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The Establishment of GREEN Integrated Model as a Promotion of Media Biodiversity, Food and Nutrition Sustainable for Students of Kota Kinabalu Indonesian School

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ABSTRACT

Making an integrated model of GREEN media starts from formulating a garden concept, planning for making GREEN through Project Based Learning, preparing locations, tools and materials, as well as arranging for school community involvement in program making. The implementation stages start from the manufacture and processing of plantation planting media, sowing seeds, transferring, maintaining and monitoring developments, harvesting activities and promotion programs to school residents. The research methods designed include research design, setting, sample variation, data collection techniques, data analysis, and reporting. Experimental research design through Project Based Learning involving high school and vocational class X students in the SIKK Farm extracurricular program. The tools and materials used are manure, fish seeds, fish feed, seedling trays, polybags, and vegetable seeds and other agricultural equipment. The study was conducted at the Indonesian School of Kota Kinabalu, Sabah, Malaysia. The number of samples studied were 34 people from class X MIPA, X SMK Tata Catering, and X SMK Hospitality. Data collection techniques using Likert Scale questionnaire instruments, interviews, and pretest-posttest (OGDE). The collected data were analyzed using the statistical description method. The integrated model GREEN media can improve student learning outcomes from an average score of 64.85 to 76.77 in knowledge of biodiversity, food and nutrition. In general, students gave feedback that making the integrated GREEN model was interesting and easy. Most of the students agreed that the GREEN model was integrated as a medium for promoting biodiversity, food and providing new learning experiences based on school gardens as well as increasing activities. In addition, it can provide nutritional intake of fruits and vegetables.

Keywords: GREEN, Biodiversity, Food, Nutrition

1. Introduction

1.1. Background

Kota Kinabalu Indonesian School (SIKK) is the 14th Indonesian Foreign School which is a tangible manifestation of the Indonesian government's attention to the education of the children of Indonesian Migrant Workers in Malaysia. SIKK apart from being an educational institution that provides education at the PAUD, SD, SMP, SMA and SMK levels is also the main school for Community Learning Centers (CLC) in Sabah and Sarawak. In the Decree of the Minister of National Education in 2008, SIKK was established to provide access to education in Sabah and Sarawak, Malaysia, both through formal and non-formal education. Based on data as of December 2020, the number of students at SIKK and CLC is as follows:

Table 1. Data on the SIKK and Assisted Schools

No	School level	Quantity	Number of students
1	PAUD SIKK	1	62
2	SIKK SD	1	361
3	SIKK SMP	1	187
4	SIKK SMA	1	258
5	SIKK SMK	1	180
6	CLC SD	115	13.446
7	CLC SMP	45	5.011
8	PKBM KJRI Kota Kinabalu	1	1237
Total of students			20.742

Sumber : Data SIKK based at Dapodik on December 2020

As the main school, SIKK carries out supporting, budgeting and controlling functions related to all aspects of the implementation of the CLC in terms of school management, academic and non-academic aspects. In the academic aspect, all CLCs are required to apply the Indonesian curriculum which is implemented by SIKK. SIKK facilitates CLC learning through various regulations including the academic calendar, curriculum structure, learning visitations, including education reporting. For the purposes of monitoring learning, Mid-Semester Assessments, Final Semester Assessments, End-of-Year Assessments, and School Exams also use questions from the SIKK (duplicated in each CLC / online exam) for the purpose of controlling the quality of learning.

As a parent school, SIKK has a role to play in maintaining the quality of education. Of course this is something very heavy. Moreover, the lack of existing learning resources such as a lack of teachers, minimal learning facilities and infrastructure, inadequate learning resource books, remote and remote locations in remote areas of oil palm fields and inadequate internet access. Therefore, SIKK needs to make a new breakthrough to create a medium that supports the quality of learning so that it can be used as a broad educational vehicle so that it can improve knowledge, attitudes, skills, health, productivity, economy, and improved nutrition for students and the wider community.

The school garden has a role as a valuable learning medium (Ohly H, et. Al., 2016; Kohlstedt SG, 2008). Recent research on school gardens has provided many benefits related to biodiversity, including increased food production and nutritional knowledge; increased interest in fruit and vegetable consumption; increased psychosocial attitudes such as a sense of responsibility, increased preferences, dietary behavior, and a willingness to try fruits and vegetables (Langellotto GA, Gupta A, 2012; Ratcliffe MM., et. Al., 2011). Other benefits can also improve students' physical health, improve physiological results, academic achievement in science, mathematics, art, language, reading, writing, positive attitudes towards the environment and give students the opportunity to be more physically active so that more time to move while studying in school gardens and to build connections with other students and the school community. In fact there are already a number of lesson plans and curricula for the teaching of basic mathematics, science, nutrition, health, social science, language, and the arts using school garden features and spaces (Burt, K. G., Koch, P., Contento, I., 2017).

Apart from that, directly benefiting, school gardens also improve well-being, quality of life, and social and cultural cohesion. To generate these benefits, gardens must be integrated into schools. In general, a greener school yard, is conducive to reducing stress to a positive mood (Burt, K. G., et, al., 2018).

Ozer conducted research on the factors that influence the use of parks as an effective educational tool by creating a social ecological model-based framework for the short- and long-term effects of well-integrated school gardens. The three main categories of Ozer are used as the basis of the framework: park locations and activities, the formal curriculum, and parental and community involvement in the park (Ozer EJ., 2007).

Garden can be effectively integrated into schools in a sustainable manner. A well-integrated school garden is described as a tended nearby park, primarily used as a learning environment to create meaningful experiences for students that are a valuable part of the school culture, and are maintained over time. This definition broadens the three main categories of application of Ozer - garden sites, curriculum or learning environments, and communities of parents and others involved with school gardens - by emphasizing the importance of sustainable use over time (Ozer EJ., 2007).

Table 2. Three Domain Categories of Ozer

Garden logistics	Student experience	School culture
Components • Garden care and upkeep • Planning and establishing the physical space • Characteristics of the physical space • Crop vitality and diversity • Budget and funding • Networks and outside organizations	Components • Connection with curriculum • Time spent in the garden • Activities • Engagement • Tasting opportunities • Additional learning opportunities	Components • Administrative support • Organizational staff structure • Volunteer and parent involvement • Social events and activities • Food environment and policies • Evaluation and feedback

Adapted from: The school garden domains created from Ozer's three domain categories and composed of 18 components described in the literature.

The school garden is an excellent means of active learning for a variety of subjects. Science is the subject most closely related to gardens. Many teachers use the school garden as a living laboratory in conducting scientific experiments (Seameo Refcon., 2018). Scientific experiments include experiential learning and hands-on activities as teaching methods to make subject content non-abstract, stimulate students' senses, and increase feelings of meaning (Christensen, J. H., & Wistof, Karen., 2019).

Furthermore, cross-subject collaboration and the learning relationship between indoors and outdoors are central factors in ensuring the effectiveness of teaching the school garden which is integrated with the subjects. Education about biodiversity, food, sustainable nutrition can be carried out through school garden programs during class hours, outside class hours, or during extracurricular activities (Robinson-O'Brien et al., 2009 as cited in Laird, 2016). Education through the school garden program can provide various benefits, including increasing children's knowledge about nutrition, increasing children's preferences for vegetables and fruit, and increasing vegetable and fruit consumption (FAO, 2010; Morris & Zidenberg-Cherr, 2002). In addition, school

gardens can provide an active learning atmosphere, thereby strengthening academic, personal, and social skills (Kammar et al., 2017).

Highlighting the importance of school gardens as a promotional medium to increase biodiversity, food and nutrition. School gardens have served a broader educational function, helping children understand science, nature and the environment. There is now broader recognition of the role of school gardens in environmental and nature education, biodiversity and local food conservation, food and ecoliteracy, diet, nutrition and health, and agricultural education.

The school garden is not just a place where students grow vegetables - it is an outdoor learning environment, food and taste, playing a major role in the educational activities that take place there (Kangas et al. 2017; Wistoft 2013). In the school garden students can learn to interact with nature so that they are able to develop an understanding of nature (Bowker and Tearle 2007; Wistoft and Dyg 2017). Gardening can develop students' critical awareness of environmental problems (Ampuero et al. 2015). Students' conceptual world is expanded through school garden programs when they learn to distinguish vegetables in a more capable way (Richards 2010). Their curiosity is high in expressing a desire to get to know new vegetables that have never been grown, harvested or tasted (Ratcliffe et al. 2011). Park research schools show effectiveness in relation to student competencies in the form of skills, knowledge, social competence, personal development and well-being (Kirby 2008; Nyberg 2014; Walter 2012). In other words, the school garden program has many positive effects based on the research outlined above, that school gardens can potentially improve students' skills, knowledge, social competence, personal development and well-being, as well as their critical awareness of environmental issues. School parks do have this potential if they are integrated with subjects.

Based on the previous description, this research is focused on making GREEN media (Garden Resources, Education, and Environment Nexus) so that it can explain how the school garden can be integrated. Building a well-integrated garden, of course, aims to make students get real benefits, they need to receive adequate education and a stretch of plantation to make long-term behavior change. Therefore, it is necessary to implement GREEN as a medium in assisting educators by building school gardens that offer guidance on how to create a well-integrated garden that is institutionalized and sustainable evidence-based. Although the Ozer framework underlines the potential benefits of a well-integrated park at the student, school and community levels, it does

not identify a strategy for how the park can be best integrated. Therefore, it is important for researchers to create an integrated GREEN Model that can be used as a media for promoting biodiversity, processed food and its nutritional content which is implemented sustainably for students at Kota Kinabalu Indonesian School at the SMA and SMK levels.

