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Systematic Studies: Students' Attitudes Toward Plants and Plant Science Learning

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Abstract

The term '*plant blindness*' has been used worldwide to indicate students' attitudes who are less concerned about surrounding plants. However, there is still no study on students' attitudes towards plants in Malaysia. Therefore, this study was conducted to analyze and synthesize the latest trends of students' attitudes towards plants in science learning. The database from Scopus was used to search for articles, and a total of 16 articles were synthesized. The analysis results found that the trend of research on students' attitudes towards plants is often conducted in 2021, and it can be synthesized that students' attitudes towards plants are still at an unsatisfactory level because students are more interested and knowledgeable about animals better than plants. It is also synthesized that the learning method to overcome students' negative attitudes towards plants is exploration and observation in their surrounding area. The results of this study are expected to help teachers choose appropriate methods to attract interest and change students' attitudes towards plants. It is recommended to conduct further research to see the level of students' attitudes towards plants and the teaching of Malaysian teachers.

Keywords: Student Attitudes, Plant Science, Learning Approach, Plant Blindness.

Introduction

Plant science is a branch of biological science education better known as botany. Based on the book Introduction of botany (Stevens, 2012), botany is the scientific study of plants and quasi-life. Since preschool, the Malaysian Ministry of Education has ensured that Malaysians receive science education involving plant topics. The purpose of the School Standard curriculum in educating Malaysian students on plant-related topics is to develop a sense of responsibility towards society and the environment in students. The National Biodiversity Policy (Mohamad, 2015) seeks to foster awareness of the importance of biodiversity in Malaysia and make Malaysia a center of excellence in conserving, researching, and using the world's tropical biological diversity. To ensure that Malaysians have a scientific mindset to conduct research, scientific investigation has been introduced since primary school (KPM, 2013). Besides, approaches such as project-based learning and inquiry-based learning (KPM 2014) are introduced to build scientific thinking. Therefore, teachers can attract students to venture into the plant science field with the suggested approaches.

Students' attitudes towards plant science have been studied abroad, and studies have found that this topic is less popular with students than themes involving animals. (Bakar et al., 2020; Strgar, 2007). The term 'plant blindness' has been used to indicate students' lack of concern for plants. This is closely related to the physiology and interactions that humans seem to have eyes and nose. At the same time, plants do not have such physiology. Only some students are interested in plants because of the shape and color of the leaves that stand out (Strgar, 2007).

In addition, some issues show that students do not feel the importance of plants to the environment. This is evidenced by a study which has found that university students in Malaysia have a high level of awareness about the environment, but the attitude of students is still at a weak level (San and Norzaini, 2011). Even students' attitudes towards plant topics are important because the statistics of students pursuing studies in this field are declining. This can be proved by the Statistical Report from the Ministry of Higher Education (2020), which found a decrease in students who venture into fields involving agriculture. This indicates that students are less interested in fields involving plants.

Although various studies have been conducted in Malaysia that is related to the topic of plants at the school level (Ang, 2014; Bakar, 2012; Nor Hamidah & Zanaton, 2014; Suriyati et al., 2014) these studies are focused on teaching and learning (PdP) methods for teachers' level of readiness and for the concepts that are involving plants and misconceptions of processes in the plant. There is still no study in Malaysia that has studied students' attitudes on plant topics.

Attitudes can be seen from affective, cognitive, and psychomotor where affective involves student motivation, cognitive is student knowledge, and psychomotor is student behavior. This study examines students' attitudes through three main domains: affective, cognitive, and psychomotor. The affective component involves students' positive and negative emotions towards the topic. In contrast, the behavioral component consists of behaviors towards the topic, such as asking many questions and giving full attention during class. At the same time, the cognitive component is related to the knowledge and development of students' intellectual skills on a topic. These three components are interconnected and help form and consolidate individual attitudes.

Research Objectives and Research Questions

The main purpose of this study was to systematically review the trend of student attitude towards plants and the teaching approach for plant topics. The research question for this study is:

- (a) What is the attitude of students towards plants?
- (b) What is the teaching approach used to teach plant topics in science education
- (c) What is the effect of teaching and the level of students' attitudes towards plant topics?

