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Original Research Article

Exploring Hands-on Science Activities among Junior High School Students Amidst COVID-19 Pandemic: A Qualitative Study

Dantic Marshall James P[1*], Gannar, Ma. Isabel R[1], Catig, Mary Jean T[1], Deymos, Marc R[1], Tamoria, Joseline R[1]

[1]President Ramon Magsaysay State University, 8X9M+GXJ, Iba, Zambales, Philippines

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Abstract: The aim of this study is to explore the different hands-on activities with its common tool, and scientific skills acquired by the students amidst pandemic. The study have used narrative – inquiry research design where short-answer type essay was used as the main instrument in gathering the required data. There are twenty junior high school students who was exposed to modular approach during that have participated in the study and purposive sampling was implemented. Findings revealed the following; (a) hands-on activities accomplished, (b) scientific skills learned, (c) scientific skills enhanced, and (d) common tools used. Based from the findings, therefore it concludes that observing and classifying were the most hands-on activities students accomplished in science during the COVID-19 pandemic. Inferring was the Science skill that students greatly enhanced in doing hands-on during the pandemic. And writing tools were the most common tools used to do hands-on activities at home.

Keywords: Science Education, Hands-on Actvities, High School Students, Pandemic, Science Activities, Qualitative Study.

INTRODUCTION

Millions of students has been affected by educational systems discruption due to COVID-19 Pandemic (Pokhrel & Chhetri, 2021). And as a result of the problem, an extraordinary decision has been made to move the classes to online remote learning (Shin & Hickey, 2021). Science education seeks to produce scientifically literate students who can make informed judgments and engage in critical thought about how science and technology affect society (Sanchez & Picardal, 2022). Students have not received face-to-face instruction, and access to laboratory facilities has been restricted or almost impossible (Gamage *et al*., 2020). Hands-on science activities, which cultivate students' scientific skills, inquisitiveness, and critical thinking, are one area of education that has been notably impacted (Ekwueme, Ekon, and Ezenwa-Nebife, 2015). Educators have thus had to discover alternate methods to engage pupils in science study and guarantee that they continue to improve their scientific knowledge and abilities despite the restrictions imposed by the pandemic.

Through hands-on scientific activities and experiments, students may observe their knowledge in action and build a deeper grasp of the topic (Staff, 2021). We were concerned about the impact of the move to remote learning on these pupils, who lack tangible experiences such as touching and observing the real experiment (Velarde *et al*., 2022). In addition, students were not acquiring laboratory skills via the use of actual equipment and instruments (Mojica and Upmacis, 2021). During the COVID-19 pandemic, junior high students must actively participate in hands-on science activities. Despite the difficult circumstances, high school students must engage in a blend of academic and practical learning, including online experimental courses (Hong, Liu, Liu, & Zhao, 2021).

The COVID-19 pandemic has brought several challenges to scientific education, but teachers and students have adapted to continue engaging in hands-on science activities during the pandemic. From virtual laboratories to at-home experiments to outdoor experiments, there are several hands-on opportunities for students to continue exploring scientific topics (Herzog & Mawn, 2020). While the pandemic has compelled a change in the way science is taught now (Pyle, 2021), the emerging creative techniques may continue to affect scientific education in the future (Fularon & Dantic, 2021). These changes may lead to a more inclusive and accessible approach to science education, allowing for greater participation and

***Corresponding Author:** Dantic Marshall James P
President Ramon Magsaysay State University, 8X9M+GXJ, Iba, Zambales, Philippines

engagement from students of diverse backgrounds. Additionally, the integration of hands-on activities amidst pandemic in science education may provide new opportunities for learning and collaboration. And based from the study of Rossi *et al*., (2021) active learning tools benefit students and improve their critical thinking and their motivation and positive positioning in science.

Hands-on science activities are important since they have been shown to improve student performance and participation (Ekwueme, Ekon, and Ezenwa-Nebife, 2015) as well as promote a favorable attitude toward the subject (Krlmazkaya & Dal, 2022). Furthermore, these activities can be carried out securely at home without the need for expensive equipment (Nguyen & Keuseman, 2020).

The aim of this study is to explore the different hands-on activities with its common tool, and scientific skills acquired by the students amidst pandemic.

