Preschoolers' Use of Magnifying Glass and Dichotomous Key for Observation Classification and Identification of Small Animals in Early Childhood Science Education

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Abstract
This study seeks to find out if preschool children have the ability to use scientific tools, such as the magnifying glass and dichotomous key to observe, compare, classify and identify small animals like insects and worms, within their preschool environments. The study adopted experimental research design. The population of the study is 68 preschool children found in Intensive Kiddies Academy, the preschool where the study was carried out. The sample size of the study is 35 preschool children, which is 52% of the total population, gotten through percentage. The study employed scientific tools such as handheld magnifying glass and dichotomous key, which was used by the preschool children for the exploration activities. The preschool children were in age bracket 3 years to 5 years. Two objectives and two research questions were posed to guide the study. The research stated with pilot study and lasted for four weeks. The study concluded that preschool children have the ability to observe, compare, classify and identify small animals such as insects and worms, using magnifying glass and dichotomous key since 29 preschool children (82%) of the 35 preschool children that participated in this study completed their key and identified their specimen. It thus recommended that the government and other educational stakeholders should, encourage and support early childhood education in the teaching and learning of early childhood science by providing the necessary technological and scientific tools to early childhood education centres and preschools.

Keywords: **Preschoolers; Magnifying Glass; Dichotomous Key; Observation; Identification; Classification and Small Animals.**

Introduction

Teaching and learning of science concepts and activities in early childhood education involves scientific inquiry in a developmentally appropriate way that help preschool children to discover things by asking questions on what they were taught, with the guidance of the caregiver. Young children learn science by doing scientific activities, observing and reflecting; these activities happens throughout the school year and should be integrated in all the early childhood science lesson plan (Sobulo, Adikuru & Peter, 2021). Scientific enquiry in early childhood education has to do with the various ways in which young children study the natural world. Science is the act of studying and learning something new, inquiry has to do with sourcing information by investigating something in order to find out or get more knowledge about that thing (Sobulo, Adikuru & Peter, 2021), as the preschool children did with small animals in this study. Scientific inquiry encourages preschool children to explore their ecological systems in their own way.

This study presents early childhood science activities performed with preschool children which allows the children to study science concepts and activities by observing small animals (insects and other tiny organisms) using a handheld magnifying glass. This enable the preschool children to develop their scientific knowledge and science inquiry skills, as they classified and identified the observed insects and other tiny organisms, using a dichotomous key (Brenneman 2011). Empirically, preschool children's natural curiosity is been stimulated by their immediate natural ecological system, to seek and find responses to everything happening around them, which suggests that preschool children begin to conceive scientific ideas from birth (Harlen 2015). Preschool children are motivated to learn when their natural curiosity is properly guided by parents and caregivers by laying good foundation for acquiring scientific knowledge through science inquiry skills.

Inquiry-based science teaching approach therefore, seems to be a developmentally appropriate approach for commencing science teaching and learning with preschool children and providing the children with important simple science apparatus and scientific knowledge needed to finding solutions to problems (Zucker et al. 2016; Canto, de Pro & Solbes, 2016). At the preschool or early childhood stage, it is imperative that preschool children should have direct experiences of real life situations through their senses (Monteira and Jiménez-Aleixandre, 2016). This will enable them to have very good foundation in the themes they study from their environment (Mazas et al. 2018). Therefore, appropriate considerations must be made by caregivers on preschool children's learning environments as preschool children are more

committed and actively participates in their science learning when guided by caregivers who employed accessible and clear teaching, than when the preschool children are at liberty to make inquiry of some science themes by themselves (Hong and Diamond 2012).

To enhance preschool children's interest and active participation in learning early childhood science concepts and activities, there is need to integrate practical real world science activities with theoretical science concept lessons. That is to say, preschool children are not inspired by learning activities that requires them to passively listen and observed, they want to get involved (Prokop and Fančovičová 2017). Consequently, in early childhood education, the teaching approach used by caregivers to introduce preschool children to early childhood science concepts and activities is very important, likewise the time spent on introducing the science concept and activities, the materials provided for them and the set objectives to be achieved (Trnova and Trna 2015). To enhance preschool children's understanding of the natural world and science concepts and activities, it is imperative that caregivers' should improvised materials and equipment such as scales, hand lens and books among others which are made from the locally sourced materials used in the society, which should be gradually introduced into early childhood science lessons (Garcia-Carmona, Cariado & Canal, 2014).