Literature Review

Plant Science Education In Malaysia

The education system in Malaysia has introduced plant science to students since they were in primary school (KPM, 2014). Since primary school, referring to the standard primary school curriculum (KSSR), grades one to six students are introduced to plant parts, growth, reproduction, response, survival of plant species, and plant interactions in general.

However, when students are in secondary level, students are introduced to plant science in more detail and use the language and terminology of plant science. (Bahagian Pembangunan Kurikulum, 2016). For example, students are introduced to the terms xylem, stoma, cotyledon, and plumule. The terms used are becoming difficult, and the concept is more complex. Therefore, the difficulty level for this plant topic increases because the concepts and terminology used cause students to be less interested in learning plant-related topics. (Sarabi & Gafoor, 2018).

Difficulties in the topic of plants occur when there are students who do not understand the concepts involved. Not understanding the idea needs to be prevented before entering university (Suriyati et al., 2014). Based on a literacy study by Wynn et al. (2017), the study of misconceptions on plants that researchers frequently do is related to photosynthesis and respiration. However, misconceptions on other topics such as plant cells, plant genetics, plant classification, plant physiology, and plant ecology are less common.

Research in Malaysia regarding misconceptions in plants that is often done is the concept of photosynthesis and respiration (Ang, 2014; Bakar, 2012; Suriyati et al., 2014). A study conducted by Bakar (2012) to test the level of understanding of form two students on the concept of photosynthesis found that if the misconceptions were not corrected, the confusion would develop with the development of knowledge. This is supported by Ang (2014) in his study, stating that misconceptions need to be emphasized since primary school. When students study in secondary schools and tertiary institutions, students will be able to build new knowledge.

Students' Attitudes Towards Plant Topics

Students' attitudes towards plant education have been studied abroad, and studies have found that this topic is less popular with students than themes involving animals. (Bakar et al., 2020; Strgar, 2007). The term 'plant blindness' has been used to indicate students' lack of concern for plants. This is related to the physiology and interactions that similar humans such as having a nose and eyes. In comparison, plants do not have such physiology. Students are interested in plants because of the shape and color of the leaves that stand out (Strgar, 2007).

In addition, there are also issues showing students do not feel the importance of plants to the environment. This is proven by several studies that found that university students in Malaysia have a high level of environmental awareness, but the student's attitude is still at a weak level. (San & Norzaini, 2011). Even students' attitudes towards plant topics are important because the statistics of students pursuing this field are declining. This can be supported by the Statistical Report from the Ministry of Higher Education (2020), which found a decrease in students who further study involving agriculture. This indicates that students are less interested in fields involving plants. Therefore, this study will look at the level of students' attitudes towards the topic of plants recently because, based on Norazilawati et al. (2013), there was a decline in students in science and among the causes of the decline were from schools.

Teacher Teaching Strategies on Plant Topics

Effective teaching and learning will enhance student performance (Bakar 2012). If the teacher uses teaching and learning methods appropriate to the student's ability, then the student's performance will be improved. This is related to a statement in literacy by Nur Amelia (2019), which states that effective teaching means that the teacher is able to identify the difficulty of the topic and create diversity in teaching because each student has different interests and

knowledge. Therefore, teaching and learning methods are one of the factors that influence the tendency of students' interest and attitude towards the subject (Nor Hamidah & Zanaton, 2014).

In conclusion, this literature review has described the plant science education available in Malaysia, and previous studies have also shown that plant science is less popular with students so the term plant blindness is used to indicate human attitude syndrome that is less aware of the plants around us and its importance.

Methodology

A systematic review is a study that identifies, selects, critically evaluates, and analyzes data from selected studies (Higgins et al., 2012). Through this systematic review, the researcher's future study is well-founded, and the researcher also can identify gaps and directions that need to be addressed.

The purpose of this study is to comprehensively understand the students' perspective that is focused on students' attitudes towards the topic of plants and teachers' teaching for that topic. Based on Xiao and Watson (2017), a systematic review has three main stages. The first is planning by identifying the need to study specific research questions and construct research protocols. In this systematic review, the research question is (a) what is the attitude of students towards plants (b) what is the teaching approach used to teach plant topics in science education, (c) what is the effect of teaching and the level of students' attitudes towards plant topics. Next is to identify and select the main study, extracting, analyzing, and data synthesis is carried out. To undergo this step, the guidelines of Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA), which involves four phases, namely identification, screening, qualification, and inclusion, are used. Lastly is to write a research report. Diagram 1 shows the flow chart for the systematic review according to the PRISMA guidelines.