The creation / application, research and development of the GREEN integrated Model will be carried out in stages in the period 2021-2025 with the following target details:

Table 3. integrated Model R & D Strategic Plan in SIKK

No	Level	Years				
		2021	2022	2023	2024	2025
1	SIKK SMK	practice	research	development	Established	Established
2	SIKK SMA	practice	research	development	Established	Established
3	SIKK-CLC SMP	-	practice	research	development	Established
4	SIKK-CLC SD	-	-	practice	research	development
5	PAUD-PKBM	-	-	practice	research	development

Based on this background, researchers are encouraged to conduct research on"***The Establishment GREEN Integrated Model as a Promotion of Media Biodiversity, Food and Nutrition Sustainable for Students of Kota Kinabalu Indonesian School***".

1.2. Objectives

The purpose of this research is to prepare an integrated GREEN (Garden Resources, Education, and Environment Nexus) Model as a learning medium to promote biodiversity and processed foods as well as provide sustainable nutritional content knowledge in schools.

1.3. Expected Output

The existence of the Integrated Model GREEN learning media that is created and developed in schools. The media is expected to promote biodiversity, food, and provide nutritional knowledge in a sustainable manner through collaborative subjects through Project Based Learning.

2. State of the art of the research

2.1 Teoritical Benefits

a. Get new knowledge or theory about the creation and development of GREEN (Garden Resources, Education, and Environment Nexus) Integrated Model in schools.

b. As a medium to promote biodiversity and processed food and provide knowledge of nutritional content in a sustainable manner in schools

2.2 Direct Benefits

a. For Students

1) Obtain new integrated school garden-based learning experiences for students in learning at school.
2) Increase the activities of students when doing activities in the school garden.
3) Obtain more real knowledge of biodiversity and nutritional content in fruits and vegetables.
4) Get additional nutritional intake from fruits, vegetables and processed foods.

b. For Teachers

1) Provide information and descriptions to other teachers in implementing the GREEN Model Integrated media in schools.
2) As a learning medium for teachers in collaborating knowledge across subjects and increasing interest and academic achievement as well as comprehensive scientific knowledge.
3) Provide an overview for the teacher or the next researcher, to create and develop the GREEN Integrated Model in schools.

c. For Schools

1) The involvement of the school garden can experience change / better improvement as a learning medium in improving the academic and non-academic abilities of students.
2) GREEN integrated Model can be a broad means of improving physical health, psychosocial, early diet behavior, and additional nutritional intake for students.
3) GREEN integrated Model is a place to build connections with students at different levels, form communities with other CLCs / schools, and create a modern school garden-based educational environment.
4) The education climate in schools is more conducive and integrated

3. Methods

This research method describes a research design that includes research design, setting, sample variation, data collection techniques, data analysis, and reporting. The research design used was an experiment through Project Based Learning involving high school and vocational school students in the SIKK farming extracurricular program.

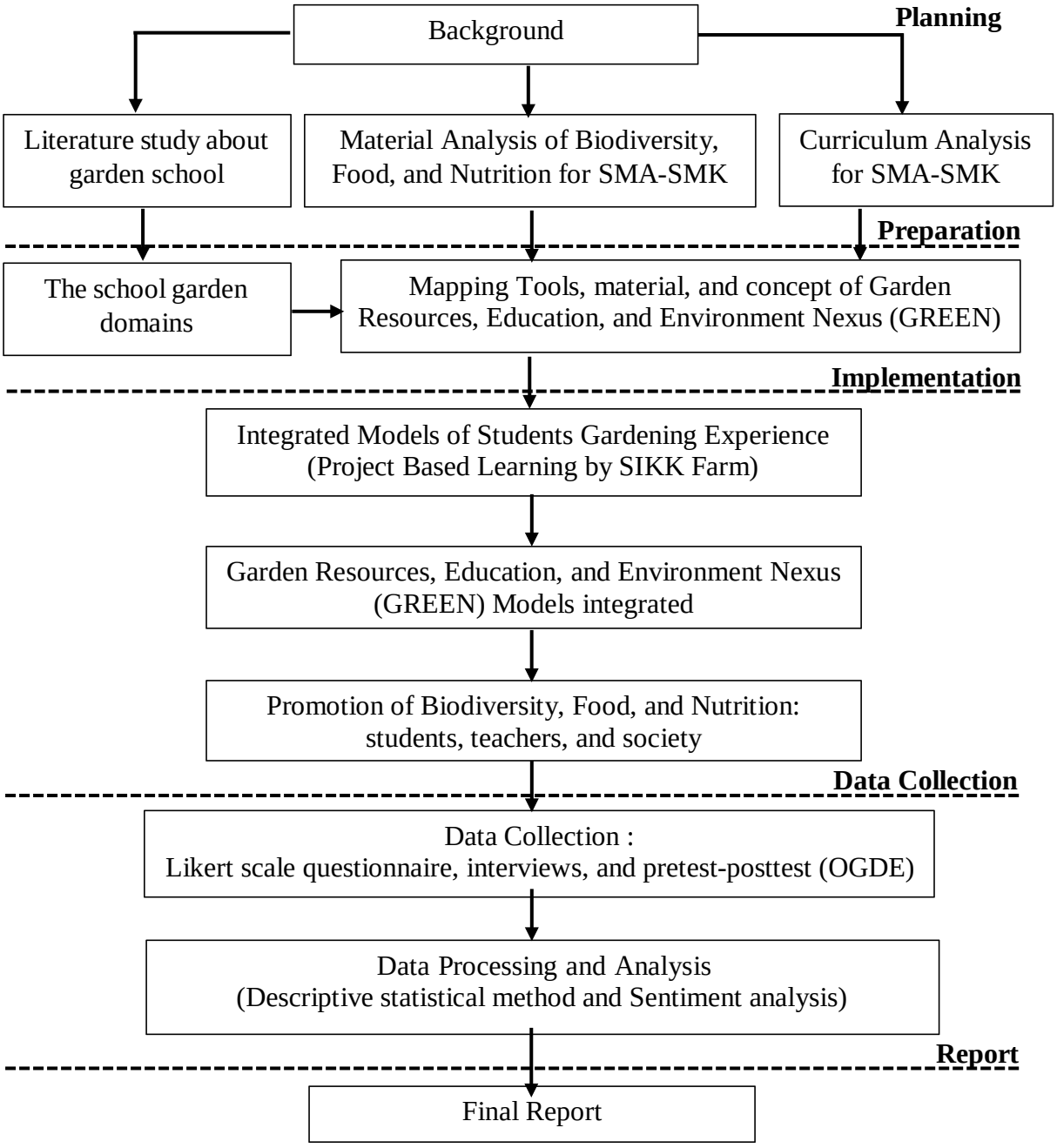


Figure 1. Research Flow

The research setting is located in the Kota Kinabalu Indonesian School environment, with the address No.1 Jalan 3B, KKIP Selatan, Kota Kinabalu, Sabah-Malaysia Post Code 88450 Telp. (+6088) 492600 Fax (+6088) 492601. For the implementation time from March to November 2021. The research implementation begins with the planning, preparation, implementation, data collection and preparation of the final research report.

The planning stage starts from the formulation of the problem that is studied based on literature studies on school gardens, analysis of material on biodiversity, food and nutrition and analysis of content standards at the SMA and SMK levels. The results of this study form the basis for concept mapping for the preparation stage.

The preparation stage is a follow-up to the planning stage, namely starting to identify the needs for tools, materials, the concept of making Garden Resources, Education, and Environment Nexus (GREEN) following the standards of the school garden domains developed by Ozer regarding three main categories of basic frameworks: location and activities parks, formal curricula, and parental and community involvement in parks. Completeness at this stage can be used at the implementation stage.

The implementation stage is an important part of starting an experimental activity in making a school garden using an integrated model that will be carried out by the SIKK Farm extracurricular group through the school's Project Based Learning. This experimental stage makes the concept of integration between agriculture, livestock and fisheries which is carried out in an integrated manner. Several commodities that will be developed in the GREEN integrated Model and the number of people in charge of implementing activities are as follows:

Table 4. Types of Commodities in the Integrated Model GREEN

No.	Division	Commodity		Job deskription	Number
1.	Agriculture	a.	Cucumber	Planting to harvesting	11 person
		b.	Spinach		
		c.	Kale		
		d.	Eegplant		
		e.	Long beans		
		f.	Mustard		
		g.	Chili		
		h.	Papaya		

No.	Division	Commodity		Job deskription	Number
		i.	Rosella		
		j.	Mango		
		k.	Pakcoy		
		l.	Flowers		
		m.	Moringa		
		n.	Herbs		
		o.	Melon		
		p.	Watermelon		
		q.	Lemongrass		
		r.	Pumpkin		
2.	Farming	a.	BSF (Black Soldier Fly)	Housing	2 person
		b.	Rabbits		
3.	Fishery	a.	Catfish	Preservation	2 person
		b.	Carp		
		c.	Crayfish freshwater		

Several parks that will be made from these commodities are using vertical plantations, landscape plantations, hydroponics and aquaponics. The stages of implementing the integration will be carried out in several stages. The following are the stages of the activity design:

No	**Division**	Commodity implemented			
		2021	**2022**	**2023**	**2024**
1.	Agriculture	• vegetables	• vegetables • fruits	• vegetables • fruits	• vegetables • fruits
2	Farming	-	• BSFs	• BSFs • Rabbits	• BSFs • Rabbits
3	Fishery	• Catfish	• Catfish • Carp	• Catfish • Carp	• Catfish • Carp • Crayfish freshwater

The experimental products from the implementation stage will then be promoted into several sections, namely biodiversity, processed food that has been harvested, and the nutritional content of these products. Promotion methods will be carried out through print

and electronic media such as making videos, books, modules, papers, infographics and direct promotion methods at seminars, open houses, school birthdays, distribution of report cards, bazaars, salary markets (weekly markets) or Kaamat celebrations. Malaysian Harvest Festival. The objects of promotion are students, teachers, parents, Indonesian society and mantra schools who are Malaysian citizens who are in Kota Kinabalu.