In early childhood education, teaching of science concepts should be hinged on acquiring simple fundamental science inquiry skills that will help preschool children develop organized approach that is potent in involving them with recording of experimental procedures, such as observing, predicting, questioning, summarizing and stating results (Gerde, Schachter & Wasik, 2013). Scientific literacy in early childhood education, therefore, refers to the development of basic understanding of science concepts and processes through inquiry-based learning experiences. It involves promoting curiosity, critical thinking and problem-solving skills in preschool children to help them make sense of the world around them. Research suggests that developing scientific literacy at preschool age can have long-term benefits for preschool children's academic success and overall cognitive development. For example, a study by Zhai, Wei, and Wen (2013) found that preschool children who received early exposure to science education had higher levels of academic achievement in later years.

Caregivers play important roles in teaching science concepts and processes in early childhood education, through planning of science lessons and organizing science learning activities and teaching science inquiry to source for scientific information (Rauf et al. 2013). The importance of teaching scientific observation to preschool children is to identify every details of observed organisms, objects or materials. Observation is very important in creating scientific knowledge

and is the key factor in understanding the world around us. Previous studies about preschool children's observation skills found that observations by preschool children were tangible and established in two ways: explaining observation by using previous knowledge and experiences and by doing more exclusive close observation on insects and other small animals

Insects

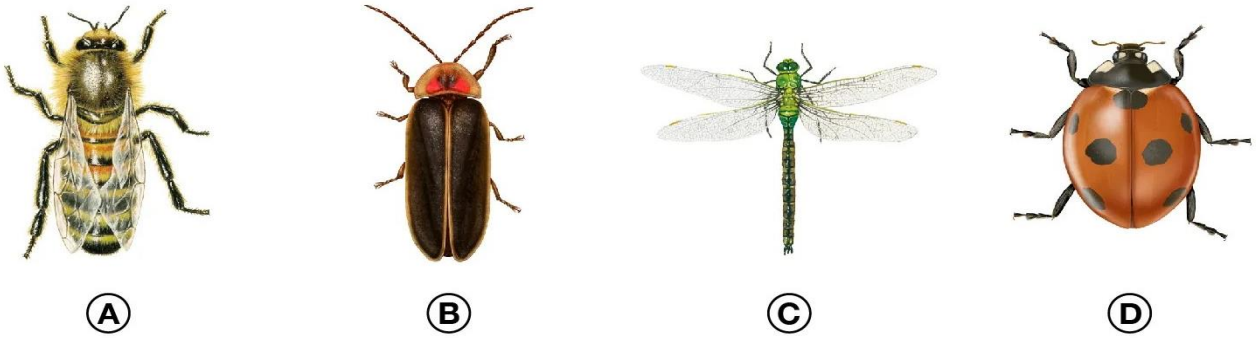
Insects (class Insecta or Hexapoda) are small animals without backbone known as invertebrate animals, they are arthropods and belong to the phylum Arthropoda, which is the largest of the animal phyla and meaning they have an eternal skeleton or exoskeleton called cuticle and articulated appendages. Insects are classified in the class Insecta because their body is divided into three main parts or segments, with which the name insect is derived from the Latin word Insectum, which means divided or segmented in to parts. Besides segmented body, insects have jointed legs, the body of insects distinguished them from other arthropods. The three body division of an insect include: the head which carry the mouthparts, the eyes and a pair of antennae; the thorax which is segmented into three and usually bears three pairs of the insect's legs, the adult insects usually have one or two pairs of wings for flight.

The many segmented abdomen bears the lineup of spiracles for respiration and contain the digestive system, the excretory system and the reproductive system. This suggests the simple definitions of insects for preschool children thus, an insect is a type of very small animal with six legs, with a body divided into three parts and usually have two pairs of wings, or more generally, any similar very small animal: Ants, beetles, butterflies and houseflies are all insects. An insect is a member of a larger group called the arthropods. This group also include spiders, ticks, centipedes, lobsters and crabs. Like all arthropods, insects have a body that is divided into segments or sections. They also lack a skeleton inside the body.

Dichotomous key

Dichotomous key is a scientific tool used in biological sciences to identify and classify organisms based on their observable traits. It consists of a series of statements or questions with two possible answers, leading to the user to progressively narrow down the options until they reach a specific identification. Each step in the key is based on a key characteristic of the organism being identified. Dichotomous keys are typically presented in a branching, tree-like format, with each decision point leading to further choices until a specific identification is made. They are often used by scientists, students and individuals working in the field of science to quickly and accurately identify unfamiliar organisms (Lopez, Carrillo & de la Cruz Vicente, 2016).