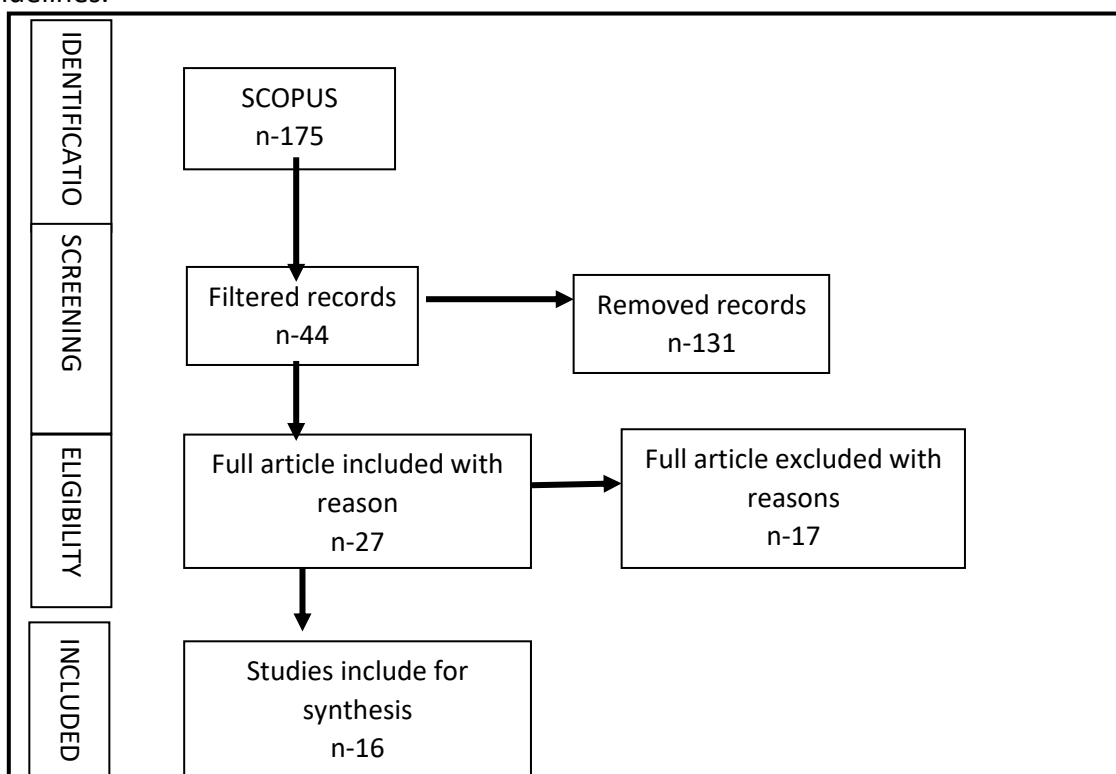


DIAGRAM 1. Flow chart for systematic review according to PRISMA guidelines.

The database used to search for articles and journals is SCOPUS, and the keywords used are "(Plant Blindness) AND (student) AND (attitude)." The time frame for the articles searched is published from 2017 to 2021. There is no restriction regarding the research design use. It can be either qualitative, quantitative, or even mixed. Meanwhile, the sample involved is also not restricted to any stages. The results found that only 16 articles out of 175 will be used for synthesis.

Findings

A total of 16 articles were reviewed, and the focus of the study was plant science, learning approaches, and attitudes towards plants. These three scopes were selected based on the purpose of the study, which is to identify attitude trends and teach plant topics from students' perspectives. In addition, to see the trends, the date of the study, methodology, and research results of the article were focused on. Table 1 summarizes the results of the analysis of 16 articles.