The data collection stage is the final part before making a research report. At this stage data collection was carried out to test the implementation of activities starting from the experimental activities of making media, the planting stage, the harvest stage, to the promotion stage. Data collection techniques will be carried out through questionnaires and interviews with student representatives either conducting experiments or promotional objects, teacher representatives, parent representatives, consulate officials, several representatives of Indonesian society, and several school mantras.

The final stage is the preparation of an activity report. This report starts from the planning stage, preparation, implementation, to data collection, which includes evidence of activities that have been carried out for nine months.

4. Result and Discussion

This research was conducted on March 22 until November 30, 2021 at the Kota Kinabalu Indonesian School in the program to create an integrated GREEN model as a medium in promoting biodiversity, food and nutrition in a sustainable manner for students in class X (ten) SMA and SMK levels. The location of the implementation can be seen in Figure 2. The results of the study are described into several stages as follows.

Figure 2. Location GREEN Integrated Model at Indonesian School of Kota Kinabalu

4.1 Stages of Problem Formulation and School Garden Planning

The stages to realize the creation of an Integrated GREEN Model at the Indonesian School of Kota Kinabalu begin with a plan derived from the formulation of the problem studied based on a literature study on school gardens that refers to the standard of the school garden domains developed by Ozer. Followed by an analysis of materials on biodiversity, food and nutrition from content standards at the SMA and SMK levels. The analysis of the high school curriculum refers to the Minister of Education and Culture Regulation Number 37 of 2018 concerning core competence (KI) and basic competencies (KD) at the Elementary, Middle and High School Levels in 2018 and the Analysis of the Vocational High School Curriculum in accordance with the Minister of Education and Culture Regulation Number 34 of 2018 concerning National Standards for Vocational Education.

Table 6. Analysis of Curriculum on Biodiversity, Food & Nutrition

No.	CurriculumAnalysis	Basic Competencies	Subject
1.	Biodiversity	3.2 Analyzing various levels of biodiversity in Indonesia and their threats and conservation as well as threats and conservation; 4.2 Presenting the results of observations of various levels of biodiversity in Indonesia and proposed conservation efforts; 3.3 Explain the principles of classification of living things in the five kingdoms; 4.3 Compile a cladogram based on the principles of classification of living things.	Biology Class X Science
2.	Food	3.11. Analyzing macromolecules; 4.11. Qualitatively test the content of carbohydrates, proteins and fats in materials used in tourism.	Applied Science Class X Vocational

No.	CurriculumAnalysis	Basic Competencies	Subject
3.	Nutrition	3.1 Analyzing nutrients as energy sources that the body needs; 4.1 Solving the problem of lack of nutrients as a source of energy that the body needs; 3.2 Analyzing nutritional sources of building blocks needed by the body; 4.2 Solving the problem of lack of nutrients as a source of building blocks needed by the body; 3.3 Analyzing nutrient sources of regulatory substances needed by the body; 4.3 Solving the problem of lack of nutrients a source of regulatory substances needed by the body.	Science of Nutrition Class X Culinary

4.2 Stages of Preparation and Creation of an Integrated GREEN Model

The preparation stage is a follow-up to the planning stage, which is to start identifying the equipment and material requirements that support the need for an Integrated GREEN Model. The tools and materials needed are manure, fish seeds, fish feed, seedling trays, polybags, and vegetable seeds. In addition, several components of tools and other materials make use of used goods that are not used in the school and utilize the land and vacant land behind the school. The needs for tools and materials for making the Integrated GREEN Model are listed in Table 7. The school garden concept at this early stage was started by implementing landscape plantations using polybags, some simple hydroponics, and aquaponics for integrated catfish and talapia cultivation as a natural nitrogen source from fish pond water to water the plants.

Table 7. Tools and Materials for Making Integrated GREEN Model

No	Tools and Materials for Making GREEN	Description
1.		Prepare fish feed as a food source for catfish in fish farming activities. Catfish as a source of carbohydrates and fat
2.		Prepare seedling trays, polybags, and seeds of vegetables and fruits that will later be sown. More than 15 types of vegetables/fruits to be planted.
3.		Prepare manure as a mixture in the planting media which will be mixed with soil, compost and other materials

No	Tools and Materials for Making GREEN	Description
4.		Catfish seeds to be cultivated in a fish pond integrated with GREEN
5.		Talapia fish seeds to be cultivated in a fish pond integrated with GREEN
6.		The process of cutting iron by pre-existing SMK students to be used as a fish pond
7.		The framework of the fish pond made of iron has been finished. It can then be moved and a tarp added to collect water.

No	Tools and Materials for Making GREEN	Description
8.		The fish pond is ready to be used as a place for catfish cultivation which is applied to the GREEN Integrated Model, the water from the fish pond can be used to water plants to make them more fertile because it contains a nitrogen source
9.		Preparing the supporting poles in making the Green House which is used as a place for seeding fruit and vegetable seeds and placing catfish ponds
10.		Installation of iron supporting poles on land that has been cleared as a green house for seeding plants and storing fish ponds

No	Tools and Materials for Making GREEN	Description
11.		The process of installing and placing fish ponds and green houses has been properly installed and ready for Project Based Learning activities

The concept of making Garden Resources, Education, and Environment Nexus (GREEN) refers to the standard of the school garden domains developed by Ozer, there are three main categories of basic framework that must be prepared. The three main categories are park location and activities, formal curriculum, and parent and community involvement in parks. The following is an explanation of the three main components that can be applied at the Kota Kinabalu Indonesian School.

a. Park Locations and Activities

The location for making the garden with the concept of Garden Resources, Education, and Environment Nexus (GREEN) is located at the Indonesian School in Kota Kinabalu, Jalan 3B No.1 KKIP Selatan, Kota Kinabalu, Sabah, Malaysia, Postal Code 88450. The land used is vacant land used as a shelter. water at the final disposal before being discharged into drains / sewers. At first this location is not utilized even looks rundown, dirty and smelly. The stages of site clearing to land use can be seen in Table 8. Below is the documentation of activities and their descriptions during the preparation stage.

Table 8. Documentation of activities in the park during site opening

No	Activity Documentation	Description
1.		The initial conditions of the location for the manufacture of the Integrated GREEN Model, vacant land used for storage and disposal of water that is not maintained and slums.
2.		Clearing the location of weeds that exist around the land to be developed GREEN Integrated Model
3.		Location checks to monitor unused materials such as iron, wood, glass, and other inorganic waste to be sorted as materials that can be used for the manufacture of the Integrated GREEN Model
4.		Site cleaning and transportation of unused materials such as inorganic waste and separating materials that can be reused such as iron, wood, and glass

No	Activity Documentation	Description
5.		Organize organic waste from leaves, weeds, and other organic waste to make compost
6.		The process of composting organic materials from leaves, grass, food scraps in the school by covering the pile of garbage with unused banners
7.		Making planting media in the form of a mixture of soil, rice husks, coconut fiber powder, manure, lime, and other materials for the manufacture of polybag-based planting media
8.		The planting media has been well mixed, including the addition of compost that has been made as an additional material to the planting media which will be put into polybags

No	Activity Documentation	Description
9.		The process of packaging the planting media into polybags that will be used to plant plants that have been sown a few weeks earlier
10.		Planting media in polybags are ready to be arranged and grouped based on the plants to be planted from previously sown seeds

b. Formal Curriculum

Curriculum is a set of subjects and educational programs provided by an educational institution that contains lesson plans that will be given to lesson participants in one period of education level. The formal curriculum used at the SMA and SMK levels is the 2013 Curriculum. The preparation of this set of subjects is adjusted to the circumstances and abilities of each level of education in providing the education as well as the needs of employment. The length of time in a curriculum is usually adjusted to the aims and objectives of the education system implemented. This curriculum is intended to be able to direct education towards the intended direction and goals in learning activities as a whole.

Biodiversity is the variation of genes, species, and ecosystems. Based on its understanding, biodiversity can be divided into three types, namely:

1). Gene Diversity

Gene diversity is the variation or difference in genes that occur in a type or species of living things. For example, the variety of manga (Mangifera indica), for example, which other manga, cengkir, golek, gedong, apple, kidang, and bapang.

2). Species Diversity

Species diversity is the difference that can be found in a community or group of various species that live in one place. For example, in a yard there are mango trees, coconuts, rambutan, oranges, roses, jasmine, cempaka, ginger, turmeric, birds, beetles, bees, ants, butterflies, and worms.

3). Ecosystems Diversity

Ecosystems are formed because various groups of species adapt to their environment, then, there is a mutually influencing relationship between one species and the abiotic environment in which it lives, such as temperature, air, water, soil, humidity, sunlight, and minerals.

Biodiversity, defined as the variety of all life on earth, requires grouping living things to make it easier for humans to study them. The grouping process is also known as classification. The main purpose of the classification of living things is to simplify the object of study of living things that are very diverse so that it will be easier to study them.

This grouping is done based on the similarities and differences in the characteristics possessed by these living things. In the classification system, living things are grouped into large groups to small groups. The categories used by Linnaeus are Kingdom (Kingdom), Phylum (Great Family), Class (Class), Order (Nation), Familia (Tribe), Genus (Marga), and Species (Type). The writing of species names made by Carolus Linnaeus is called Binomial nomenclature (double name system). The rules for naming species include: (1) Consists of two words; (2) Written in Latin; (3) The first word indicates the name of the genus and the second word indicates the Ephitethon specificum (type designator); (4) The initial letter of the first word is capitalized, while the initial letter of the second word is not; (5) Species names must be italicized. The results of the study became the basis for concept mapping for the preparation stage.

Food and nutrition are closely related to food ingredients. Each food ingredient has a different chemical composition and contains nutrients that vary in type and amount. Various nutrients needed by the body can be classified into 6 kinds, namely (1) carbohydrates, (2) proteins, (3) fats, (4) vitamins, (5) minerals and (6) water. Meanwhile, the energy needed by the body can be obtained from the combustion of carbohydrates, proteins and fats in the body, in nature there are various types of food ingredients both derived from plants called plant foods and foods derived from animals known as animal foods.