METHODOLOGY

The study have used narrative – inquiry research design where short-answer type essay was used as the main instrument in gathering the required data. There are twenty junior high school students who was exposed to modular approach during that have participated in the study and purposive sampling was implemented. The instrument in was validated by an education research expert, a science education expert, and professional education specialist. The short-answer type essay is composed of 4 questions, including: (a) What are the different hands-on activities that the students have accomplished in science during the COVID-19 pandemic?; (b) What scientific skills have the students learned during the pandemic?; (c) What scientific skills have the students enhanced in doing hands-on science activities during the pandemic?; (d) What are the common tools and devices that the students used in doing hands-on activities at home? Also, the steps in thematic analysis of Braun and Clark (2019) were employed in identifying, analyzing, and reporting patterns (themes) within the data.

RESULTS AND DISCUSSION

Hands-on activities accomplished in Science during the COVID-19 pandemic

Table 1 introduces the hands-on activities accomplished in Science during the COVID-19 pandemic.

Table 1: Hands-on activities accomplished in Science during the COVID-19 pandemic

Main Themes	Significant Statement	F (N=23)
Observing and Classifying	I combine the different colors of mentos and put them in sprite. I discovered the different colors of bubbles. (SS4)	11
Exposure to Nature	Seeing at different kinds of plants in yard. (SS20)	8
Recycling	What I did was creating new things from old materials. (SS6)	2
Sketching	Drawing objects outside and inside the house. (SS3)	2

Observing and Classifying

Fundamental skills in scientific investigation such as observation and classification can offer worthwhile learning opportunities. And based from the article of Ergul *et al*., (2011) numerous studies have demonstrated that introducing hands-on activities into inquiry-based science education will enhance students' attitudes toward science and science process skills. And this also happened during pandemic education, where a participant (SS15) emphasized, “The hands-on activities that I accomplished in Science during this pandemic are simple experiments like mixing oil and water” (SS15). Another notable response from a participant (SS4), I combine the different colors of mentos and put them in sprite. I discovered the different colors of bubbles.” Through these simple activities skills were developed. The result is supported by Zubaidah (2020), that curiosity, asking questions, and investigations formed in early life lead to understanding instructions, and these mechanisms are used in observing and classifying. It increased the kids' ability to mentally comprehend the world around them and stimulated their innate interest by teaching them how to observe and classify things. It merely serves to highlight how crucial it is for students to understand fundamental scientific concepts and procedures (Kurtz & Levering, 2014).

Exposure to nature

According to Mason, Ronconi, Scrimin, and Pazzaglia (2022), that there is a positive impact on the academic achievement when students are exposed to nearby nature. This also offers numerous opportunities to learn sciences.

Student participants justifying that exposure to nature really contributed to the attainment of their science activities. These include backyard gardening, propagating as well as maintenance like weeding, trimming, cultivating and daily watering and etc. The benefits of being outdoors include better academic performance and healthier development (University of Illinois College of Agricultural, Consumer and Environmental Sciences, 2019). Nature provides a hands-on environment for exploration, allowing students to collect samples, conduct experiments, and make connections between different elements of the ecosystem.

Vegetable gardening is one of the best things to do, to help augment food needs and as said by a participant "I accomplished in Science during this pandemic is planting crops and segregating." (SS19). Students can get a lot from gardening, including better focus, more physical activity, and more creativity. Through the planning, planting, and maintenance of a garden, it also promotes the development of problem-solving abilities (Mark, 2023). Teaching science in the garden is a new approach that allows students to become part of the learning process and gain appreciation for the skills they learn. It also provides teachers with a unique opportunity to show students biodiversity and natural life rhythms (Grant, 2021).

Recycling

Because of economic, environmental, and scientific developments, the use of recyclable materials is increasing. However, neglecting to reuse these materials results in resource waste and environmental impact (Asmatulu & Asmatulu, 2011). As a result, environmental education is critical for students to understand and resolve environmental challenges (Mostowfi, Mamaghani, & Khorramar, 2016). Recycling can help individuals develop a sense of responsibility for the environment. Recycling is one of the hands-on activities that was accomplished by the participants in the time of pandemic. A participant described that "I accomplished in Science during this pandemic is more on recycling plastic materials" (SS16). According to Barber *et al*., (2014), recycling is one of the best ways to enhance the students' creativity. It also builds a good relationship with the students to nature. Like one of the participants emphasized, "What I did was creating new things from old materials. (SS6)" According to Nyathi (2023), school recycling programme inspires students' creativity. And creativity brings limitless learning opportunities and enhancing problem solving skills (Martin, 2021). Therefore, recycling science activity is very important because many science skills can be developed and environmental stewardship was encouraged.

