

PLANNING IN ENHANCING HIGHER ORDER THINKING AMONG SCIENCE'S STUDENTS: THE FUTURE OF GREEN TECHNOLOGY

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Abstract

The initiatives of green technology module through curriculum is an anticipated outcome of the continuous integration of Science, Technology, Engineering and Mathematics (STEM) into the syllabus of educational curriculum in schools. This attempt is among the accomplishments by the Ministry of Education in promoting enthusiasm and engagement of students in STEM. Critical thinking, innovating thinking, problem solving and scientific thinking are the components that should be present in STEM education to build up students' higher order thinking skills (HOTS). In this concept paper, green technology implementation along the process of learning which could build up students' thinking skills is discussed. According to the literature, there are problems that arise due to the lack of understanding to implement green technology that would eventually impact STEM education. Nevertheless, in implementing it, numerous aspects and disputes have to be put into consideration. In this study, the researchers will find practical strategies that are usable in building up higher order thinking skills of students in which they will experience a number of hands-on green projects.

Keywords: Green technology, HOTS, Higher Order Thinking, STEM

INTRODUCTION

Education in Malaysia is now placing emphasis on the importance of STEM education that empowers students to learn through multi-disciplinary learning, an inquiry-based approach and problem-solving approach. Through discovery and structured research experience, students can learn about science. STEM Education Approach should include all the elements that allow the students to have the ability to solve problem, and have critical, innovative and scientific mind which could intensify HOTS among students. Each student must also learn research skills and continue to gain lifelong knowledge, so that students can link different fields of knowledge and build new knowledge (Lee, Kamarudin, Talib & Hassan, 2016). STEM education also constitutes the most promising teaching and learning innovation, especially to prepare students honing higher-order thinking skills as well as to attract students' interest in learning, which is crucial in adapting to the competitive era (Wahono, Lin, & Chang, 2020). In the fast-growing world of technology, HOTS and the capacity to develop are indispensable. Therefore, to concentrate on HOTS, revision of the curriculum is a very crucial step.

For example, through the application of HOTS in pedagogy and also evaluation, inquiry-based learning and high-level questioning are able to encourage higher order thinking skills which will result in the enhancement of accomplishment by students. The learning process can only be helpful to students if they are actively interested in the process of reasoning (Vygotsky, 2012). In the 21st century, therefore, teaching and learning should concentrate more on individualistic, learner-centred, project-based and cooperative learning, and also on genuine evaluation (Barak & Assal, 2018). These approaches enable higher intelligence skills and cognitive development to be employed. Teachers can use various methods, including questioning approaches, problem-solving exercises, project-based

learning, thinking instruments, simulations, discussions, and the increase in terms of task difficulties (Baharin, Kamarudin, & Manaf, 2018). Problem based learning approach also contains the criteria for 21st century learning that will foster higher order thinking skills among students (Mohd Najid, Kiong, Che' Rus, & Budiman, 2019).

By the means of inquiry-based learning and high-level questioning in teaching and evaluation, the application of HOTS will allow students to have higher order thinking skills and this will bring improvement to the students right away. Students will gain benefits in the process of learning only if the thinking process involves their participation. The learner-centred and self-reliant learning and project-based learning, 21st century collaboration along with genuine assessment must be further focused on teaching and learning. These techniques allow for better understanding and cognitive learning. Different strategies could be used by instructors, for example questioning methods, problem-solving exercises, project-based learning, thinking tools, simulations, talks, role plays. For instance, student-centered learning (SCL) has been an efficient way to enhance the experience of student learning by applying different methods, tasks or assessments to understand a specific problem and this is appropriate to understand the concept of science as an environment which enables students to control the learning experience in a real way.

We need great knowledge and have to understand our actions in approaching the world. Besides, it is essential to change people's activities against their related surrounding. According to Chan et al. (2014), a person's good characters and characteristics are the personal characteristics that they use to achieve, retain, and also to acquire jobs. On the other hand, green skill includes mechanical skill as according to Kamis et al. (2017), for instance, Brown (2013)'s perspective where both hard and soft skills are imparted by green skills. For future growth in human resources, it is now very important to be trained with generic green skills, because Malaysia can develop in line with the green economy by the means of the 4th industrial revolution.

Government's Role Towards Developing and Intergrating Green Technologies in The Education System.

To achieve a sustainable leadership, the government should move towards a more sustainable development. Yet, achieving this goal will not lead to sustainable growth without education. People who are educated, trained and optimistic can build a more prosperous and secure future, which is the cornerstone for creating a greener society. For this reason, educational institutions must have an experience which must be learned and improved to maximise their talents (Abdullah, 2012). An accurate approach is to put green skills as a core module in which green competences are included in the integrated or stand-alone curriculum. However, despite the introduction of environmental education in the curriculum since long time ago, the awareness on environment is still poor (Azmi et al. 2015).

Green growth is the increase in resource use with efficiency, safe, and sustainability. A strong commitment to green growth ensures the preservation and protection of the climate and natural resources of the country for the sake of current generations and in the future (Fien & Guevara, 2013). As in the first transformation strategy for vocational education, it offers a vocational training programme which can generate professional human resource for work and is ready for higher education. The curriculum should also be transformed into vocational education (Pavlova & Huang, 2013).

