To maintain the students' engagement in a flipped learning environment, a study found that students who learned using comic books found the aesthetic experience with visuals pleasurable (Avgerinou & Pettersson, 2020). Thus, the combination of both flipped learning approach and visual literacy of comic books provides an experience for students to create deeper, more complex, more exploratory, more comprehensive understandings of the topics discussed. This is possible in a flipped learning environment because students will have ample time to explore and apply the knowledge they have learned (Othman & Rahman, 2023), unlike traditional classroom approaches where students spent more time listening to chalk and talk.

The use of Hormone in Action comic book as a tool in a flipped classroom



environment serves an interesting educational tool for students to grasp the concept of endocrine system. It is based on the three significant characteristics: humor, visualizing learning, and contextualizing learning. Students are assisted by the amalgamation of images and texts in the comic book by changing their perspectives on the learning process (Gunraj et al. (2017). During real-time learning in a flipped classroom, students can discuss the images and text strips in Hormone in Action comic book which then leads to interpretations of concepts and the processes involved in the endocrine system. Such engagement does not only enhance students' critical thinking, but also provides the permanence of knowledge as it is visually attractive and the complexity and abstraction of the topic is minimized (Şengül & Dereli, 2010). This educational comic book is further supported by Dual Coding Theory, which explains that "basic mental structures and processes are associative networks of verbal and imaginal representatives" (Clark, 1991 p.151). Hence, it is evident that the use of this educational comic book supports the importance of images in students' cognitive development.

INNOVATION DEVELOPMENT

The Hormone in action is a simplified comic book suitable for light reading with short notes, mind maps, trivia and diagrams to enhance learning and understanding on endocrine system. The comic is expected to be published as e-book to suit the current generations' preference for its cheaper price. It uses simulation of hormones mechanism in a cell step by step to enlighten students understanding and creating visualization for easy memorizing.

Hormone in Action

This comic was originally developed to facilitate secondary school students in learning and understanding the topic related to the endocrine system in a visual approach. It then evolved into new episodes that comprehensively cover animal hormones that can also be found in humans. In line with the government's desire to disseminate academic knowledge to the wider community, the second episode of Hormone in Action highlights current issues related to the shortage of chicken and egg supplies that is affecting many countries, including Malaysia.





Figure 1: Episode 1 of hormone in Action

Figure 2: Episode 2 of Hormone in Action on Poultry Edition

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The of visualization technique in memorization involves the creation of mental imagery or visual representations in order to improve learning and retention of information. Memory palaces, also known as the method of loci, are utilized in this comic, whereby information is mentally associated with a familiar physical space, such as a tower, and recreational park. Research by Kroneisen and Makerud (2017) states that method of loci is more effective in memorizing words with low imageability. This indicates that the method of loci, which relies on creating associations between words and specific locations in a familiar environment, is more effective for remembering less visually memorable information. In order to facilitate visualization, Hormone in Action uses a specific setting comprised of familiar Malaysian locations. This familiar setting was chosen intentionally to aid readers in visualizing the content. In episode 1 (working towards nation building), the twin towers represent the trachea, whereas in episode 2 (adventurous ride: poultry edition), a water slide represents the reproductive tract of a laying hen.



Figure 3: A different setting in Hormone in Action: (a) Episode 1 features the Petronas twin

towers to represent trachea. (b) Episode 2 uses a water slide to represent reproductive tract of a laying hen for egg production.

In this comic book, all hormones are portrayed as either robots or humans, each with distinct personalities and functions (Figure 4). These characters respond to various



warning or alarm signals that indicate body imbalances. They regulate and control the situation through a variety of mechanisms that mimic the body's own regulatory processes, such as hormone cascades. By portraying hormones as human or robot characters in the comic, students are able to immerse themselves in the roles of the hormones and the regulatory mechanisms they represent. This aligns with the findings by Gunraj et al. (2017), which suggests that when readers actively engage with a story, they have the ability to infer and simulate the mental processes of the characters. As a result, they can recall and retain information in a manner like how the story characters remember it.



Figure 4: (a) Hormones feature in Episode 1: Thyroid Stimulating Hormone (TSH). (b) Hormones

feature in Episode 2: Luteinizing Hormone (LH).

COMMERCIAL POTENTIAL

Hormone in Action provides fun, low-cost, and interesting self-learning materials. It offers an engaging educational opportunity for individuals, including students and those with a limited interest in reading lengthy texts. By presenting information in a visually appealing format, it facilitates better information retention as visual graphics are often easier to remember. A preliminary was conducted online involving more than 50 respondents of A level and SPM students. The session has turned into a very interesting revision for them since they enjoy reading comic books. All of the students give very supportive feedback and would suggest using Hormone in Action as lastminute study materials instead of the traditional method. Undeniably, Hormone in Action can provide an effective learning strategy and suitable for students as well as public to promote scientific awareness on current issues via informative and engaging manner.



CONCLUSION

Challenges of 21st century learning demand a creative approach to provide students with understanding as well as self-motivation to learn. Hormone in action is developed to students or public to learn and understand about endocrine system in fun, light and entertaining way. This comic has high potential to be a useful tool used as light reading materials as public, or in various secondary, or tertiary level education institutions.

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