TABLE 1. Summary of study findings

Researcher	Country	The focus of the study			Sample				Method		
		PT	LA	AP	P-S	PS	SS	US	T	QT	QL
Panitsa et al., 2021	Greece	/	/	/			/	/	/	/	
Wells et al., 2021	USA	/	/	/				/		/	/
Brownlee et al., 2021	USA	/	/	/				/		/	
Pedrerera et al., 2021	Spain	/		/			/			/	/
Kubiatko et al., 2021	Slovakia	/		/			/			/	/
Borsos et al., 2021	Serbia	/	/	/				/		/	
Amprazis et al., 2019	Greece	/	/	/		/				/	/
Melis et al., 2020	Norway	/		/	/						/
Lampert et al., 2020	Austria	/		/			/				/
Bakar et al., 2020	Turkey	/	/				/				/
Kissi & Dreesmann, 2020	German	/	/	/		/	/			/	
Borsos, 2018	Serbia	/	/	/		/				/	
Kaasinen, 2019	Finland	/		/			/			/	
Comeau et al., 2019	USA	/	/	/		/				/	
Sobieszczuk-Nowicka et al., 2018	Poland	/	/					/	/	/	/
Kissi & Dreesmann, 2018	German	/	/	/		/	/			/	

Note: Plant Topics (PT), Learning Approaches (LA), Attitudes towards Plants (AP), Pre-school (P-S), Primary School (PS), Secondary School (SS), University Students (US), Teachers (T), Quantitative (QT), Qualitative (QL).

Discussion

Trends in the Study of Students' Attitudes towards Plant topics and Learning

Based on the Scopus database, the study found that the trend of research on plant topics in the last five years is often done in 2021, which consists of six studies (Borsos et al., 2021; Brownlee et al., 2021; Kubiatko et al., 2021; Panitsa et al., 2021; Pedrerera et al., 2021; Wells et al., 2021). The trend also indicates that there has been an increase in studies conducted

regarding plants science and student's attitude each year since 2017. This indicates that more and more people are interested in studying students' attitudes to learn plants and appropriate teaching methods.

In addition, the studies mainly conducted to see whether students have plant blindness syndrome, which observed students' attitudes and understanding of plants around them. The majority of the studies conducted attract students' interest and enthusiasm towards plants.

The country that most frequently conducts studies on this plant topic is the United States (USA) (Brownlee et al., 2021; Comeau et al., 2019; Wells et al., 2021) This is related to their students' increasing level of awareness about plants. In addition, based on the analysis, most of the study was conducted on samples with plant areas such as botanical gardens, forests, and agricultural areas. The area helps to observe student attitudes towards plants in their surroundings. Hence, it is important to observe student attitudes towards plants in Malaysia as Malaysia is one of the rainforest countries that have rich plants diversity. Ignoring such importance can lead to a loss in the ecosystems.

The studies sample was focused on various ages of group. However, most of the study was conducted on primary and secondary school students. This is related to students who are required to learn about plants in school compared to university students who already have a permanent major (Kaasinen, 2019; Wells et al., 2021). In addition, some studies add teachers as a sample (Panitsa et al., 2021; Sobieszczuk-Nowicka et al., 2018) because they want to see teachers' responses toward the study conducted on students. There is a Malay's saying that 'a child is a piece of white cloth, it is the parent that will pattern it', this saying shows how important to shape children from an early age, hence studies can be done in Malaysia with the younger student so that plant blindness can be prevented before it is too late.

A frequently used instrument is a questionnaire. The questionnaires were given usually have pre-test and post-test. These are related to the purpose of studies that would observe the improvement in students' level of knowledge regarding the name, function, and importance of the plants after the learning approach is carried out. Moreover, interviews were also used in several studies (Amprazis et al., 2019; Lampert et al., 2020; Melis et al., 2020) due to the age factors such as pre-school children and elementary school. It is stated in the study that interviewing pre-schoolers and primary school is done because the ability to read and understand the questionnaire is not suitable for the students.

Students' Attitudes towards Plants

These studies show that students' attitudes towards plants are still at an unsatisfactory level. Most of these studies found that students were indifferent to their plants. There were three studies (Kubiatko et al., 2021; Pedrera et al., 2021) conducted to compare students' attitudes towards plants and animals. The studies also found that students know more about the species of animals and the importance of those animals than plants. Hence it can be concluded that topics about animals are more attractive to students than plants.

In addition, some studies found students do not know the names and types of plants near them. A study by Amprazis et al. (2019) stated that there are students who do not know that plants are living things. This can be detected during the pre-test run. After making the learning approach, the majority of studies show that there is an improvement in the level of students' knowledge of plants but from the aspect of attitudes towards plants is not significant. Two studies (Bakar et al., 2020; Melis et al., 2020) found that there were no significant differences in gender when studying plant titles. This indicates that gender does not affect students' attitudes towards plants.