In the 11th Malaysia Plan, the fifth strategy noted that the development of an effective curriculum system is a necessary start for each level of students' fertilisation of green technology culture. Green skills along with green technologies are therefore very useful to be introduced in primary schools to encourage from an early stage before students enter secondary schools. Where the green values should be synonymous with the student in order to apply green and green technology skills in the development of a product while they move to higher education and practice skills using what they have and experienced prior to taking green growth into account (Colijn, 2014).

The introduction of green technology by the government is perceivable as two innovative components in design or production of green techniques. The aim of producing products and designs that are simple, friendly, and realistic for our country is realized through encouraging students at school to create products. As researchers, we can develop high-level technology that can produce a product without having to waste resources like water and energy. Fresh designs that can be sold for both local and export applications should include functional designs.

Applicable Green Skills for Secondary School Curriculum

The curricula should include green skill topics based on green technology adapted to high school students. Moreover, the knowledge they receive is deeply rooted within them (Brown, 2013; Cedefop, 2012; Zuhair, 2015). Incorporating green skills in their everyday lives, students are suggested to be green and begin to utilise resources that are recycled for education like cane, bamboo, bottles made up of plastic, coats, wood paring and scrap plastic pipe. For example, they may practise bringing lunch to work instead of using polystyrene (Arasinah et al., 2016) in their daily lives. Next, based on Carbonel (2015)'s report, the respondents perceive the necessity for stimulus and campaigns by the government, like the reduction of the use of non-environmentally friendly Styrofoam, or plastic containers, separation of food with plastic bags and own containers to buy food. In this respect, green practice is constantly implemented.

Following the KPM: Malaysian of Educational (2011), undesired resources when being used can lead to cost-saving and stimulate both economics and creativity when a student is engaged in a project. Students would have high awareness on the importance and in many innovative ways of the present tools around them with this approach. Therefore, it is essential that knowledge and practices related to recycling of used materials are supplied by students, especially in RBT subjects. Recycling waste products will protect the environment and help individuals to have green practice in their everyday lives. The objective set up by the government is producing human capital with high skills while maintaining sustainable development and green technology (Mass, Moss, Hopkins & Ross, 2012). At the same time, Brown (2013) define the act of recycling is "not only the conservation of resources, but the added value found in the processing of certain ingredients."

We could use our skills and expertise to carry out reworked innovation. It may therefore be called "upcycled" if people can add value to the commodity; economic, intellectual, emotional, and material by the reuse process. Communities should follow green practices as a way of life. Various initiatives have been launched by the government.

Environmental Awareness, Conservation and Protection

The main aspect of the launch of the Green Skills programme is raising public awareness that rejuvenation of education is critical to sustainability. If school administrators ignore the vital links between education and sustainable development, education will not be rehabilitated to resolve sustainable development (Raudsepp, 2001). If citizens recognise that education will increase the potential to implement national policies, regional land, resource, and local programmes, then education can be refocused on sustainable development (Rattan et al., 2016).

Malaysian government's target is to minimise the level of carbon dioxide by up to 40 percent by 2020. The Malaysian government came up with the 11th Malaysian plan sustainable development in line with this goal (Zakaria et al., 2018). This strategy is partly focused on sustainable growth. Under the 11th Malaysian plan, six strategies exist: i) comprehensiveness, ii) enhancing well-being for everybody; (iii) acceleration of manpower production in advanced country; (iv) green growth in terms of being sustainable and resilient; (v) establishing infrastructure for the growth of economy.

Based on (Maclean et al., 2018), the purpose of the two targets are ensuring the achievement of the objectives which are having a prosperous economy and becoming a developed country by 2020 (Rattan et al., 2016). Next emphasis focuses in particular on green growth in a number of four main aspects, for instance, improving green growth ecosystems and the principle of sustainable consumption and production, protecting current and future generations of natural resources and improving natural disasters and climate change resilience (Horvatinčić, Demonja, & Tišma, 2016). Therefore, in such circumstance, green growth carries the meaning of achieving a model with resilience, and efficiency in resources, have low-carbon and economic model contributing towards enhanced life quality along with promoting citizens' well-being.

CONCLUSION

In conclusion, it is essential to have the introduction of green skills in learning particularly the secondary school students as such abilities or skills can generate information, visibility and also understanding for younger generation of green skills and protect the environment (Kamis et al., 2017). Green skills are carefully integrated and led through green technology to sustainability. Green technology is a sustainable, clean, and environmentally friendly technology aimed at protecting the natural resources and nature. Everyone should love the world to build a sustainable life. An integration of those concepts should be made into school curriculum, studying material, teaching-learning processes through design and technology subjects, and should be expressed in all activities. Therefore, students need general green skills training. Teachers must play a role in the realisation of green teaching and learning skills and must also explain the real environmental conditions to improve students' attitudes, actions, and environmental awareness (Ifegbesan, 2010). The school also has a role to play in contributing to environmental sustainability in the best way possible.

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