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Website: https://etcor.org
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P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

Design Thinking Skills, and Scientific Research Skills Among Grade 7 Students: Basis for Designing Learning Activity Sheet for Research 7

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Received: 11 April 2025 **Revised**: 11 May 2025 **Accepted**: 12 May 2025

Available Online: 14 May 2025

Volume IV (2025), Issue 2, P-ISSN – 2984-7567; E-ISSN - 2945-3577

https://doi.org/10.63498/etcor322

Abstract

Aim: The study primarily aimed to evaluate the level of design thinking skills and scientific research skills among 124 out of 182 Grade 7 students at the Regional Science High School for Region VI, District of Kalibo II, Division of Aklan served as the foundation for designing Learning Activity Sheets (LAS) for Research.

Methods: A survey-correlational method of research design using a 30-item Design Thinking Skills Questionnaire, adapted from Brown (2009), Change by Design, IDEO. U (2019), The Design Thinking Field Guide, and Kelley and Kelley (2013), Creative Confidence. Additionally, a 30-item Science Research Skills checklist aligned with the Most Essential Learning Competencies for Grade 7 Research was employed. Descriptive statistics such as frequency count, percentage, mean, and standard deviation, along with Pearson r and linear regression for inferential analysis, were applied, with a 0.05 level of significance.

Results: The finding revealed that Grade 7 students demonstrated "very high" levels of both design thinking skills and scientific research skills. A significant positive relationship was observed between these variables, with design thinking skills identified as a significant predictor of scientific research skills. In response, Learning Activity Sheets (LAS) was developed to enhance critical thinking, observational skills, and scientific reasoning through hands-on, inquiry-based activities, supporting students' continued growth in both competencies.

Conclusions: The results confirmed the students demonstrated great empathy, creativity, and collaboration during problem-solving and addressing complex real-world problems in a user-centered way. This ability to view things from various perspectives and become recipients of feedback sparks creative thought and collaborative ability-qualities that modern technology, engineering, and social innovation crave. Furthermore, the grade 7 students excelled in various research skills. Therefore, the students may lead on to research-oriented projects foster young student's critical thinking, problem-solving, and analytical skills. It is these very traits in students that would render them capable of bringing sanity-based analysis to the study process, enabling passable analysis of drafts during scientific research studies and the proper decision-making atmosphere in themselves to back-up their arguments with evidence.

Keywords: *Design Thinking Skills, Scientific Research Skills, Learning Activity Sheet*

INTRODUCTION

Knowledge of science is essential for a country's development as it leads to advances in technology that are crucial for competition in the 21st-century world. This is connected to the importance of science education which plays a great role in both developing learners' skills and supporting their attitudes toward science (Wu et al., 2013).

Design Thinking Skills is a systematic approach that utilizes the attitude, sensibility, and methodology of designers to meet the demands of end-users (Retna, 2015). Its goal is to develop a strategy that is both technologically possible and commercially viable, resulting in customer value and market opportunities (Kreutz et al., 2015).

Royano et al. (2023) further elucidate that design thinking is a non-linear methodology that involves perceiving, molding, and constructing while incorporating profound understanding into the process to tackle unforeseeable challenges and difficulties. These concerns and problems are often known as "wicked problems" in the

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field of design thinking. Wicked problems are characterized by their apparent lack of answers or the need for interdisciplinary approaches to tackle them (Carlgren et al., 2016).

In short, design thinking uses the sensibilities or mindsets and methodologies often used by designers to create new ideas, solutions, alternatives, and choices that satisfy the desires of the end users or stakeholders. Fundamentally, it is abductive in nature as it requires one to clear one's mind of traditional solutions leading to new and creative problem solving (Fischer, 2015; Johansson-Skoldberg & Wodilla, 2013; Schlenker, 2014).

According to PISA (OECD, 2016) science literacy is knowledge and its use to identify questions, acquire new knowledge, explain scientific phenomena, and draw conclusions based on scientific evidence. For the second time, the Philippines landed in the bottom 10 out of 81 countries in reading comprehension, mathematics and science, based on the 2022 PISA. The Philippine achieved a 2.2-percentage point hike in mathematics from 2018 to 2022, 6.9 percent in reading and a 0.8-percent drop in science proficiency. Hence, indicators of the test, however, showed that despite moving up the rank, the performance of students showed minimal improvement (Servallos, 2023).