Fig 1. Dichotomous Key for Insects



1a. Wings are covered by an exoskeleton — go to step 2.
1b. Wings are not covered by an exoskeleton — go to step 3.

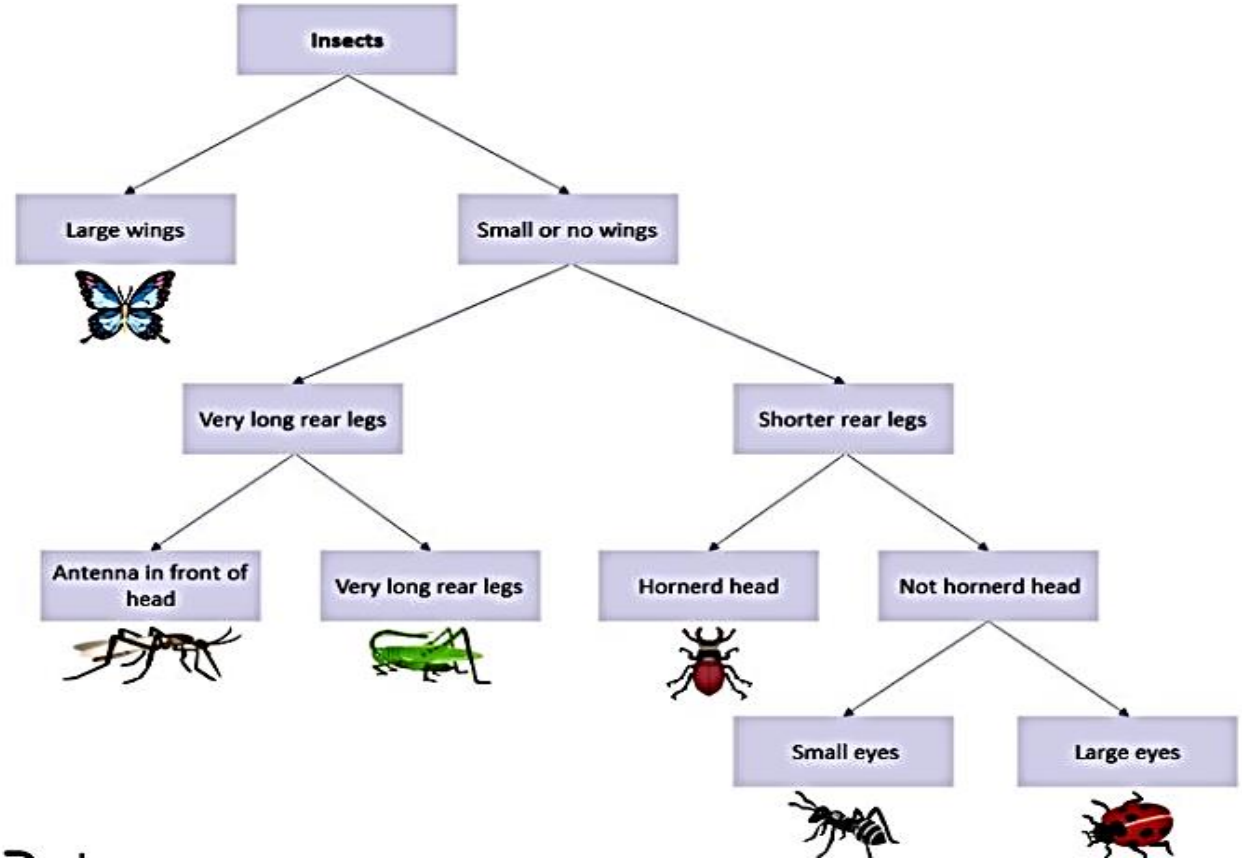
2a. Body has a round shape — *ladybug*.
2b. Body has an elongated shape — *firefly*.

3a. Wings point outward from the body — *dragonfly*.
3b. Wings point toward the rear of the body — *bee*.

Source: Wondershare Edraw

The process of using a dichotomous key involves carefully observing and comparing the characteristics of the organism in question with the descriptions provided in the key. By systematically following the key and making decisions based on the presence or absence of specific features, users can determine the correct identification of the organism. Dichotomous keys are valuable tools for organizing and categorizing the vast diversity of living organisms on earth, providing a systematic method for identification based on observable traits and characteristics (Prior Español & Mazas Gil, 2016). Dichotomous keys are commonly used in teaching science in early childhood education to classify living organisms or inert matter based on specific defining characteristics. This tool is utilized in early childhood education curricula to present dilemmas to preschool children, who must choose one option over another to resolve a dichotomy and identify a specimen. Preschool children develop logical and critical thinking through the use of dichotomous key, by experimenting and observing the changeover from one impasse to another after making a decision based on their observations.