Advances in science and technology in the field of chemistry have succeeded in revealing the amount of nutrient content in various types of food ingredients. Nutrient content figures of some food ingredients can be found in the Food Composition Table. In the list of foodstuffs are grouped into groups: (1) Grains, (2) Tubers, (3) Nuts and fatty seeds, (4) Vegetables, (5) Fruits, (6) Meat, (7) Eggs, (8) Fish, (9) Milk, (10) Sugar and Oil, (11) Others.

Carbohydrates are defined as compounds whose elements consist of carbon (C), hydrogen (H), oxygen (O), with an empirical ratio of the elements $(CH_2O)n$. Carbohydrate compounds are divided into three main groups consisting of monosaccharides, oligosaccharides, and polysaccharides.

Protein is the main component of all living cells. This protein functions as a building block for cell structures that produce hormones, enzymes, and others. In terms of chemistry, protein is a polymer compound of amino acids with a high molecular weight. Judging from the elements that make up the protein, it consists of elements C, H, O and N. Some of the proteins also contain sulfur, phosphorus and some metals such as zinc, iron and copper. The number of N elements in a food ingredient is a criterion for determining protein levels.

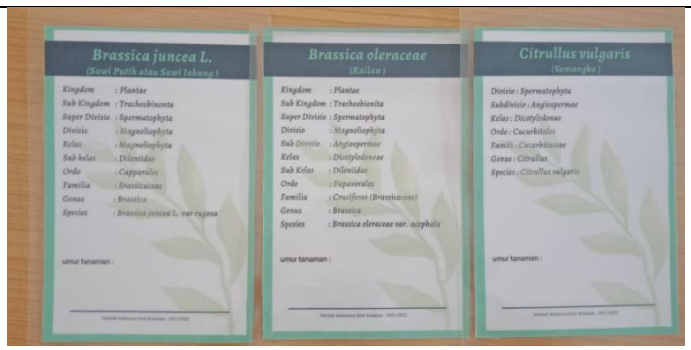
Fats and oils are simple lipids. The use of this material in everyday life is quite broad, such as being used as a frying agent, paint thinner and others. From a chemical point of view, lipids can be viewed as ester derivatives of glycerol and high fatty acids. Oil is generally obtained from plant and animal materials. Oils from plants are known as vegetable oils, while oils from animals are called animal oils.

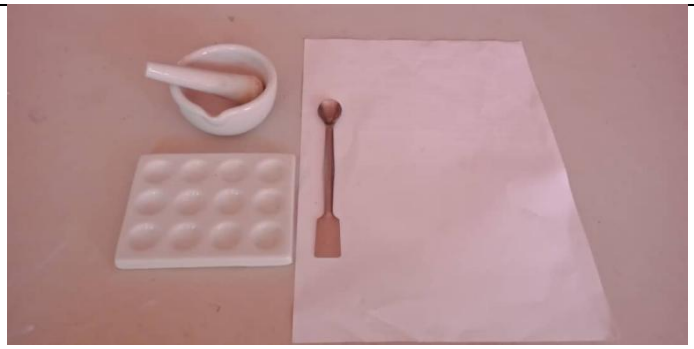
The potential for biodiversity from the ecosystem, species, and genetic levels has not been widely used as the basis for learning policies in schools as a source of food as well as sustainable nutritional intake for students. For this reason, food and nutrition is an integrated part, it is necessary to map and develop variations of food sources that can be produced in school gardens and processing them into nutritious food for students. Biodiversity (flora, fauna, micro-organisms/microorganisms) is the center of all sectors that are important for human life (bioprospecting). wealth and biodiversity must be managed and developed so as to ensure food availability. Food consumption will directly affect nutritional status. The low quantity and quality of food consumption is one of the main causes of nutritional problems (Koletzko et al., 2011). According to Sunita, 2009 nutrition is a chemical bond that the body needs to perform its functions, namely to

produce energy, build and maintain tissues, and regulate life processes. Nutrition is an important part in realizing quality human resources.

Operationally, the implementation of the curriculum is contained in the Student Worksheet which is prepared to facilitate the implementation of learning for students at school. Supporting tools and materials for achieving the curriculum can be seen in Table 9.

Table 9. Tools and Supporting Materials for Curriculum Achievement

No	Tools & Supporting Materials for Achievement	Description
1.		Classification Labels: Red Spinach Kangkong Melon
2.		Classification Labels: Bitter Mustard Mustard greens White radish
3.		lassification Labels: Chilli / Mustard Greens Kailan Watermelon
4.		Classification Labels: White Spinach Green Spinach Mustard Meat/Pakcoy

No	Tools & Supporting Materials for Achievement	Description
5.		Classification Labels: Purple Pakcoy Water spinach
6.		Carb test kit set: Mortar, pestle, spirit burner, test tube, tube rack, wood tongs, beaker, tripod, gauze, Benedict's solution
7.		Protein test kit set: Mortar, pestle, drip plate, spatula, beaker, dropper, Benedict's solution, Iodine solution
8.		Fat test kit set: Mortar, pestle, spatula, drip plate, white paper

c. Parental and Community Involvement in the Park

The community components that make up the community at the Kota Kinabalu Indonesian School are divided into four groups. The first group is students from PAUD, SD, SMP, SMA, and SMK levels. The second group is teachers and employees. The third group is the parents of students and the school committee and its members. The fourth group is partner schools affiliated with SIKK such as CLC SD and CLC SMP as well as

other general public such as representative office officials and Indonesian community/diaspora leaders. The involvement of teachers and employees at the Kota Kinabalu Indonesian School park is carried out in the form of mutual cooperation activities or community service every Friday. Community service activities can be seen in Table 10.

Table 10. Involvement of Teachers and Employees in the Park

No	Involvement of Teachers & Employees at the Park	Description
1.		Renovation of the garden in front of the school gate
2.		Main parking area garden renovation
3.		Transportation of bricks for the arrangement and preparation of the renovation of the main parking lot of the school garden

No	Involvement of Teachers & Employees at the Park	Description
4.		Transportation of bricks for the arrangement and preparation of the school garden renovation for the security post section
5.		School garden cleaning and leaf collection for compost
6.		Cleaning unproductive plants to replace with productive plants
7.		Renovation of the security post section of the garden

In the implementation of Project Based Learning in schools, involvement in this research utilizes groups of students to assist in implementing the Integrated Model GREEN program by creating small groups in which there is a person in charge of activities in the fields of agriculture and fisheries as well as other more detailed division of work tasks. . In addition, teachers and employees also help in realizing a Garden Resources, Education,

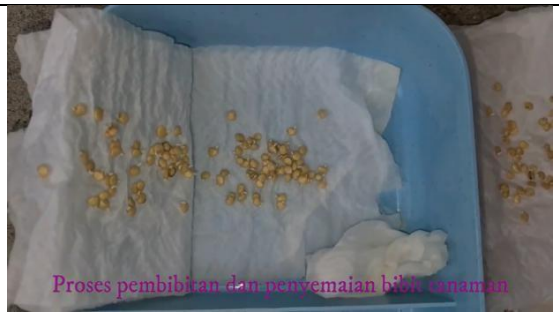
and Environment Nexus (GREEN)-based school garden through a community service program. Meanwhile, parents of students, school committees, school partners, representative office officials and Indonesian community/diaspora leaders are targets for the promotion of biodiversity, food and nutrition in a sustainable manner in seminars or school open houses at the Student Appreciation Week held in November 2021.

4.3 Stages of Program Implementation

The implementation phase is an important part of starting the experimental activities of making school gardens using the Integrated Model which will be carried out by the SIKK Farm extracurricular group through Project Based Learning schools and the involvement of teachers and employees. For the first stage, this experiment was made with the limitation of the concept of integration only between agriculture and fisheries which was carried out in an integrated manner. Several commodities that have been developed in the GREEN Integrated Model with variations and types of existing gardens are made using the concept of landscape plantations, using polybag planting media, hydroponic systems, and aquaponics. The results of the integration that have been carried out starting from the preparation of the planting media to the treatment can be seen in Table 11.

Table 11. Project Based Learning Implementation Activities in the Park

No	Activities in the Park	Description
1. Making and processing gardening media		
1.		Black soil, roasted husks, powdered fine coconut fibers that have not been mixed as seeding media

No	Activities in the Park	Description
2.		Making fruit and vegetable seeding media that will be inserted into the seedling tray
2. Seeding		
1.		Soaking the seeds for one day and the growth of shoots from seeds has appeared, it's time for separation and sowing into the planting medium in the seedling tray
2.		Plant seeds have grown well. Treatment continues until it is ready to be transferred into the planting medium in polybags

No	Activities in the Park	Description
3.		Care of plant seeds before being transferred to polybags
3. Transfer of plants from seeding		
1.		Transferring plant seeds into polybags after the age of the plant is approximately two weeks, while kale can be planted directly without the seeding process, only needs to be soaked in water for 6-12 hours
2.		Plant seeds have grown well in landscape soil-based seeding media. Treatment continues until it is ready to be transferred to the next planting medium
3.		Transferring plant seeds from landscape soil-based seeding media to landscape land directly to create landscape plantations

No	Activities in the Park	Description
4.		Catfish ponds as a source of water containing nitrogen elements
5.		Watering polybag planting media with catfish pond water so that the process of stabilizing soil temperature and moisture becomes stable and fertile quickly as well as a natural nitrogen source
4. Plant Development Monitoring & Classification		
1.		The process of transferring plants from seeds to polybags has been successfully carried out and has started to live and grow leaves
2.		Water spinach planting with a hydroponic system using used drink bottles
3.		Land spinach planting with polybag planting media