Therefore, based on previous studies, students' attitudes towards plants show that it is still unsatisfactory. Various learning approaches are used to improve students' attitudes towards plants. Hence it is suggested that engaging in different approaches could help students to have a better interest towards plants in the surrounding. Studies on suitable approaches in teaching plant science could be done so that it could help other educators.

Learning Approaches are Used to teach Plant Topics

Most researchers use exploratory learning approaches outside the classroom to teach plants (Bakar et al., 2020; Borsos et al., 2021; Comeau et al., 2019; Panitsa et al., 2021; Wells et al., 2021). The results of this study show changes in students' attitudes towards knowledge of the plant names around them. In addition, several studies have found that this approach also improves students' comprehension. This indicates that this approach is suitable for teaching about plants.

Another study found that while making a project-based learning approach, the older the students, the less interested they are in plants (Amprazis et al., 2019). This indicates that students' attitudes towards learning in plant topics decrease as students' age increases. This approach was once studied by Norazizah et al (2016) in Malaysia where they discovered that project base learning increase student knowledge because the project gives students excitement and a happy surrounding when they were studying plant. However, this method was applied to the primary student. Therefore, observing secondary students on project base learning to study plant science should be done too.

The Gamification approach can also improve student morale and create a fun atmosphere for learning (Borsos, 2018; Kissi & Dreesmann, 2018). Games can also increase students' level of knowledge about plant systematics.

Based on the analysis, it can be synthesized that the approach based on exploration and observation in the surrounding area or botanical garden is the most effective and followed by the project-based learning and games. This method can change students' attitudes to be positive towards plants. Hence, it is advisable for Malaysian teachers to use this approach to teach plant science topics to provide a fun learning surrounding and positive attitude towards plants. As written in a study by Amelia (2019), an excellent teacher uses suitable approaches to teach in class.

Effects of Learning Approaches Used to Teach Plant Topics

Researchers have used various learning approaches to increase students' interest, understanding, and attitude towards plants. The main focus of this learning approach is to look at students' perspectives from the aspects of students' awareness, interest, and understanding of the plants around them.

Several researchers have found outdoor learning methods where students will explore and observe the plants around them (Bakar et al., 2020; Borsos et al., 2021; Comeau et al. 2019; Panitsa et al., 2021; Wells et al., 2021). Students will draw their observations or answer a questionnaire for the researcher to make an analysis. The study results show that learning through exploration can increase students' enthusiasm and motivation to learn about plants. The approach through the project also affects students, such as the improvement of students' attitudes towards the understanding of plants.

In contrast to conventional learning, where students attend classes and labs only, Sobieszczuk-Nowicka et al. (2018) found that conventional teaching caused misconceptions on the topic of tropism increases after post-test testing conducted. The study also found that

teachers who taught the topic are not able to detect misconceptions faced by students. This shows that teachers are not aware of the problems faced by students and teachers need to be creative with the approach taken to teach the topic of plants.

Ultimately, an appropriate approach is very important to help students understand the topic of plants more efficiently get to know the plants around them and the importance of those plants. A fun learning approach can increase students' attitudes and interest in plants. Hence it is the teachers' responsibility to be prepared and uses approaches that are suitable to pique students' interest in plants so that the plant-blindness can be avoided.

Conclusion

Students' attitudes towards plants are not something to be taken lightly. Plants have a lot of importance on the balance of biodiversity. This study looks at the last five-year trend in plant attitudes towards plants and plant science learning. Findings show that students' attitudes towards plants and plant-related topics are still at an unsatisfactory level. Therefore, students' positive attitude towards plants must be inculcated in students not only for the environment but also for the future. In addition, this systematic study found that the way to increase students' enthusiasm and interest in plant topics that have been done frequently in the last five years is learning based on exploration and observation around. Therefore, teachers play an essential role in cultivating students' interest in plants by using a suitable approach when teaching plant topics in the classroom. This study is expected to help teachers in Malaysia to know the appropriate approach that can be implicated in plant-related topics so that their students are more positive about plant topics. This study is also expected to help the Ministry of Education Malaysia to know the current trends in the issue of students' attitudes towards the topic of plants and teacher teaching. However, this study had the shortcomings of such a single accessible database. The researcher suggested that further research be conducted, such as studying the level of students' attitudes towards the topic of plants and teacher teaching in Malaysia. This study should be performed because of the lack of plant science studies in science learning. Next, study the implication of scientific plant names pictures of plants and plants as examples in science learning and science textbooks. Finally, a study that measures plant blindness should also be done in Malaysia to see students' level of attitude, awareness, and importance of the surrounding plants.