Fig 2. Dichotomous Key for Insects (Invertebrates)

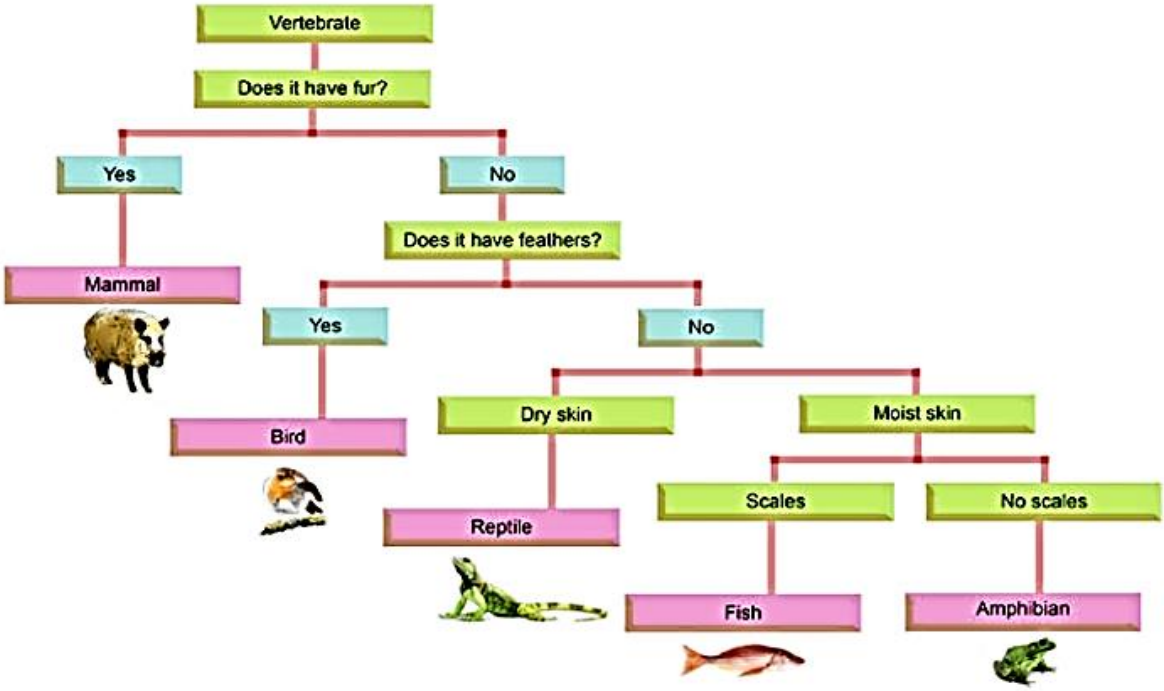


Source: Wondershare Edraw

Teaching and learning of science in early childhood education may focuses on vertebrate animals such as farm animals and pets, but expanding to include invertebrates found in the environment is crucial for a comprehensive understanding. Encouraging preschool children to observe and recognize living organisms in their surroundings fosters scientific curiosity and questioning (Fusaro and Smith 2018). Outdoor environments provide valuable opportunities for preschool children to observe natural phenomena and develop observational skills. Analyzing an animal's habitat, anatomy, behaviour and functional aspects aids in naming and studying animals, particularly invertebrates found in school gardens. Preschool children should have the knowledge of small animals found in their environment like the ones without backbone known as the invertebrates in the school and home garden. Observing and describing them in their natural environment or habitat and then take the lesson in the science class with the caregiver performing science activities to enable preschool children relate their previous knowledge with their newfangled knowledge (Martinez-Losada, Gracia-Barros & Gambo, 2014). According to Pardo Santano (2011) dichotomous key help to interact with nature and

manipulate its components that is the natural elements and phenomena, develop scientific skills, enhance scientific knowledge, classify and keep inventory of elements in the natural ecological system.

Fig 3. Dichotomous Key for Animals (Vertebrates)



Source: Wondershare Edraw

Magnifying glass

A magnifying glass is a simple optical device used for viewing minute details of objects with some magnification. Magnifying glass (hand lens) is held at a distance from the eyes in order to view an object. A magnifying glass is a convex lens that magnifies the appearance of an object placed under it making it bigger than the normal size so that the very tiny details of that object can be seen. It is like a tiny window into a world of minute details, allowing the user to see things more conspicuously and in greater detail than with the naked eyes alone. These technological optical tools have been in use for years, for conducting scientific experiments, observing and examining tiny objects and reading very tiny print. It is sometimes called a simple magnifier, in scientific terms. Its function is based on the principles of convex lenses, which converge light rays and enlarge the visual field. Magnifying glass is widely used in many scientific disciplines, such as physics, chemistry and biology. To observe specimen very

closely to perform detailed examination and analyse complicated structures that may not be visible to the naked eyes in the field of science, scientists make use of magnifying glasses.