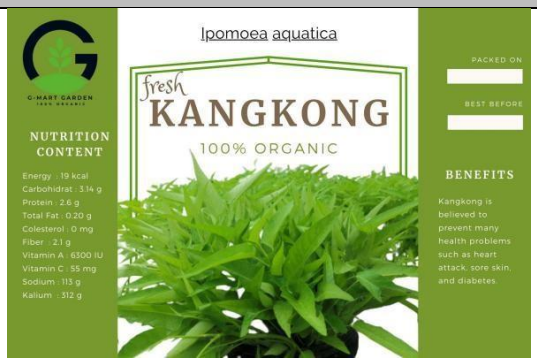
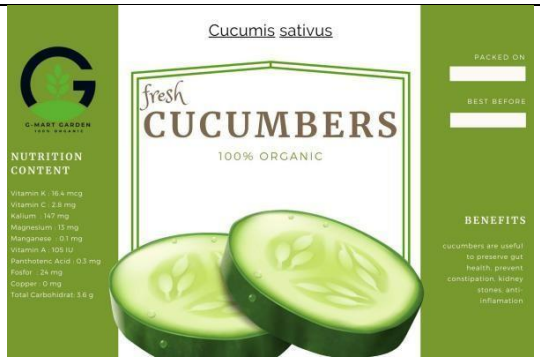
No	Activities in the Park	Description
4.		White radish planting with polybag planting media
5.		Planting mustard greens with polybag planting media
6.		Watermelon planting with landscape plantation concept in front of the main parking lot
7.		Melon planting with landscape plantation concept in front of the main parking lot
8.		Aquaponic growing media for growing water spinach and catfish farming
9.		Aquaponic growing media for water spinach and catfish cultivation

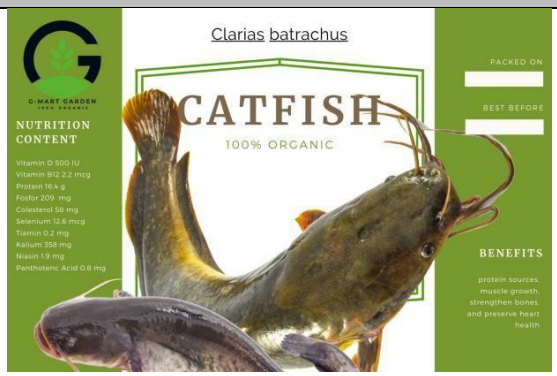
No	Activities in the Park	Description
10.		Chili plant care activities in the school garden
11.		An integrated model GREEN media that has been developed in the school garden with a variety of fruits and vegetables in several places around the back of the school
5. Harvest		
1		kale harvest and washing and cleaning process
2		Stages of packaging the kale harvest

No	Activities in the Park	Description
3		Melon and watermelon harvest from the front of the school is given to students in need
4		Eggplant harvest takes a long time so that when harvested, the other vegetables have finished harvesting
5		Eating together from the watermelon harvest for female students who have finished working in the school garden
6		Eating together from the watermelon harvest for male students who have finished working in the school garden

No	Activities in the Park	Description
7		Red chili harvesting activities in the garden behind the school
8		Harvesting fruits and vegetables in the garden behind the school
6. Food content test		
1		Test the carbohydrate content in food
2		Test the protein content in food

No	Activities in the Park	Description
3		Test the fat content in food
7. Promotion		
1		Sales activities of packaged and labeled kale harvested
2		Marketing activities for the general public and the use of fruits and vegetables in the SMK environment
3		Labels for marketing promotion activities and utilization of harvested eggplants

No	Activities in the Park	Description
4		Labels for marketing promotion activities and utilization of harvested kale
5		Labels for marketing promotion activities and utilization of harvested cucumbers
6		Labels for marketing promotion activities and utilization of harvested chili
7		Labels for marketing promotion activities and utilization of harvested green mustard

No	Activities in the Park	Description
8		Labels for marketing promotion activities and utilization of harvested catfish
9		Labels for marketing promotion activities and utilization of harvested watermelon

To see the achievement of the Integrated Model GREEN program, school parks that have been operating can be evaluated based on the self-assessment component following the main categories developed by Ozer. The following are the temporary achievements of the school gardens that have been developed to measure the achievement of the Integrated GREEN Model. When the GREEN Integrated Model is deemed to have been achieved, the next step is to promote biodiversity, food and nutrition in a sustainable manner. The achievements of the Integrated GREEN Model can be seen in Table 12.

Table 12. Main Ozer Categories and their Component Achievements

No	Main Ozer Categories	Observed Components	Description
1.	Garden Logistics	1. Garden care and upkeep	Yes
		2. Planning and establishing the physical space	Yes
		3. Characteristics of the physical space	Yes
		4. Crop vitality and diversity	Yes
		5. Budget and funding	Yes
		6. Networks and outside organizations	Yes

2.	Student Experience	1. Connection with curriculum	Yes
		2. Time spent in the garden	Yes
		3. Activities	Yes
		4. Engagement	Yes
		5. Tasting opportunities	Yes
		6.Additional learning opportunities	Yes
3.	School Culture	1. Administrative support	Yes
		2. Organizational staff structure	Yes
		3. Volunteer and parent involvement	Yes
		4. Social events and activities	Yes
		5. Food environment and policies	Yes
		6. Evaluation and feedback	Yes

4.4 Data Collection

Data collection is an important part before making a research report. At this stage, data collection was carried out to test the implementation of activities ranging from experimental activities of making media, planting stage, harvesting stage, to promotion stage. Data collection techniques are carried out in accordance with the objectives to be achieved. The instrument used in the study was a written test consisting of a pretest-posttest using the One-Group Pretest-Posttest Design Experiment (OGDE) method, a Likert Scale questionnaire, and interviews.

In the One-Group Pretest-Posttest Design Experiment method, the dependent variable was measured as a group before (pretest) and after (posttest) through a given treatment. After the treatment was given to the group, the values before and after the treatment were then compared. The advantage of this experiment is that it can compare the values before and after treatment on the same students using the same measuring instrument. The subjects of this study were the students of the Kota Kinabalu of Indonesian School who studied the material on biodiversity and nutrition to measure aspects of their knowledge.

The One-Group Pretest-Posttest Design

O	*X*	*O*
Pretest	Treatment	Posttest

Figure 3. One-Group Pretest-Posttest Research Method Design

In accordance with the research design of the One-Group Pretest-Posttest Desigen Experiment before the treatment was carried out on the students, a pretest was carried out first to determine the value of the students' initial understanding of the material on biodiversity and nutrition. Furthermore, treatment was carried out to students in the form of an Integrated GREEN Model program as a medium for promoting biodiversity and nutrition science at the Kota Kinabalu Indonesian School. The material presented is divided into 2 groups, namely: knowledge of biodiversity and nutrition in accordance with the program of making the Integrated GREEN Model. After the session ended, students were asked to do the posttest again with the same questions as the pretest. The questions used for the pretest and posttest consisted of 11 descriptive questions. Each question has the same weight, which is 10 points for the correct answer and no points deducted if the answer is wrong. Thus, the maximum total points for the pretest and posttest are 110. The questions for the pre-test and post-test are attached in appendix 8. The final score is with the following formula:

$$\text{Score} = \frac{\text{Total Score}}{\text{Maximum Score}} \text{ x } 100$$

In addition to the pretest and posttest, students were also given a Likert Scale questionnaire which was used as feedback on the activities held. Likert scale is used to measure attitudes, opinions, and perceptions of a person or group of people about social phenomena. With a Likert Scale, the variables to be measured are translated into variable indicators. The Likert scale can provide clearer and more tangible information about the respondent's income or attitude about the issue in question because of the larger response period. The questionnaire in this study consisted of 10 questions as in Appendix 9.

In addition to questionnaires, interviews were also conducted with students. An interview is a conversation with a specific purpose by two parties, namely the interviewer as the questioner and the interviewee as the answerer to the question (Basrowi and Suwandi, 2008). This interview was conducted with the intention of obtaining further data and information regarding people, events, activities, feelings and others; verify and expand the information developed by the researcher as checking the answers to the questionnaire. Interviews were conducted based on interview guidelines that had been made which referred to the indicators that had been set. In conducting interviews, researchers can make changes and developments but within the scope of existing indicators. Interviews were

conducted on students who were involved in the GREEN Integrated Model development program in the class that was the subject of the research. The interview guide used is contained in appendix 10.

4.5 Data Processing and Analysis

The analysis in this study can be done in two ways, namely qualitative and quantitative analysis. Qualitative data analysis is used to determine the increase in activity in the school garden and the learning process as a form of action that has been taken. While quantitative data analysis is used to determine the increase in student learning outcomes as a result of each action taken (Sanjaya, 2010).

a. Knowlade Test Data Processing and Analysis

For quantitative data analysis, simple statistical calculations are used which serve to describe the results of the study which only apply to the sample studied and cannot be generalized to a population. The data analyzed in this study is data that comes from quantitative data. Quantitative data to be analyzed is Pre-Test and Post-Test data. Pre Test is a test that is given before learning begins and aims to find out to what extent students' mastery of knowledge of the learning materials to be taught. Post Test is a test that aims to find out the final differences of students after learning is carried out. The number of students who were used as the experimental sample amounted to 54 students. The value of the results of the Pre Test and Post Test can be seen in Table 13.