Sketching

Sketching is an important science activity because it allows students to visually represent scientific concepts and findings. Visual arts, according to Dantic (2021), are critical for recreating scientific numerical data. Learners can improve their metacognition and critical thinking skills by engaging in creative drawing. It is done to have a visual documentation of the environment. Based from the participants' responses, they have accomplished sketching as a hands-on activity from their module. One of the participant stated that they are "Drawing different pictures from the environment" (SS16). Through this activity, it helps students identify the patterns or phenomena in the environment which later will be significant for their analysis and documentation. Like the other participants described, "Drawing objects outside and inside the house. (SS3)". Some teachers believe that sketching can influence science learning (Areljung, Due, Ottander, Skoog & Sundberg, 2021).

Scientific Skills learned in doing Hands-on Activities during the pandemic

Table 2 presents the scientific skills learned in doing hands -on activities during the pandemic.

Table 2: Scientific skills learned in doing hands-on activities during the pandemic

Main Themes	Significant Statement	F (N=23)
Observation and classification	"The new scientific skill I learned is being easily familiarized with elements in periodic table and being flexible in using alternative materials in hands on activities." (SS17)	15
Experimentation	I found out that I am good in segregating things like in experimenting. (SS2)	5
Naturalistic Intelligence	I learned a lot when cleaning our environment and segregating waste. (SS14)	3

Observation and Classification

Science process skills are the things that scientists, teachers and students do when investigating (Maranan, 2017). Additionally, these skills are essential for helping students build a valuable and useful grasp of scientific ideas, (Ango, 2002). Based from the participants descriptions, there are two basic science process skills that have been mastered by the students through their hands-on activities which are Observation and classification.

Most of the participants have developed their observation and classification skills in hands-on in Science during the pandemic based from the activities presented in their modules. One of the participants (SS5) stressed "I learned the different activities through observing the environment." and "I learned about plants by classifying it" Classification and observation provide hands-on learning opportunities, allowing students to make their own discoveries and gain a deeper understanding of scientific concepts. And O'Connor and Rosicka (2020) emphasize that these hands-on opportunities are a great way to develop scientific concepts. They allow learners to have personal experiences as they develop science concepts and support their interest in future science learning.

Experimenting

Doing experiments is one of the hands-on activities done by the students in the face-to-face-classes with the close supervision of the teacher. Kang and Wallace (2005) emphasized that experiments are vital to science education. It expands knowledge, challenge theories, and uncover new insights.

During the COVID-19 pandemic, all educators were challenged to conduct classes online, particularly chemistry/science school teachers who had to transfer experiments and laboratory activities to an online environment (Babincakova & Bernard, 2020). Despite that, they could still perform hands-on experiments. Students experienced doing experiments like, saturated and unsaturated, mixtures and chemical changes. One of the participants (SS1) remarked that, "I am good in observing an experiment or hands-on that we do." As cited by Babinkacova and Bernard (2020), a student can handle experimental activities at their homes using household substances or reagents sent to them. Experimentation fosters critical thinking and problem-solving skills (Mangiante, 2013), allowing science students to explore new phenomena and make new discoveries.

Naturalistic Intelligence

The development of naturalistic intelligence is one of the many benefits of exposing kids to nature. Naturalistic intelligence means cultivating a strong bond with and appreciation for nature. Fieldwork and outdoor learning are important in science education because they help to a thorough knowledge of scientific topics (Hayes, 2009). As a result, knowledge gained from such encounters tends to be kept for an extended period of time. As mentioned by one of the participants "I think the new scientific skills I learned is awareness to nature since I am more connected with nature during the pandemic," (SS16). There is a positive effect in the intrinsic motivation to learn and sense of competence among students who takes part in an outdoor education activity as part of their science curriculum (Denworth, 2018). It provides a dazzling opportunity to help contextualize the curriculum, wrapping real world applications (Bauld, 2021).

Scientific skills enhanced in doing Hands-on Activities during the pandemic

Table 3 presents the scientific skills mostly enhanced in hands on activities.