Fig 4. Handheld Magnifying Glasses (Hand Lens)

Source: Westlab Online

In this study, the researchers incorporated magnifying glass to enhance preschool children's observation for the exploration of small animals that need to be classified and identified, this helped the children to have closer look at the small animals, making detailed examination of the small animals (insects and worms) and see every part of it, which contributed to preschool children's more accurate observation and comparison for classification and identification of the small animals.

Valuation of Preschool Children's Scientific Knowledge

In valuation of preschool children's scientific knowledge, their science learning should be done with diversity of scientific and technological tools instead of relying only on direct observation in the classroom (García-Carmona, Criado, & Cañal 2014). Use of technological devices such as video cameras for collection of audio and video documentation help caregivers to evaluate preschool children's comments and discussions, their reactions to various conditions, the questions they pose and the answers they gave to the caregivers when working collaboratively in group. Therefore video camera is a tool that should be used for proper audio and visual documentation of preschool children's learning of science concepts and activities in early

childhood education. However, preschool children's knowledge of living organisms can also be analysed by the drawings preschool children prepared on their own when they have finished science learning (Villarroel & Infante, 2014). Preschool children who gained adequate knowledge of living organisms made better drawing of living organisms than others, their drawings usually contain other features such as the sun, grass, soil and water among others. Therefore, caregivers should underscore the significance of preschool children's drawings as part of the yardstick in evaluating early childhood science knowledge gained by preschool children (Villarroel et al. 2017). Such drawing made by the preschool children is an internalization of the scientific activity they have learnt (Garcia, Barros, Martinez-Losada & Garrido, 2011). Scientifically, a drawing has the possibility of performing and facilitating role in visualizing preschool children's exploration of scientific concepts and activities. Besides, the preschool children's drawing can form the foundation of discussion that underpins verbalization of notions and observations and can substantially improve in the targeted features if the children's observation is guided through object-centered questions.

Statement of the Problem

Early childhood science education is a fundamental domain of study that lack enough empirical study that concentrated on the usefulness of early childhood science activities in preschools. As a result, the current emphasis on science teaching and learning in early childhood education underscores the importance of research in early childhood science concepts and processes (Bustamante, White & Greenfield, 2018). Caregivers have the opportunity to introduce scientific ideas by leveraging on the inherent inquisitiveness of preschool children and relate the ideas to their environment, taking advantage of this, caregivers should introduce scientific tools to underpin the ideas. This made it imperative for the researchers in this current study to work with 5 caregivers in the preschools to design a series of science education activities for preschool children, to learn with scientific tools such as magnifying glass and dichotomous key, which will enable preschool children to develop science inquiry skills like observation, identification, comparison and classification of tiny organisms like insects and worms, small invertebrate creatures. The science activities in this current study were carried out in the preschool children's school garden and its environs, so as to present them with a real life scenario.

Objectives of the Study

The aim of this study is to examine preschool children's capability in using magnifying glass for learning science concepts and activities in early childhood education. Specifically, the study seeks to achieve the following objectives:

1. Examine preschool children capability in using magnifying glass to identify the different parts of the body of an insect.
2. Examine preschool children capability in comparing and classifying small animals observed using magnifying glass and dichotomous key.

Research Questions

1. To what extent are preschool children capable to observe and compare different parts of the body of an insect using magnifying glass?
2. To what extent are preschool children capable to classify and identify insects using a dichotomous key?

Method

The study adopted experimental research design. The population of the study is made up of 68 preschool children in Intensive Kiddies Academy in Iba Local Government Area of Lagos State. The sample of the study is comprises 35 preschool children, (20 girls & 15 boys) which is approximately 52% of the entire population of the study, gotten by percentage method, participated in the activities. The preschool children were in age bracket of 4 years to 5 years. Appropriate measures were taken to ensure the safety of the preschool children, besides the parents' consent were sought and received before the participation of the children in the study. The children have been interacting with their environment when playing and when learning outdoors with the caregiver. Though they were not new to using magnifying glass in carrying out scientific activities like using magnifying glass to read very tiny prints on a paper and attracting sunrays to get a hot spot that can ignite fire but they have not used it for any activity relating to the activities obtainable in the study they are about to participate in. Having only 5 magnifying glasses for the class of 68 preschool children, however, for the purpose of the current study, thirty (30) 1.5x hand-held magnifying glasses were purchased to augment the five they have in the school to enable every preschool child participating in the study have one to him or herself to use for the study, not sharing with anybody. These were distributed to the preschool children and contributed to the success of the study. Hand gloves were also used by the preschool children to protect their hands from sharp objects that may injure them and from stinging insects.

