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**Country Report**

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## **Refined Malaysia's Pre-University Biology Syllabus with a Focus on Sustainable Development and STEM**

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As the global community increasingly emphasizes the importance of sustainability, education systems must align with these values. Recent PISA results highlight the challenges faced by Malaysian students in mastering STEM techniques, revealing gaps in critical thinking and problem-solving skills. In response, it is crucial for Malaysia to reorient its education system towards sustainable development and the integration of STEM principles. This manuscript reports on the Malaysian government's effort to enhance sustainable development and STEM education by refining pre-university programs, specifically the Sijil Tinggi Persekolahan Malaysia (STPM) Biology syllabus to integrate sustainability education and foster a deeper understanding of STEM. This revision aimed to equip students with not only theoretical knowledge but also practical skills relevant to addressing real-world environmental challenges. By embedding sustainability concepts within the syllabus, the initiative seeks to cultivate critical thinking, problem-solving abilities, and ethical decision-making in students. Furthermore, the updated syllabus encourages collaboration and innovation, preparing students to be involved in sustainability and scientific research. This restructuring reflects the government's commitment to developing a workforce equipped for the challenges of a rapidly changing global economy, especially in green technologies and sustainable industries. Ultimately, the refined STPM Biology syllabus ensures that students are prepared for further education or the workforce with relevant skills and knowledge.

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### **INTRODUCTION**

There are a few pre-university programmes provided by the Malaysian Government. Sijil Tinggi Persekolahan Malaysia (STPM) is one of the most prominent programmes offered for students aged 18–19 (Setapa et al., 2024; Sivalingam, 2020). This programme aimed to prepare students for tertiary education, and used to be the benchmark for entering into local universities as well as universities around the world (Qi & Binti Saharan, 2024).

In 2024, Malaysia's performance in STEM (Science, Technology, Engineering, and Mathematics) education showed a notable increase in STEM

enrolment, with 45.73% of students in schools now participating in STEM programs (Ibrahim et al., 2024). The increment in students taking STEM education reflects some success in government initiatives to boost interest in these fields. This progress is critical for Malaysia's ambitions to enhance its technological and scientific capabilities. However, despite this positive trend in enrolment, the overall situation remains challenging. There is still a significant shortage of qualified STEM teachers, especially in rural areas, which hampers the quality of education. Schools in these areas often lack the necessary resources, such as modern

laboratories and proper equipment, which are essential for effective STEM education. Furthermore, the perception that STEM subjects are difficult continues to deter many students from fully engaging with these fields (Dost, 2024).

In addition, sustainable development has become a central theme in global policy discussions, emphasizing the need to balance economic growth, environmental protection, and social equity (Svärdh, Brodin, Pettersson, & Palstam, 2024). In response to this global trend, education systems worldwide are being urged to incorporate sustainability into their curricula. Malaysia, as part of its broader educational reform efforts, must consider how to integrate sustainable development into its pre-university Biology syllabus to prepare students for the challenges of the 21st century.

Hence, a task force was put into action to refine the current STPM Biology syllabus to ensure the competency of Malaysian's younger generations in this changing and challenging developing society few years ago (Sivalingam, 2020; Zariyawati, 2011). Recently, a restructured and refined Pre-University STPM Biology Syllabus was introduced. This new Biology syllabus will be implemented in year 2025.

### **CURRENT STATE OF PRE-UNIVERSITY BIOLOGY IN MALAYSIA**

The current pre-university Biology syllabus (before the refining process) in Malaysia is well-rounded, covering fundamental topics such as genetics, evolution, ecology, and human physiology. However, the syllabus predominantly focuses on traditional biological concepts without sufficient emphasis on their relevance to sustainable development. While topics like ecology touch upon environmental issues, there is limited integration of broader sustainability concepts, such as the impact of human activities on the environment, biodiversity conservation, and the principles of

sustainable resource management. The impacts of lacking these concepts integrated in the syllabus were revealed partially in the PISA results Malaysia achieved in the past few years. Hence, an effort was made in the national level to rectify the issue by refining the syllabus of all subjects offered in STPM curriculum.