Table 13. Pre-Test and Post-Test scores for Biodiversity and Nutrition

NO	NIPD	NISN	Name	Pre Test	Post Test	Description
1	2122.10.1053.005	0068166756	PD-1	91	80	Valid
2	2122.10.1053.006	0056020547	PD-2			Invalid
3	2122.10.1053.007	0057406350	PD-3	67	76	Valid
4	2122.10.1053.008	0055972069	PD-4	95		Invalid
5	2122.10.1053.009	0054599336	PD-5	82	85	Valid
6	2122.10.1053.011	0054437351	PD-6	85	77	Valid
7	2122.10.1053.013	0069573275	PD-7	78		Invalid
8	2122.10.1053.017	0056121499	PD-8	83	74	Valid
9	2122.10.1053.018	0057502581	PD-9	91	100	Valid
10	2122.10.1053.019	0059484918	PD-10	87		Invalid
11	2122.10.1053.021	0044573613	PD-11	82	85	Valid
12	2122.10.1053.024	0043723611	PD-12	96		Invalid
13	2122.10.1053.028	3049624587	PD-13	63	78	Valid
14	2122.10.1053.029	0054610798	PD-14	32	35	Valid
15	2122.10.1053.030	0055964029	PD-15			Invalid

16	2122.10.1053.039	0066646816	PD-16	60	51	Valid
17	2122.10.1053.041	0042942168	PD-17	67	60	Valid
18	2122.10.1053.042	0056973193	PD-18	85		Invalid
19	2122.10.1053.043	0058848459	PD-19	66	84	Valid
20	2122.10.1053.046	0059098081	PD-20	91		Invalid
21	2122.10.1053.048	0057679927	PD-21	80	71	Valid
22	2122.10.1053.051	0054368445	PD-22	0	56	Valid
23	2122.10.1053.052	0054221469	PD-23	89	96	Valid
24	2122.10.1053.053	0057734769	PD-24			Invalid
25	2122.10.1053.054	0048888194	PD-25	91	84	Valid
26	2122.10.1053.055	0059571814	PD-26	71	80	Valid
27	2122.10.1053.058	0061841558	PD-27	85	87	Valid
28	2122.10.1053.062	0045987523	PD-28	81	85	Valid
29	2122.10.1053.063	0061743550	PD-29			Invalid
30	2122.10.1053.066	0062583670	PD-30	64	64	Valid
31	2122.10.1053.023	0052129765	PD-31	83	95	Valid
32	2122.10.1053.068	0054517977	PD-32	89		Invalid
33	2122.10.1053.069	0056039191	PD-33	0	100	Valid
34	2122.10.1053.070	0056142195	PD-34	76	69	Valid
35	2122.10.3923.001	0046844114	PD-35			Invalid
36	2122.10.3923.002	0071770743	PD-36	0	62	Valid
37	2122.10.3923.047	0058051337	PD-37	67	75	Valid
38	2122.10.3923.005	0056177562	PD-38	85		Invalid
39	2122.10.3923.010	0058108078	PD-39	0	78	Valid
40	2122.10.3923.012	0059305173	PD-40	85	93	Valid
41	2122.10.3923.015	0055807979	PD-41	59	78	Valid
42	2122.10.3923.024	0014545511	PD-42	56	32	Valid
43	2122.10.3923.026	0062817640	PD-43	65	85	Valid
44	2122.10.3923.029	0056260526	PD-44	93	93	Valid
45	2122.10.3923.032	0044197609	PD-45	49	100	Valid
46	2122.10.3923.051	0057314676	PD-46			Invalid
47	2122.10.3923.050	0068008489	PD-47	78		Invalid
48	2122.10.3923.034	0029495799	PD-48	71	64	Valid
49	2122.10.3923.037	0067311101	PD-49			Invalid
50	2122.10.3923.038	0061246365	PD-50			Invalid
51	2122.10.3923.049	0039440097	PD-51			Invalid
52	2122.10.3923.041	0053793678	PD-52	71	78	Valid
53	2122.10.3923.042	0054916803	PD-53	71		Invalid
54	2122.10.3923.046	0055739541	PD-54	85		Invalid

After the Pre Test and Post Test are carried out, the next step is to select valid student scores and discard invalid values, namely student scores number 2, 4, 7, 10, 12, 15, 18, 20, 24, 29, 32, 35, 38, 46, 47, 49, 50, 51, 53, 54 so that the data used to calculate the

increase in student learning outcomes are 34 students. Furthermore, the data is processed and obtained the minimum value, maximum value, and the average value of the students' pre-test and post-test results on aspects of knowledge about biodiversity and nutrition according to table 14.

Table 14. Comparison of Average Pre-Test and Post-Test on Aspects of Knowledge on Biodiversity and Nutrition

Description	Pre Test Score	Post Test Score
Minimum	0	32
Maximum	91	100
Average	64,85	76,77

Based on the data from Table 13, it can be seen that the average value of the initial pre-test was 64.85, which increased the average value of the post-test to 76.77, although it was not very significant. This means that the learning carried out by students about biodiversity and nutrition based on the integrated GREEN model results in an increase in student learning outcomes. Meanwhile, the qualitative data in this study were obtained from the results of interviews and questionnaires.

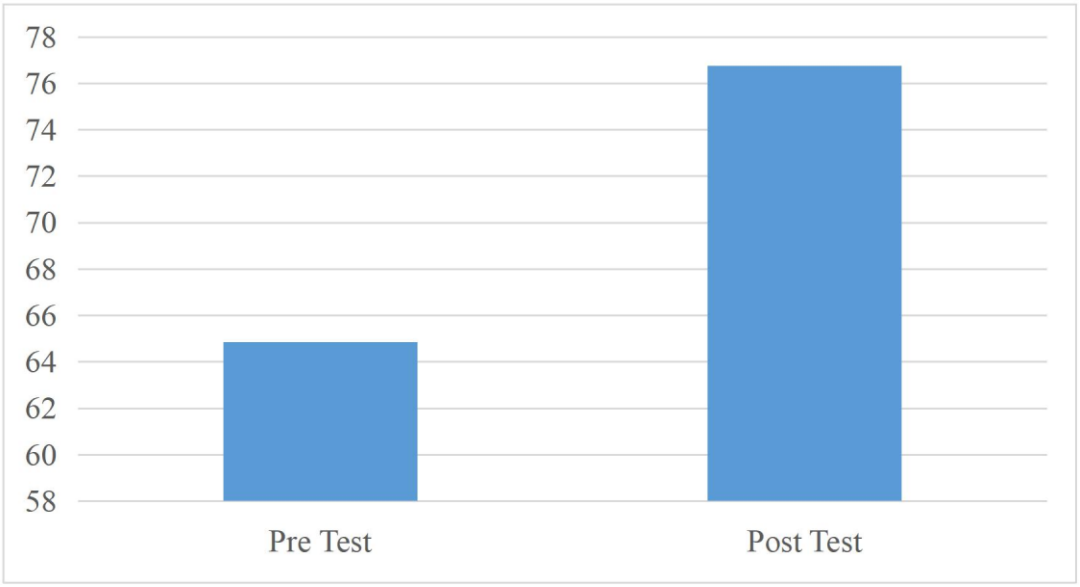


Figure 4.
Average Pre-Test and Post-Test Knowledge of Biodiversity, Food, and Nutrition

b. Questionnaire Data Processing and Analysis

A total of 143 students gave feedback on 10 questions related to the creation of an integrated model GREEN media. Students' responses to the Likert scale questionnaire can be categorized into three main aspects, namely the motivation and ease of making integrated GREEN media models (items 1 and 2), aspects of knowledge about biodiversity and nutrition (items 4,7,8,10), and activities. and promotion of integrated GREEN Model media for students (items 3, 5, 6, 9). The results of the Likert scale questionnaire feedback can be seen in Figure 5, Figure 6, and Figure 7.

Feedback from students in expressing their motivation regarding interest or liking for new theories in the creation and development of the Integrated GREEN Model based on biodiversity and nutrition in schools (39% like and 43%). Thus, in general, students stated that they strongly agreed that the integrated model GREEN media was interesting.

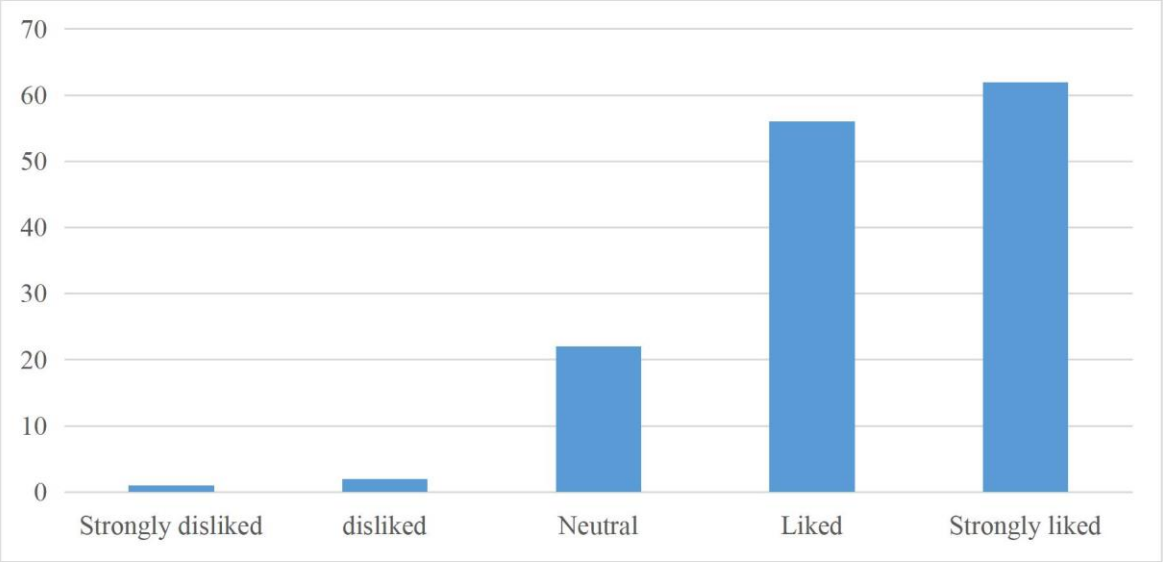


Figure 5.
Motivation about new theory in the creation and development of GREEN Integrated Model on biodiversity, food and nutrition in schools

While the responses of students in expressing their activities in the manufacture and development of the Integrated GREEN Model on biodiversity and nutrition in schools (easy 36% and very easy 28%). Thus, in general, students agreed that the integrated model GREEN media was easy to do.

