

# E-BOOK OF EXTENDED ABSTRACT

## THE 14<sup>TH</sup> INTERNATIONAL INVENTION, INNOVATION & DESIGN COMPETITION 2025



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# TECH MEETS BIOLOGY: STUDENT PERCEPTIONS ON METANEXUSBOT FOR LEARNING METABOLISM AND CELL DIVISION

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## ABSTRACT

Metabolism and cell division are fundamental components of the BIO150 course within the Diploma in Science (AS120) programme. Despite their significance, many students struggle to comprehend these complex and abstract processes through traditional lecture-based approaches. With advancements in educational technology, AI-driven chatbots present new opportunities to enhance student engagement and provide personalized learning experiences. This study investigates student perceptions of MetaNexusBot, an AI-powered learning assistant, in facilitating the understanding of metabolism and cell division through the lens of the RASE model (Resources, Activities, Support, Evaluation).

**Keyword:** AI, education, MetaNexusBot, RASE model, metabolism, cell division

## 1. INTRODUCTION

The Telegram Bot API is a powerful feature of the Telegram messaging platform, offering developers an HTTP-based interface to create automated bots capable of performing a wide range of tasks. These bots can fulfill various roles, including educational support, information retrieval, message broadcasting, reminder scheduling, service integration, and even controlling Internet of Things (IoT) devices (Rianto, Rahmatulloh, & Firmansah, 2019). Instant messaging (IM) platforms such as WhatsApp, Facebook Messenger, Microsoft Teams, and Telegram have become integral to daily communication, enabling seamless information exchange (Bini, 2025; Sulistiani & Al-Amin, 2025). In response, many service providers have adopted IM applications to deliver real-time information services, shifting from traditional user interfaces to more conversational ones. This transition is driven by rapid advancements in communication technologies and the global proliferation of smartphones, creating a strong foundation for the evolution of Telegram-based chatbots (Lin & Ye, 2023; Adamopoulou & Moussiades, 2020).

The primary aim of this study is to investigate students' perceptions of MetaNexusBot's effectiveness in supporting their learning of BIO150 course content. Specifically, the research explores how the bot's functionalities align with the four elements of the RASE framework: Resources, Activities, Support, and Evaluation. MetaNexusBot was strategically embedded within a structured learning module, enabling students to engage with it as a supplementary learning tool throughout the semester.

## 2. METHODOLOGY

This study involved 62 diploma-level science students from a government university in Perak, Malaysia, during the 2025 academic year. A purposive sampling technique was employed to ensure that participants possessed specific characteristics aligned with the research focus. Data were gathered through online surveys incorporating five-point Likert-scale items, and subsequently analyzed using descriptive statistics. The study hypothesized that the implementation of MetaNexusBot represents an authentic teaching strategy that fosters a student-centered learning environment, in which students are actively engaged through the use of educational technology.

## 3. FINDINGS

Preliminary findings indicate that the majority of students found MetaNexusBot engaging and useful, particularly for revising and understanding difficult subtopics such as glycolysis, the Krebs cycle, and photorespiration. The integration of the MetaNexusBot within the RASE model was evident: (1) as a **Resource**, students accessed diagrams and interactive explanations; (2) through **Activities**, they completed exercises containing problem-solving tasks via the bot; (3) under **Support**, the bot provided instant clarification; and (4) in **Evaluation**, students used self-check questions to monitor their progress.