With the help of the caregivers, the preschool children learnt about magnifying glass and how to use it. The caregivers taught them how to place the magnifying glass on an object to get the best possible image magnification. With the joy of having this technology tool in their hand, they started using it in their classes to observe the objects they could find in their classrooms. They joyfully went outside to explore after satisfying themselves with the objects inside the classroom. These previous activities acquainted the preschool children with the use of magnifying glasses, which is fundamental for development of observation skills and in preparing preschool children for successive science practices. These initial activities and experiences were aimed at acquainting the preschool children with the small animals without backbone known as invertebrates by checking the differences and similarities with the animals with backbone known as vertebrates, which they know at home or studied at school. This helped preschool children to incorporate magnifying glass in their observation practices, so that they can use it anytime the need arises, to see small details. In conducting the observation of the invertebrates, caregivers taught preschool children to count the number of the necessary parts of the insects body needed for classification and identification, such as the eyes, antennae, legs, wings and colour, among others. This helped in the development of necessary scientific skills in in preschool children. Preschool children's knowledge acquired during pilot study which we started with, helped them in their activities. At the first presentation of the invertebrates to the preschool children as part of the natural endowment to the environment, the skill of learning to learn, observation and curiosity was concentrated on (GraciaCamona, Criado, & Canal, 2014).

At the first session, the children were able to mention the animals they know, both domestic and wild animals, explaining what the domestic animals have in common and what the wild animals have in common and how they differe from each other. This is followed by the presentation of pictures of various animals, cockroaches, ants, millipede, earthworm, larva, cat, goat, horse, fowl, jelly fish and shark, among others, which required the preschool children to observe and identify the differences and similarities between them and to find out the invertebrate animals in both water-dwelling (aquatic) and land-dwelling (terresterial) habitat. With the help of the caregivers, the children identified and named some invertebrates and their habitat.

Two (2) weeks was used with the children in practicing how to use magnifying glass for exploration of various objects and materials in the environment, under the supervision of the caregivers. They were introduced to animals with backbones, which are the vertebrates using

the domestic animals they have watched on the televisions and the ones they have seen in their environment, complemented with the ones they have seen in books. Another two (2) weeks was used for the study, which took them to the school garden where they were presented with real life scenario. The caregivers ensured guided activities for preschool children's observation, classification and identification of the small animals that is insects and others.

The whole process was supervised by the researchers. Then time was given to the preschool children to search for invertebrate animals in the environment, which they searched at the school garden, field compost yard and other places in the immediate environment. On returning to the classroom they brought all they found together with the sole aim of acquainting preschool children with invertebrate animals and their habitat. They also worked in groups with plastic invertebrates such as insects, myriapods and arachnids. All groups had all the specimen provided to them, such as houseflies, dragonflies, butterflies, grasshoppers, ants, cockroaches, beetles and spiders. The preschool children studied and identified the small animals using dichotomous keys and point out the differences and similarities. Different dichotomous keys were designed for each group as the animals are different in each group. With the help of the caregivers and using the dichotomous key, the invertebrates and the vertebrates were identified and differentiated. After taking away the plastic animals and the dichotomous key from the table, the preschool children were asked to draw any of the invertebrate they came across during the study, this is aimed at analyzing which invertebrate feature they have learnt during the study.

In documenting the preschool children's scientific activities, modern technological tools suitable for early childhood education such as video camera was used for audio-visual recording of the preschool children's activities, which provides evidence of the preschool children's knowledge of animals without bones and their characteristics. Pictures of those animals were produced from the video camera to augment the preschool children's freehand drawings of invertebrates. This help to know if the invertebrates are adequately represented and its tandem with the established classification criteria and if there is representation of any object in the environment.