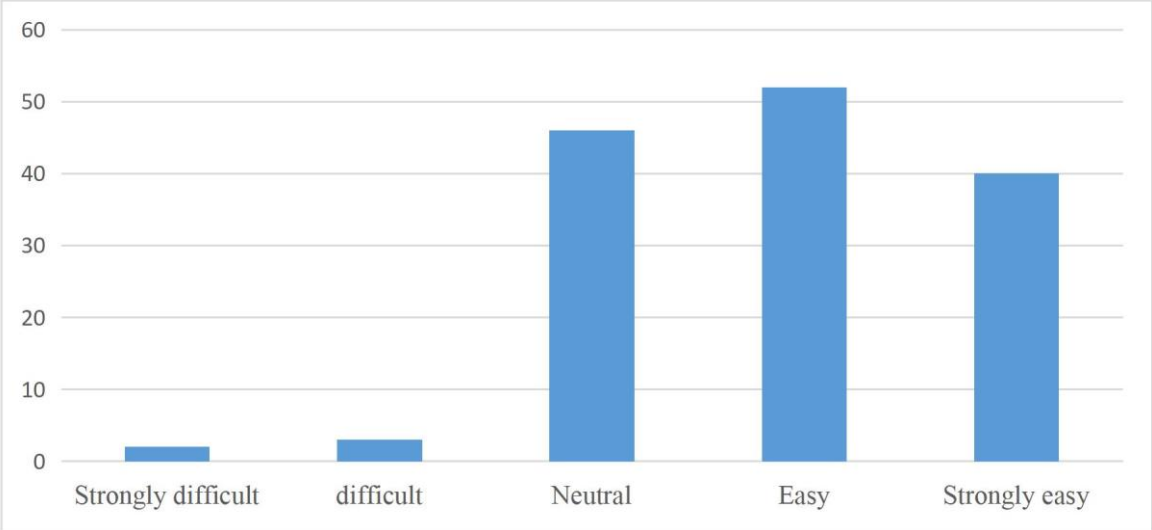


Figure 6.
GREEN Integrated Model creation and development activities on biodiversity and nutrition in schools

Based on the student feedback questionnaire in the aspects of knowledge about biodiversity and nutrition on questions 4, 7, 8, and 10 (average agree 26.40% and strongly agree 61.11%. Thus, in general (87.51 %) of students stated that they strongly agree that they have gained new knowledge / theory about the creation and development of the GREEN (Garden Resources, Education, and Environment Nexus) integrated model and more real knowledge of biodiversity in schools as well as getting information on the nutritional content of fruits, vegetables , and fish.

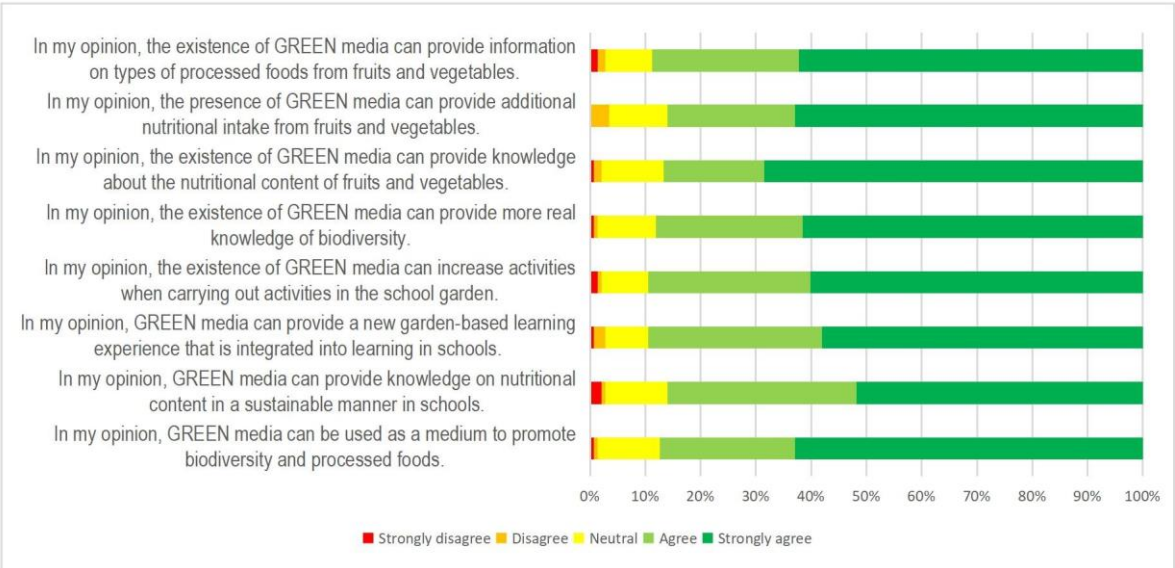


Figure 7. Questionnaire Feedback Results on Integrated Model GREEN Media

While the student feedback questionnaire in the aspects of activities and promotions of the integrated GREEN Model media for students on questions 3, 5, 6, and 9 (average agree 27.00% and strongly agree 60.52%. Thus, in general (87.52%) of students stated that they strongly agree that the GREEN model is integrated as a medium to promote biodiversity and its processed foods and gain new learning experiences based on school gardens that are integrated in learning at school and increase activities when carrying out activities in the school garden. , they also get additional nutritional intake from fruits and vegetables and processed foods taken from the garden.

c. Interview Data Processing and Analysis

Interviews were conducted with 3 resource persons who were students of the Kota Kinabalu Indonesian School who were the implementing coordinators of SIKK Farm who participated in making the integrated model GREEN media. The informants who were interviewed intensively with names using initials, namely MBY, AAA, and DM.

Interviews with resource persons with the initials MYB were held on Wednesday, November 24, 2021; resource persons with the initials AAA will be held on Thursday, November 25, 2021; resource person with the initials DM will be held on Friday, November 26, 2021.

The data that the researcher collects is then tested to determine whether or not a finding that the researcher gets in the field is valid. All data from this research are described based on the focus of the research objectives as follows:

1. How do you get new learning experiences based on school gardens that are integrated into learning in schools?

According to sources, they have experience with direct activities in the garden, such as cleaning the garden, sowing vegetable seeds, watering. They also admit that through these activities they get very useful experiences in learning. For example, relating to biology subjects such as knowing the scientific name of plants, in chemistry knowing the chemical elements used in the manufacture of organic fertilizers. In addition, it increases the enthusiasm of students to love green plants.

2. Can an integrated model GREEN program increase activities in school gardens? Explain!

According to the resource person, the integrated model GREEN program provides many positive activities that make students active not only in learning gardening but also in

competitions that can maximize students' ability to communicate and share opinions about gardening at SIKK Farm and increase self-confidence.

3. Can the integrated model GREEN program provide more real knowledge of biodiversity and the nutritional content of fruits and vegetables? Explain!

According to the informant, the integrated model GREEN program is very helpful in knowing more about the nutritional intake of vegetables and plants. In addition, it can also help in choosing healthy foods with adequate nutritional intake.

4. Can the integrated model GREEN program provide additional nutritional intake from fruits and vegetables and their processed foods? Explain!

According to the informants, they got knowledge and how to make organic fertilizers that can make plants grow with good nutrition without using chemicals, so they can consume healthy and nutritious food.

5. Can the integrated model GREEN program provide changes/improvements for the better as a learning medium in improving students' academic and non-academic abilities?

According to the informant, the integrated model GREEN program is very influential in improving abilities in academic and non-academic fields, in addition to being able to learn and participate in competitions, it also gains awareness of the importance of consuming vegetables.

6. Can the GREEN Integrated Model become a broad tool in improving physical, psychosocial health, early dietary behavior, and additional nutritional intake?

According to the informant, the existence of an integrated model GREEN program influences students to start being wise in processing leftovers, being more responsible in carrying out tasks in the garden or in the classroom, in managing and caring for plants as well as growing a sense of love for the environment.

7. Can the Integrated GREEN Model be a vehicle for building connections with students at different levels, forming communities with other CLCs/schools, and creating a modern educational environment based on school gardens?

According to the informant, they held a webinar Sharing Is Caring which invited students from all school levels, and several other communities such as CLC. They shared about how to grow vegetables in a simple space and invited students to learn gardening, and increase knowledge about nutrition and nutrition, and also share experiences during gardening.

8. Does the Integrated GREEN Model affect the educational climate in schools so that it is more conducive and integrated?

According to the informant, the integrated GREEN model program not only adds knowledge and enthusiasm but also makes new friends, and the main beauty is that they learn happily, working together because there are no superhumans, only super teams.

From the results of interviews with the three sources, it can be concluded that the integrated model GREEN program has an influence on learning experiences, activities, knowledge, and skills in communicating, working together, collaborating, and choosing healthy foods. In addition, self-confidence and a sense of love for the environment increase.

5. Conclusion

The establishment of an integrated GREEN (Garden Resources, Education, and Environment Nexus) model can be done at the Kota Kinabalu Indonesian School. Starting from the process of formulating the school garden concept in accordance with the basic competencies of the subjects, planning the making of GREEN through Project Based Learning, preparing locations, tools and materials, as well as regulating the involvement of school residents in making the integrated model GREEN program. The implementation stages start from the manufacture and processing of plantation planting media, seeding, transfer, maintenance and monitoring of developments, harvesting activities and promotion programs to school residents.

The integrated model GREEN media can improve student learning outcomes from an average score of 64.85 to 76.77 on knowledge of biodiversity, food and nutrition.

In general, students gave feedback that making the integrated GREEN model was interesting and easy. Most of the students agreed that the GREEN model was integrated as a medium for promoting biodiversity, food and providing new learning experiences based on school gardens as well as increasing activities. In addition, it can provide nutritional intake of fruits and vegetables.