**Table 1** Collated Responses Related to RASE Model

Survey Question	Survey Response Score					Grouped Data (%)	
	1	2	3	4	5	1+2+3	4+5
<b>Student Perception on use of MetaNexusBot for RESOURCES</b>							
R1. The MetaNexusBot provides easy access to relevant BIO150 learning materials.	0	0	4	15	43	6	94
R2. The information delivered by the MetaNexusBot helped me understand the key concepts of BIO150.	0	1	2	20	39	5	95
R3. The MetaNexusBot presented learning materials in a clear and organized manner.	0	0	4	17	41	6	94
R4. I can use the resources on the MetaNexusBot anytime I need.	0	0	4	13	45	6	94
R5. The materials (e.g., videos, exercises, notes) are appropriate for my level of understanding.	0	0	4	18	40	6	94
<b>Student Perception on use of MetaNexusBot for ACTIVITIES</b>							
A1. The learning tasks provided by the MetaNexusBot were engaging.	0	0	6	22	34	10	90
A2. I was encouraged to think critically while interacting with the MetaNexusBot.	0	4	11	20	27	6	94
A3. The MetaNexusBot made learning BIO150 more interactive and enjoyable.	0	0	5	15	42	8	92
A4. I feel motivated to complete the activities provided in the MetaNexusBot.	0	1	7	23	31	11	89
A5. The activities in the MetaNexusBot help me apply what I've learnt.	0	0	3	24	35	5	95
<b>Student Perception on use of MetaNexusBot for SUPPORT</b>							
S1. The MetaNexusBot provided adequate guidance when I faced difficulties.	0	0	10	25	27	16	84
S2. I felt supported when using the MetaNexusBot to explore the BIO150 topics	0	0	4	25	33	6	94

S3. The MetaNexusBot responded effectively to my inputs.	0	0	5	24	33	8	92
S4. I can easily get help or clarification when I need it	0	0	5	28	29	8	92
S5. I feel supported while using the MetaNexusBot for learning.	0	0	3	25	34	5	95
<b>Student Perception on use of MetaNexusBot for EVALUATION</b>							
E1. The MetaNexusBot helped me check my understanding of BIO150 concepts.	0	0	4	28	30	6	94
E2. I received timely and useful respond through the MetaNexusBot.	0	0	5	25	32	8	92
E3. The exercises reflect what I've learnt in BIO150.	0	0	6	23	33	10	90
E4. I am more confident in my BIO150 knowledge after using the MetaNexusBot.	0	1	6	28	27	10	90
E5. I find the option of "Rate Yourself" is motivating.	0	0	3	30	29	5	95

Grouped data refers to the proportion of responders who chose 1, 2, 3, 4 or 5 scale corresponding to “Disagree” and “Agree”, and expressed as a percentage (%).

The findings (Table 1) reveal a strong positive student perception, with over 94% agreement regarding the use of MetaNexusBot to access learning resources in the BIO150 course. Students regarded the MetaNexusBot as a convenient tool for retrieving relevant materials at any time, and the content was deemed appropriate for their academic level and needs. Feedback also indicated favourable views of the learning activities facilitated by MetaNexusBot, with over 90% agreement across most items. One item (A4) showed a slightly lower score (89%), suggesting a minor area for improvement in activity design. Student perception of the support provided by MetaNexusBot was equally positive, with most items scoring above 92% agreement. However, one item (S1) registered a lower rating (84%), which may point to a perceived lack of comprehensive instructional guidance. Evaluation features received strong endorsement, with all related items scoring above 90% agreement. Students reported that the bot effectively assisted in checking and reinforcing their understanding of BIO150 concepts. Collectively, these results underscore MetaNexusBot's effectiveness in fulfilling the RASE model's components. Its use contributed to a shift away from passive learning towards a more interactive and enjoyable learning experience. While further development is needed to enhance motivational elements and expand instructional support, MetaNexusBot is seen as a valuable educational companion supporting self-evaluation, reinforcing comprehension, increasing learner motivation, and promoting active learning in biology.

### 3. CONCLUSION

This study concludes that AI tools like MetaNexusBot can serve as valuable application in biology education when integrated within a sound pedagogical framework. The RASE model ensures that such technologies are adopted not merely as digital innovations, but as intentional learning tools that support meaningful educational outcomes. The findings suggest that chatbot-assisted learning holds potential for broader application across subjects and disciplines, offering a scalable approach to enhance student engagement and deepen conceptual understanding, particularly in the sciences.

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