Table 3: Scientific skills enhanced in doing Hands-on Activities during the pandemic

Main Themes	Significant Statement	F (N=23)
Inferring	I enable to know the answer through the experience of other people. (SS3)	10
Predicting	I learned to make possible predictions based from observation. (SS4)	5
Measuring	Another skill that enhanced during pandemic is measuring things. (SS5)	5
Experimenting	"I can easily understand when I performed the laboratory activity." (SS18)	3

Inferring

According to Donnchaidh (n.d.) Inference skills is essential for students to develop critical thinking and access the deepest levels of comprehension. The ability to infer is a crucial skill for learning science because it allows pupils to draw inferences and make logical deductions from data and observations.

Many of the participants justified that inferring skills was enhanced through hand-on activities. One of the participants (SS3) said that "Able to infer answers based from the experiences of others." So, through inferences, a person can draw conclusion and making sense out of the data or evidence (Sharer, 2023). Like the other participant (SS7) stated, "Its hard, but I was able to draw conclusion what I observed." Therefore, to improve the individual's understanding and ability to create explanations in science, abductive inferences play a role in building knowledge (Aduriz-Bravo & Pinilos, 2022). It plays a significant role in building knowledge and improving the understanding and ability to create explanations in science.

Predicting

Prediction is an important skill for scientific students because it helps them understand events, test hypotheses, and make educated decisions. Trent University (n.d.) defines prediction as the expected outcome that would be observed if a theory were right. As a result, prediction is crucial to developing scientific knowledge and improving our understanding of the natural world. And based from a participant (SS4), "I learned to make possible predictions based from observation." So, based from what their prior learning, it helps them craft a possible prediction. However, one of the participants (SS11) justified that, "Its hard to make predictions if phenomena was not observed. Findings from other studies suggests, that making predictions increases the element of surprise when unexpected answers are encountered. This heightened surprise then directs attention towards the correct answer, reinforcing its memory encoding (Brod, 2021). Prediction skills contribute to scientific inquiry and aid in the comprehension of scientific topics.

Measuring

Modern science relies heavily on measurement since it enables us to quantify data, test hypotheses, and confirm findings (Newton, 2020). Meanwhile, measurement abilities are crucial for learning science because they allow students to carry out thorough investigations, arrive at trustworthy findings, and improve scientific knowledge.

Some of the participants answered that measuring skills was enhanced during this hands-on activities. One of the participant (SS5) described that they don't have proper tools to measure substances. That's why they improvised or used alternatives. A participant (SS6) also reiterated this, that at their homes they don't have the measuring cups or glass, instead

they use the ordinary cup to measure 1 cup, and for little amount of seasonings, the tablespoon or teaspoon is used instead of the standard measuring spoon. And another participant also described "I used empty bottle of water or softdrinks labelled 250 ml or 200 ml for measurement." The participant uses household alternative in measuring liquids. So there are many household materials that can be used in measuring for science experiments (Helmenstine, 2023). However, the accuracy of the results is not exactly accurate. So, carefully monitoring the phenomena or physical occurances can prevent error. And the measurement is precise, then reliable predictions are possible (Standford Encyclopedia, 2020). In summary, measurement skills are critical in scientific exploration and contribute to the precision and validity of scientific findings.

Experimenting

Experimentation is essential for science as it enables exploration, hypothesis testing, verification, understanding cause and effect, problem-solving, innovation, and critical thinking. According Saarelainen (n.d.) that experimentation is all about feeding your curiosity and testing the assumptions. And participants SS18 and SS1 described, "I can easily understand when I performed the laboratory activity." and "I can now do experiments on my own, and follow procedures. With this, I can easily understand it due to hands-on experiment." The hands-on laboratory experiment gives the students opportunity explore and learn on their own. Because experimentation allows them to explore the natural world, investigate phenomena, and discover new knowledge. Students can understand how things work and why they happen by testing and observing the results (Thomke, 2022). Experimentation is distinct in that it entails the purposeful manipulation of specific components of a real system as well as the observation of the results of that alteration (Carpi & Egger, 2008). Overall, experimentation is an essential component of scientific research because it promotes active learning, critical thinking, and the development of practical skills.

Common Tools that Students used in doing Hands-on Activities at Home.

Table 4 shows the common tools in doing home hands-on learning activities.