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References

- Amprazis, A., Papadopoulou, P., Malandrakis, G. (2019). Plant blindness and children's recognition of plants as living things: A research in the primary school's context. *Journal of Biological Education*, 55(2), 139–154.
- Ang, B. S. (2014). Miskonsepsi fotosintesis dan respirasi pelajar sekolah menengah. Institut Pendidikan Guru Kampus Dato' Razali Ismail. <https://pdfcoffee.com/miskonsepsi-fotosintesis-dan-respirasi-pelajar-sekolah-menengahdoc-pdf-free.html>.
- Bahagian Pembangunan Kurikulum, K. (2016). DSKP Sains Tingkatan 2. Putrajaya: Kementerian Pendidikan Malaysia.

- Bakar, F., Avan, Ç., Şeker, F., Aydinli, B. (2020). Plant and animal awareness in nature education perspectives: Where is blindness? *International Electronic Journal of Environmental Education* 10(2), 122–135.
<https://files.eric.ed.gov/fulltext/EJ1256294.pdf>.
- Bakar, M. N. B., & Mohamad, S. M. B. S. (2012). Masalah pembelajaran pelajar sekolah menengah dalam mata pelajaran sains tingkatan 2 tajuk: fotosintesis. <https://bit.ly/3wZuQA3>. Eprints.Utm.My (1996).
- Borsos, E. (2018). The gamification of Elementary School Biology: A case study on increasing understanding of plants. *Journal of Biological Education*, 53(5), 492–505.
- Borsos, É., Borić, E., Patocskai, M. (2021). What can be done to increase future teachers' plant knowledge? *Journal of Biological Education*, 1–11.
- Brownlee, K., Parsley, K. M., Sabel, J. L. (2021). An analysis of plant awareness disparity within introductory biology textbook images. *Journal of Biological Education*, 1–10.
- Comeau, P., Hargiss, C. L., Norland, J. E., Wallace, A., Bormann, A. (2019). Analysis of children's drawings to gain insight into plant blindness. *Natural Sciences Education*, 48(1).
- Higgins, S., Xiao, Z., Katsipataki, M. (2012). *The Impact of Digital Technology on Learning: A Summary for the Education Endowment Foundation*.
<https://files.eric.ed.gov/fulltext/ED612174.pdf>.
- Kaasinen, A. (2019). Plant species recognition skills in Finnish students and teachers. *Education Sciences*, 9(2), 85.
- Kementerian Pendidikan Malaysia. (2013). Pelan Pembangunan Pendidikan Malaysia 2013 - 2025. Education. Retrieved from <http://linkinghub.elsevier.com/retrieve/pii/S0742051X10001435>.
- Kementerian Pendidikan Malaysia. (2014). DSKP KSSR Tahun 6. Putrajaya: Bahagian Pembangunan Kurikulum.
- Kissi, L., & Dreesmann, D. (2018). Plant visibility through mobile learning? implementation and evaluation of an interactive flower hunting a Botanic Garden. *Journal of Biological Education*, 52(4), 1–20.
- Kissi, L., & Dreesmann, D. (2020). Flowers with powers – conception and evaluation of an “educational seed mix.” *Journal of Biological Education*, 1–16.
doi:10.1080/00219266.2020.1757485.
- Kubiatko, M., Fančovičová, J., Prokop, P. (2021). Factual knowledge of students about plants is associated with attitudes and interest in botany. *International Journal of Science Education*, 43(9), 1426–1440.
- Lampert, P., Müllner, B., Pany, P., Scheuch, M., Kiehn, M. (2020). Students' conceptions of plant reproduction processes this paper was presented at the ERIDOB conference 2020. *Journal of Biological Education*, 54(2), 213–223.
- Melis, C., Wold, P. A., Billing, A. M., Bjørgen, K., Moe, B. (2020). Kindergarten children's perception about the ecological roles of living organisms. *Sustainability*, 12(22), 9565.
- Ministry of Higher Education. (2020). 02 universiti awam (public universities). *Statistik Pendidikan Tinggi 2020* (pp. 9-44). Retrieved from <https://www.mohe.gov.my/muat-turun/statistik/2020/493-statistik-pendidikan-tinggi-2020-04-bab-2-universiti-awam/file>.
- Mohamad, A. L. (2015). Dasar kepelbagaian biologi negara. *Salam Lestari*. Institut Alam Sekitar dan Pembangunan, (35), 1–24. <http://www.ukm.my/ppl/salamlestari35.pdf>.
- Nor Hamidah, A. M., & Zanaton, H. I. (2014). Persepsi pelajar terhadap pembelajaran berasaskan projek dan hubungannya dengan sikap pelajar terhadap sains. *International*