Results

The preschool children exhibited good knowledge of invertebrate small animals such as ants, housefly, butterfly, wasp, earthworm, larva, snail, grasshopper, cockroach, worms, spider and wasp among others and domesticated vertebrate animals that can be found in the home vicinity, such as goat, sheep, dog, cat, fowl, rabbit, pig, donkey and duck, among others; vertebrate

wild animals that cannot be found in the home vicinity but in the wild forest, such as tiger, lion, elephant, crocodile, antelope, gorilla and chimpanzee, among others. These wild animals were characterized by their big bodies, their predatory nature on other animals, some are carnivores, (flesh-eaters) some are herbivores (leaves or grass eaters) and some are omnivores (both grass and flesh eaters), all have back bones or spinal cord in their body. The results are in tandem with the research questions as they are linked to it. All the explanations from the preschool children revealed that the magnifying glasses are used in a purposeful manner as guided by the caregivers to compare animals with each other and establish comparison procedures. In the classroom, the invertebrates were observed, described, classified and identified by the preschool children who structured the classification criteria that is age appropriate such as the number of legs, wings and presence of antennae, this means that they were able to observe different animals with the magnifying glass and compared their characteristics. The dichotomous keys were distributed to the children and were guided to use the three differentiation criteria through observation to identify the invertebrates, with help of the caregivers, they used the dichotomous key effectively.

Presentation of Tables

Table 1 below, shows the list of all the small animals that were collected, observed, classified and identified by the preschool children, assisted by the caregivers using magnifying glasses and dichotomous keys. Also included in the table are the places those small animals could be found, that is their habitat. Mentioned also on the table is the scientific tool for the observation, which is the 1.5x handheld magnifying glass and the scientific tool for classification and identification which is the dichotomous key.

Table 1: Small Animals Observed by Preschool Children Using Magnifying Glass and Places Found

SN	Small Animals	Observation Tool	Identification and Classification Tool	Places Found
1	Cockroaches	Magnifying Glass with magnification = 1.5x	Dichotomous Key	Cupboards, Sewers, Basement
2	Ants	Magnifying Glass with magnification = 1.5x	Dichotomous Key	Soil & decaying plant leaves
3	Houseflies	Magnifying Glass with magnification = 1.5x	Dichotomous Key	Homes and food markets
4	Butterflies	Magnifying Glass with magnification = 1.5x	Dichotomous Key	Gardens and fields
5	Beetles	Magnifying Glass with magnification = 1.5x	Dichotomous Key	Under Materials on the ground
6	Wasps	Magnifying Glass with magnification = 1.5x	Dichotomous Key	Shrubs, trees or bushes
7	Earthworms	Magnifying Glass with magnification = 1.5x	Dichotomous Key	Inside wet soil & watersides
8	Spiders	Magnifying Glass with magnification = 1.5x	Dichotomous Key	Backyards and Bushes
9.	Snails	Magnifying Glass with magnification = 1.5x	Dichotomous Key	Soil, leaves, wetlands, trees
10	Grasshoppers	Magnifying Glass with magnification = 1.5x	Dichotomous Key	Grasslands, fields & leaves
11	Millipedes	Magnifying Glass with magnification = 1.5x	Dichotomous Key	Moist soil beneath leaf litter
12	Dragon flies	Magnifying Glass with magnification = 1.5x	Dichotomous Key	Waterways, canals & lakes
13	Palm weevils	Magnifying Glass with magnification = 1.5x	Dichotomous Key	Rotten palm trees and leaves
14	Mosquito Larva	Magnifying Glass with magnification = 1.5x	Dichotomous Key	Stagnant waters

Source: Field survey, 2024

Table 2 below, reveals that 82% of the preschool children completed the tasks of observation, identification and classification of the small animals, while 6% completed the observation and classification but could not identify the small animal. Another 6% of the preschool children completed the observation and started the classification but could not complete it with the dichotomous key. Another 6% of the preschool children completed the observation only. This shows that greater percentage of the preschool children have the capability to observe different parts of the small animals using magnifying glass, this answers research question one. Also, greater percentage of the preschool children have the capability to compare and classify the

specimens with the handheld magnifying glass of 1.5x and dichotomous key, this answered research question two.

Table 2: Preschool Children's Achievement Level on Observing, Classifying and Identifying Small Animals with Magnifying Glass and Dichotomous Key

Groups	Stages of Science Activities	Number Preschool Children	Descriptions of Science Activities
1	Complete Observation Only, No Classification.	2 (6%)	The preschool children observed the small animals with magnifying glass of magnification = 1.5x, but could not do the classification.
2	Complete Observation, but Incomplete Classification.	2 (6%)	The preschool children observed their small animals, started the classification of the small animals with the 3 established measures but did not complete the classification.
3	Complete Observation, Complete Classification but no Identification	2 (6%)	The preschool children observed their small animals, classified their small animal with respect to the 3 established criteria but could not identify the specimens.
4	Complete Observation, Complete Classification Complete Identification	29 (82%)	The preschool children observed their small animals, classified their small animals in accordance with the 3 established criteria and Identified their small animals.