Table 4: Common tools that students used in doing Hands-on Activities at home

Main Themes	Significant Statement	F (N=23)
Writing tools	I often used ballpen, pencil, and crayons. (SS7)	10
Kitchen tools	The common tools that I used are bottle, knife, cups, ladle and spoon." (SS16)	5
Measuring tools	"Measuring tools that I always use are rulers, thermometer, watch, and meter stick." (SS8)	5
Cutting tools	"Ang mga kagamitang aking ginamit ay gunting, papel, cutter, karton, baso, kutsilyo, at lagari." (The materials I used are scissor, paper, cutter, box, glass, knife, and saw). (SS19)	3

Writing tools

Writing is an essential skill for academic achievement in science. It helps students develop critical thinking skills by organizing their knowledge and documenting their activities. Writing also allows scientists to properly communicate their discoveries to colleagues and the general public (Harris, 2022). As Grogan (2020) emphasizes, writing is a crucial component of science at all stages. It's how we organize projects, express ideas, present our findings in research publications, and discuss scientific thoughts. Writing is integrated in all hands-on activities of the students. So, obviously writing tools is most commonly used. And majority of the participants proved it having common answers that they used pencil, ballpen, paper for their activities. When engaging students in science discourse, writing and task structure are crucial instructional factors (Cavagnetto, Hand, & Norton-Meier, 2010).

Kitchen tools

A kitchen can become an official research lab, with the same tools and equipment as a science lab, allowing one to experiment and learn something new (Van Wagenen, 2003). Some of the tools that students used in schools in doing experiments can be found in the kitchen. These tools can be used as alternative tools for hands-on activity.

Participants said that kitchen tools were used commonly used for their hands-on activities. As one of the participants (SS14) enumerated, different tools that is in the kitchen like bowl, gloves, hot water, and sometimes DIY crafts are used. The home-based kitchen laboratory experiment heightened and gained newly scientific knowledge among learners (Nguyen & Keusemen, 2020). According to the UTAH Education Network (2018), having knowledge about identifying and understanding the various tools in the kitchen contributes to organization and proper functioning. These tools, such as gloves, tongs, bowls, knives, and mixers, are extremely useful for hands-on activities. Though, it is important to return these tools to their designated places after each use. Cooking provides a tangible opportunity to teach physics, and kitchen lab experiments have been found to generate enthusiasm and strong motivation among students when learning physics (Rowat *et al*., 2014).

Measuring tools

These enable accurate data collection, quantification and comparison, and standardization of scientific experiments. Measurement is necessary for science students to undertake controlled experiments that produce quantifiable data in order to test their hypotheses (Columbia University Press, 2023). Measuring tools give accuracy thus make every activity well done.

Participants described that they always use measuring tools for their home-based science activities. As one of the participants SS16 described, "We often use rulers, DIY beaker made of cup to measure for our experiments." And another participant (SS2) stated, I used glass instead of beaker, meter or ruler, to measure things." These help students finish their work and enhance their manipulative skills. Measuring tools are used to find length, volume, mass, and time. Measurement in science uses specific instruments (McAlister & Zundel, 2022).

Cutting tools

Cutting tools are used to modify materials and create custom apparatus by cutting extra layers of material from a work piece (Saif, 2023). These can be used to collect samples for analysis and modify materials during experiments. They can be used to obtain representative samples that can be studied and analyzed to understand ecological or geological processes. Cutting tool have a significant impact on the cutting process, tool life, and manufacturing times (Uhlmann & Frost, 2001).

Participants described that cutting tools are used for their home-based activity. One of the participants (SS9) mentioned, "The tools I used are like scissor, paste, and cutter." These cutting tools contributes to the development of different skills. Cutting activities are a wonderful approach to improve visual motor skills. This talent is critical in science because it allows students to achieve practical and technical proficiency, ensuring their ability to carry out scientific processes safely and successfully. Cutting activities also help to promote bilateral coordination and visual motor integration (Shakibaie, 2022). They also help to strengthen hand muscles, encourage good grasp patterns, and improve fine motor skills like hand and finger dexterity (Bishop, 2018).

CONCLUSION

The significant conclusions based on the findings of the study are as follows:

1. Observing and classifying are the most hands-on activities students accomplished in science during the COVID-19 pandemic.
2. Observation and classification are the Science skills that student learned mostly during the pandemic.
3. Inferring is the Science skill that students greatly enhanced in doing hands-on during the COVID-19 pandemic.
4. Writing tools are the most common tools utilized by the students in doing hands on activities at home.

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