- Seminar oOn Global Education II: Educational Transformation towards a Developed Country* (pp. 2440–2451).
- Norazilawati, A., Noraini, M. N., Mahizer, H. (2013). Memperkasakan dasar pembudayaan sains. *Trend dan lisu: Pengajaran dan Pembelajaran*, 1(1), 75–92.
- Norazizah, A. R., Sopia, M. Y., Noor Ashikin, M. Y. (2016). Pembelajaran secara inisiatif kanak-kanak tumbuhan ke sekaki payung (Learning Initiation of Children through Project Approach : From Plants to Umbrella. *Jurnal Pendidikan Awal Kanak-Kanak*, 5, 78–95.
- Nur Amelia, A. (2019). Faktor keberkesanan guru cemerlang sains dalam proses pengajaran dan pemudahcaraan. *National Conference of Educational Research (September)*, 1–29.
- Nurhayati, D., Bahtiar, Arini Zahrotun, N. (2019). Improving student’s cognitive learning outcome through discovery learning model in structure and function of plant tissues subject. *Florea*, 6(1), 10–15.
- Panitsa, M., Iliopoulou, N., Petrakis, E. (2021). Citizen science, plant species, and communities’ diversity and conservation on a Mediterranean biosphere reserve. *Sustainability*, 13(17).
- Pedrer, O., Ortega, U., Ruiz-González, A., Díez, J. R., Barrutia, O. (2021). Branches of plant blindness and their relationship with biodiversity conceptualization among secondary students. *Journal of Biological Education*, 1–26.
- San, T. P., & Norzaini, A. (2011). Hubungan antara komitmen terhadap alam sekitar dengan tingkah laku mesra alam sekitar dalam kalangan pelajar universiti. *Jurnal Personalia Pelajar*, 14(9), 1689–1699.
- Sarabi, M. K., & Abdul Gafoor, K. A. (2018). Student perception on nature of subjects: impact on difficulties in learning high school physics, chemistry, and biology. *Innovations and Researches in Education*, 8(1), 42–55.
- Sobieszczuk-Nowicka, E., Rybska, E., Jarmużek, J., Adamiec, M., Chyleńska, Z. (2018). Are we aware of what is going on in a student’s mind? Uunderstanding wrong answers about plant tropisms and connection between student’s conceptions and metacognition in teacher and Learner Minds. *Education Sciences*, 8(4), 164.
- Stevens, W. C. (2012). *Introduction to Botany*. London, England: Forgotten Books.
- Strgar, J. (2007). Increasing the interest of students in plants. *Journal of Biological Education*, 42(1), 19–23.
- Suriyati, S., Zanaton, H. I., Akmal, N. I. (2014). Miskonsepsi terhadap konsep fotosintesis dalam kalangan bakal guru biologi. *International Seminar On Global Education II : Education Transformation Towards a Developed Country*, 3037–3046.
- Wells, C. N., Hatley, M., Walsh, J. (2021). Planting a native pollinator garden impacts the ecological literacy of undergraduate students. *The American Biology Teacher*, 83(4), 210–213.
- Wynn, A. N., Pan, I. L., Rueschhoff, E. E., Herman, M. A. B., Archer, E. K. (2017). Student misconceptions about plants: A first step in building a teaching resource. *Journal of Microbiology & Biology Education*, 18(1), 1-4.
- Xiao, Y., & Watson, M. (2017). Guidance on conducting a systematic literature review. *Journal of Planning Education and Research*, 39(1), 93-112.