6. Personal Investigator and other researcher

No	Name	Position	Institution
1.	Nayudin Hanif, S.Pd.,Gr.	Research Coordinator	SIKK
2.	Dr. Ir. Supriyanto, DEA.	Research Collaborator	SEAMEO BIOTROP
3.	Rangga Bhakty Iskandar, S.Pd.,Gr.	Member	SIKK
4.	Susmin Ito, S.Pd.,Gr.	Member	SIKK
5.	Siti Fatimah, S.Pd.,Gr.	Member	SIKK
6.	Ahmad Arif Febriyanto, S.Pd.,Gr.	Member	SIKK
7.	Endang Sari P. Nababan, S.Pd.,Gr.	Member	SIKK

5. References

Ampuero, D., Miranda, C. E., Delgado, L. E., Goyen, S., & Weaver, S. (2015). Empathy and critical thinking: Primary students solving local environmental problems through outdoor learning. *Journal of Adventure Education and Outdoor Learning*, 15(1), 64–78.

Basrowi dan Suwandi. (2008). *Memahami Penelitian Kualitatif*. Jakarta: Rineka Cipta

Bowker, R., & Tearle, P. (2007). Gardening as a learning environment: A study of children's perceptions and understanding of school gardens as part of an international project. *Learning Environments Research*, 10(2), 83–100.

Burt, K. G., et, al., (2018). School Gardens in the United States: Current Barriers to Integration and Sustainability. *Ajph Open-Themed Research*. 108(11), 1543-1549.

Burt, K. G., Koch, P., Contento, I. (2017). Development of the GREEN (Garden Resources, Education, and Environment Nexus) Tool: An Evidence-Based Model for School Garden Integration. *Journal Of The Academy Of Nutrition And Dietetics*, 1-11.

Christensen, J. H., & Wistof, Karen. (2019). Investigating the effectiveness of subject-integrated school garden teaching. *Journal of Outdoor and Environmental Education*, 10(09), 1-15

Food and Agriculture Organization. (2010). A New Deal for School Gardens. Rome,Italy: FAO.

Kammar, M., Biradar, A.P., Angadi, S.C., Vidyavathi, G.Y. (2017). Impact of School Nutrition Garden on the Nutrient Intake of Children. *Asian Journal of Agricultural Extension, Economics & Sociology*. 18(2), 1-6.

Kangas, M., Kopisto, K., Löfman, K., Salo, L., & Krokfors, L. (2017). 'I'll take care of the flowers!': Researching agency through initiatives across different learning environments. *Journal of Adventure Education and Outdoor Learning*, 17(1), 82–91.

Kirby, T. (2008). *A garden of learning. Science and Children,* 45(9), 28.

Kohlstedt SG. (2008). "A better crop of boys and girls": The school gardening movement, 1890-1920. *History Educ Q*. 48(1), 58-93.

Laird, H. (2016). *Garden-Based Nutrition Education Programs: A Review of Impact and Evaluation Methods*. [Thesis]. Pittsburgh: University of Pittsburgh.

Langellotto GA, Gupta A. (2012). Gardening increases vegetable consumption in school-aged children: A meta-analytical synthesis. *HortTechnology*. 22(4), 430-445.

Morris, J.L. & Zidenberg-Cherr, S. (2002). Garden-enhanced nutrition curriculum improves fourth-grade school children's knowledge of nutrition and preferences for some vegetables. *Journal of The American Dietetic Association*. DOI: https://doi.org/10.1016/S0002-8223(02)90027-1.

Nyberg, L. (2014). "Seeding science in elementary schools." *Science and Children*. March 2014, Vol. 51 Issue 7, s. 84–88.

Ohly H, Gentry S, Wigglesworth R, Bethel A, Lovell R, Garside R. (2016). A systematic review of the health and well-being impacts of school gardening: synthesis of quantitative and qualitative evidence. *BMC Public Health*. 16:286.

Ozer EJ. (2007). The effects of school gardens on students and schools: Conceptualization and considerations for maximizing healthy development. *Health Educ Behav*. 34(6), 846-863.

Ratcliffe MM, Merrigan KA, Rogers BL, Goldberg JP. (2011). The effects of school garden experiences on middle school-aged students' knowledge, attitudes, and behaviors associated with vegetable consumption. *Health Promot Pract*. 12(1), 36-43.

Ratcliffe, M. M., Merrigan, K. A., Rogers, B. L., & Goldberg, J. P. (2011). The effects of school garden experiences on middle school-aged students' knowledge, attitudes, and behaviors associated with vegetable consumption. *Health Promotion Practice,* 12(1), 36–43.

Richards, D. 2010, "Primary school permaculture". *Primary Geographer,* Vol. 95 issue 3, s. 7–9.

Sanjaya, Wina. (2011). *Penelitian Tindakan Kelas*. Jakarta: Kencana.

Tim Penyusun Seameo Refcon. (2018). *Kumpulan Rencana Ajar Untuk Guru Sekolah Dasar dan Menengah: Edukasi Gizi Berbasis Kebun Sekolah*. Jakarta : *Southeast*

Asian Ministers of Education Organization, Regional Center for Food and Nutrition (SEAMEO RECFON).

Walter, P. (2012). Educational alternatives in food production, knowledge and consumption: The public pedagogies of growing power and tsyunhehkw. *Australian Journal of Adult Learning*, 52, 3, s. 573–3, s. 594.

Wistoft, K. (2013). The desire to learn as a kind of love: Gardening, cooking, and passion in outdoor education. *Journal of Adventure Education and Outdoor Learning*, 13(2), 125–141.

Wistoft, K., & Dyg, P. M. (2017). Wellbeing and social relations in school gardens: The case of the gardens for bellies food and environmental education program. *Environmental Education Research*.

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    2. Penggunaan Tabel Konfigurasi Elektron untuk Meningkatkan Hasil Belajar Siswa Kelas XI IPA pada Materi Konfigurasi Elektron di SMA Sekolah Indonesia Kota Kinabalu
    3. Meningkatkan kemampuan berhitung peserta didik dengan bantuan MR Palepi pada kelas VA SD SIKK Tahun pelajaran 2019/2020

Appendix 2: Curriculum Vitae Research Collaborator

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Appendix 3**:** Curriculum Vitae Research Member

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Appendix 4**:** Curriculum Vitae Research Member

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13. Achievements	:
14. Research	:

Appendix 5**:** Curriculum Vitae Research Member

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13. Achievement	:
14. Research	:

Appendix 6**:** Curriculum Vitae Research Member

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Appendix 7**:** Curriculum Vitae Research Member

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13. Achievement :
14. Research :

Appendix 8 : Questions Pre Test dan Post Test

QUESTIONS PRE TEST DAN POST TEST

Name : ……. Gender : **male** **female**

Class : ……. Date : ……

Fill in the following questions clearly!

1.Give examples of plants that can be grouped into gene-level diversity!

2.Give examples of plants that can be grouped into species-level diversity!

3.Give an example of ecosystem level diversity!

4. What are the benefits of biodiversity?

5. What can be done to maintain biodiversity?

6. Write down the foods as a source of carbohydrates!

7.Write down the foods as a source of protein!

8. Write down the foods as sources of fat!

9. How do you know if a food contains carbohydrates?

10.How do you know if a food contains protein?

11.How do you know if a food contains fat?

Appendix 9 : Research Questionnaire

RESEARCH QUESTIONNAIRE

Name : ……. Gender: **male** **female**
Class : ……. Date : …….

Please tick (√) the option that matches your response!

1. In my opinion, new knowledge or theory about the creation and development of the GREEN (Garden Resources, Education, and Environment Nexus) Integrated Model on biodiversity and nutrition in schools is a program that …..
   strongly liked liked neutral disliked strongly disliked

2. In my opinion, the establishment and development of the GREEN (Garden Resources, Education, and Environment Nexus) Integrated Model on biodiversity and nutrition in schools is an activity that …..
   strongly easy easy neutral difficult strongly difficult

3. In my opinion, GREEN media can be used as a medium to promote biodiversity and processed foods.
   strongly agree agree neutral disagree strongly disagree

4. In my opinion, GREEN media can provide knowledge on nutritional content in a sustainable manner in schools
   strongly agree agree neutral disagree strongly disagree

5. In my opinion, GREEN media can provide a new garden-based learning experience that is integrated into learning in schools.
   strongly agree agree neutral disagree strongly disagree

6. In my opinion, the presence of GREEN media can increase activities when carrying out activities in the school garden.
   strongly agree agree neutral disagree strongly disagree

7. In my opinion, the existence of GREEN media can provide more real biodiversity knowledge.
   strongly agree agree neutral disagree strongly disagree

8. In my opinion, the existence of GREEN media can provide knowledge about the nutritional content of fruits and vegetables.
   strongly agree agree neutral disagree strongly disagree

9. In my opinion, the presence of GREEN media can provide additional nutritional intake from fruits and vegetables.
   strongly agree agree neutral disagree strongly disagree

10. In my opinion, the existence of GREEN media can provide information on types of processed foods from fruits and vegetables.
    strongly agree agree neutral disagree strongly disagree

Appendix 10 : Research Interview Guidelines

INTERVIEW GUIDELINES

1. How do you get new learning experiences based on school gardens that are integrated into learning in schools?

2. Can an integrated model GREEN program increase activities in school gardens? Explain!

3. Can the integrated model GREEN program provide more real knowledge of biodiversity and the nutritional content of fruits and vegetables? Explain!

4. Can the integrated model GREEN program provide additional nutritional intake from fruits and vegetables and their processed foods? Explain!

5. Can the integrated model GREEN program provide changes/improvements for the better as a learning medium in improving students' academic and non-academic abilities?

6. Can the GREEN Integrated Model be a broad tool in improving physical, psychosocial health, early dietary behavior, and additional nutritional intake?

7. Can the Integrated GREEN Model be a vehicle for building connections with students at different levels, forming communities with other CLCs/schools, and creating a modern educational environment based on school gardens?

8.Does the Integrated GREEN Model affect the educational climate in schools so that it is more conducive and integrated?

Appendix 11 : Research Documentation

The Best Documentation of Activities in the School Garden

Vegetable harvesting activities in the backyard of the school

Vegetable harvesting activity in the front of the school garden

School cleaning activities in front of the school

Watermelon harvest activity in the school garden

The activity of collecting compost from dry leaves behind the school

Caring for the garden in front of the school