Source: field survey, 2024.

Discussion of Findings

The findings made on this study shows that it is imperative to teach science concepts and processes to preschool children in order to equip them with scientific knowledge on the use of age appropriate scientific tools like the magnifying glasses and dichotomous keys, among others. It was observed that the preschool children know more about big domestic animals in the farm and wild animals in the forest than the small animals in their surroundings. It was also observed that the preschool children have gained the knowledge of observation, classification and identification of the small animals using magnifying glasses and dichotomous keys and the places where the small animals can be found, which is very essential to their understanding of the adaptation of each small anima in their habitat (Cascarosa, et al. 2019). The preschool children have discovered new environment by learning science outside the classroom, in their school garden and compost areas being immersed in real life scenario for real life experiences in learning science concept and processes. The preschool children can now contextualize the

invertebrate small animals they know, their habitation and mode of feeding. They have come to know that invertebrate animals don't have backbones or spinal cord while the vertebrate animals have backbones. They understood the differentiation criteria among different small animals that was used in this study.

The researchers observed that the preschool children have incorporated magnifying glasses as purposeful observation scientific tools that will help the preschool children explore their immediate environment, this implies that magnifying glasses enable them to differentiate small animals form one another and establishment of classification criteria, the whole process help them to achieve their objectives (Monteira and Jimenez-Alexandre, 2016). However, the preschool children encountered challenges on the course of this study, especially in the classification and identification of the small animals using the dichotomous keys, many of them needed help form the caregivers to be able to understand the dichotomous key.

These challenges faced by the preschool children were as a result of lack of understanding on the use of the dichotomous key, special sessions would be needed to explain to the preschool children what the dichotomous key is and how to use it for classification and identification. The dichotomous key was complex, the key should be designed in a way that preschool children will make good of how the key works and its use independently, (Lopez Carrillo & de la Cruz Vicente, 2016). The preschool children did not clearly understand the symbols signifying that a given criteria is present or absent. The dichotomous key was presented in unattractive way. Dichotomous key must be presented in a way that will attract the attention of the preschool children to read it. One way to do this is to design the dichotomous key with fine drawings and colours.

Figure 1, 2, 3 are examples of well-designed dichotomous keys. These challenges notwithstanding, 29 preschool children (82%) of the 35 preschool children that participated in this study completed their dichotomy key and identified their small animals with the help of the caregivers. This suggests that the challenges were not as a result of the preschool children not knowing how to use the dichotomous key after being taught, but were as a result of the preschool children not being used to working with dichotomous key. Dichotomous keys enables preschool children to work on observation of specimens for a long period of time in a systematic way and with kin focus. It also enable caregivers to teach preschool children how to make comparison, to enable them identify the differences and similarities between the small animals they observed and how to present their observations. Dichotomous key help to interact with nature and manipulate its components that is the natural elements and phenomena, develop

scientific skills, enhance scientific knowledge, classify and keep inventory of elements in the natural ecological system (Pardo Santano, 2011).

In presenting their works, the preschool children made drawings of their observations, drawings help them to recollect the things they observed and exchange their ideas with one another. This agrees with Gomez and Gavidia (2015), who asserts that the approach to drawing underpin observational procedures in communicating what was observed.

Regarding the gender of the preschool children, no gender differences were found in the activities of the boys and girls, probably because of their tender age and active nature.

Conclusion

In conclusion, preschool children have the ability to observe, compare, classify and identify small animals such as insects and worms, using magnifying glasses and dichotomous keys. Despite the challenges they faced in this study with the use of dichotomous keys, 82% of the preschool children still managed to complete their science activity. This shows that greater percentage of the preschool children have the capability to observe different parts of the small animals using magnifying glass, this answered research question one. Also, greater percentage of the preschool children have the capability to classify and identify the small animals using dichotomous key, this answered research question two.

Recommendations

It was recommended that:

- Government and other educational stakeholders should, encourage and support early childhood education in the area of teaching and learning of science in early childhood education, by providing the necessary technological and scientific tools to the early childhood education centres and preschools.
- Caregivers should be trained through capacity building workshops or in-service trainings on the use of various technological and scientific tools in teaching science in early childhood education.
- Caregivers should learn to improvise some simple scientific tools that can be used to teach preschool children when the factory made tools are not in stock.

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