### **IMPORTANCE OF SUSTAINABLE DEVELOPMENT AND STEM IN BIOLOGY EDUCATION**

Sustainable development is integrated into the Biology syllabus for several reasons:

#### **1. *Holistic Understanding of Environmental Issues:***

Students need to understand the interconnectedness of biological systems and human activities. By studying sustainable development, they can appreciate the impact of their actions on the environment and learn how to mitigate negative effects through sustainable practices.

#### **2. *Preparation for Future Challenges:*** As future scientists, policymakers, or informed citizens, students must be equipped with the knowledge and skills to address global challenges such as climate change, food security, and biodiversity loss.

#### **3. *Fostering Responsible Citizenship:*** Education for sustainable development encourages students to think critically about their role in society and the environment, promoting values of stewardship, equity, and social responsibility.

### **CHANGES MADE IN THE REFINED STPM BIOLOGY SYLLABUS**

The revised STPM (Sijil Tinggi Persekolahan Malaysia) Biology syllabus in Malaysia has undergone several significant changes to better align with current scientific developments and educational needs (Majlis Peperiksaan Malaysia, 2024). Here are some of the key changes:

**1. Incorporation of Modern Biological Concepts:**

The new syllabus includes updates to reflect the latest advancements in biology. Topics such as genetic engineering, biotechnology, and molecular biology are given more emphasis to ensure students are up-to-date with current scientific knowledge.

**2. Sustainable Development Focus:** There is a greater integration of sustainable development topics, including environmental conservation, biodiversity, and the impact of human activities on ecosystems. This reflects a growing awareness of the importance of sustainability in biology education.

**3. Enhanced Practical Components:** The syllabus now places a stronger emphasis on practical skills and hands-on learning. Laboratory work, field studies, and investigative projects are more thoroughly integrated into the curriculum to develop students' practical and analytical skills.

**4. Critical Thinking and Problem-Solving:** The revised syllabus encourages critical thinking and problem-solving abilities by introducing more complex, real-world biological issues for students to explore. This includes case studies and problem-based learning activities.

**5. Use of Technology in Learning:** There is a greater emphasis on using digital tools and resources in the learning process. This includes online databases, virtual labs, and other digital platforms that can supplement traditional teaching methods.

**6. Assessment Changes:** The assessment structure has also been updated to include a wider range of evaluation methods. In addition to traditional exams, students are assessed through continuous assessment tasks that include lab reports, projects, and presentations.

These changes aim to make the STPM Biology syllabus more relevant to today's scientific

landscape and to better prepare students for higher education and careers in the biological sciences.

## CHALLENGES IN INTEGRATING SUSTAINABLE DEVELOPMENT AND STEM

The integration of sustainable development into the Biology syllabus presents several challenges:

**1. Curriculum Overhaul:** Introducing sustainability requires a significant overhaul of the existing curriculum. This includes updating teaching materials, redesigning lesson plans, and incorporating new assessment methods that emphasize critical thinking and problem-solving.

**2. Teacher Training:** Effective teaching of sustainable development concepts requires teachers to be well-versed in both Biology and sustainability. Continuous professional development is needed to equip teachers with the necessary knowledge and pedagogical skills. Teacher training was provided to new and in-service teachers immediately after the launching of the refined syllabus nationwide.

**3. Resource Availability:** Schools, especially in under-resourced areas, may lack the necessary materials and support to teach sustainability effectively. This includes access to up-to-date textbooks, digital resources, and opportunities for experiential learning through fieldwork or projects. Some of the centres offering STPM Biology study, especially centres in rural areas or with less enrolment, were relocated to a more centralised location to ensure better allocation of resources for teaching and learning Biology.

To address these challenges, experts are advocating for a more engaging and practical STPM Biology curriculum, with the aim of increasing awareness campaigns about the opportunities in Biology careers, and better training and incentives for STEM teachers. Additionally, there are calls for leveraging digital technology, such as educational

apps and gamification, to make STEM subjects more accessible and interesting to students.

## CONCLUSION

The inclusion of sustainable development in Malaysia's pre-university Biology syllabus is a necessary step towards preparing students for a challenging future. By revising the curriculum to integrate sustainability concepts, Malaysia can foster a generation of students who are not only knowledgeable in Biology but also equipped with the skills and values needed to contribute to a more sustainable world.

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