Moreover, Grade 7 is a pivotal stage in education as students transition into a high school academic setting for the first time. They must adjust to a new educational setting where they are subjected to distinct treatment compared to their experiences in primary school (Dizon & Sanchez, 2020; Karlsen et al., 2022; Muńoz & Sanchez, 2023).

Design thinking Skills and scientific research skills are important for learners at the age of preadolescence. With decent knowledge and a positive attitude toward science learning, teenage learners would develop related skills in education that could shape their future careers (Afari, 2015). According to Harper (2018),the maturation of the brain throughout adolescence is vital for the transition into adulthood. Adolescents in middle and high school must develop problem-solving, analytical thinking, and other higher order cognitive skills that they may later use in their adult lives. Consequently, scientific research skills.

According to PISA (OECD, 2016) science literacy is knowledge and its use to identify questions, acquire new knowledge, explain scientific phenomena, and draw conclusions based on scientific evidence. For the second time, the Philippines landed in the bottom 10 out of 81 countries in reading comprehension, mathematics and science, based on the 2022 PISA. The Philippine achieved a 2.2-percentage point hike in mathematics from 2018 to 2022, 6.9 percent in reading and a 0.8-percent drop in science proficiency. Hence, indicators of the test, however, showed that despite moving up the rank, the performance of students showed minimal improvement (Servallos, 2023).

Moreover, Grade 7 is a pivotal stage in education as students transition into a high school academic setting for the first time. They must adjust to a new educational setting where they are subjected to distinct treatment compared to their experiences in primary school (Karlsen et al., 2022).

In the light of the foregoing discussion, the focus of the study was the level of design thinking skills and level of scientific research skills among Grade 7 Students in the Regional Science High School for Region VI, District of Kalibo II, Division of Aklan towards to the development of Learning Activity Sheet for Research.

Research Questions

This study was conducted to assess the level of design thinking skills and scientific research skills of Grade 7 students as a basis for designing Learning Activity Sheet for Research at the Regional Science High School for Region VI, District of Kalibo II, Division of Aklan for the school year 2024-2025.

Specifically, the study sought answers to the following questions:

1. What is the level of design thinking skills of the Grade 7 students?
2. What is the level of scientific research skills of Grade 7 students as a whole and in terms of scientific attitudes, observation skills, measurement, scientific inquiry, data analysis, and scientific communication?
3. Is there a significant relationship between the design thinking skills and scientific research skills of Grade 7 students?
4. Is design thinking skills a significant predictor of scientific research skills of Grade 7 students?
5. What Learning Activity Sheet can be designed based on the result of the study?

Hypothesis

Based on the statement of the problem mentioned above, the following hypotheses were tested:

1. There is no significant relationship between the design thinking skills and scientific research skills of Grade 7 students.
2. Design thinking skills is not a significant predictor of scientific research skills of Grade 7 students.

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METHODS

Research Design

The research design for this study was survey-correlational research. A survey is a type of research methodology in which self-reported answers to questions are used to gather data from a population or sample. (Fredricks et al., 2014). Correlational research, on the other hand, is a non-experimental research approach that looks at the connections between two or more variables. The goal is to determine the direction and intensity of the association between variables (Cooke et al., 2014). On the other hand, it is correlational as it attempted to determine the extent to which different relevant variables are related with each other.

Population and Sampling

The respondents of this study were the 124 out of 182 Grade 7 students of the Regional Science High School for Region VI, District of Kalibo II, Division of Aklan from the School year 2023-2024.

The study employed the Rao soft sample size calculator to determine the appropriate sample size. Additionally, given that the Grade 7 population was divided into five sections, a stratified random sampling technique was employed. This approach ensures that each section is adequately represented in the sample, allowing for more accurate and reliable results.

Instrumentation

The data for the study were gathered using a combination of adopted and modified survey questionnaires which was self- administered. As used in this study, in order to gather relevant information needed, a set of questionnaire checklists was used. The questionnaire was made up of two (2) parts. Part I, determined the Level of Design Thinking Skills and Part II, determined the Level of Scientific Research Skills.

Part I, Design Thinking Skills Questionnaire. This was used to measure the ability of Grade 7 students to employ a structured approach to problem-solving and innovation, characterized by empathy, ideation, prototyping, and testing. The following scoring procedure was used:

Rating	Range	Verbal Interpretation
5	4.20 – 5.00	Very High
4	3.40 – 4.19	High
3	2.60 – 3.39	Moderate
2	1.80 – 2.59	Low
1	1.00 – 1.79	Very Low

Part II, Scientific Research Skills Questionnaire. This was used to measure scientific attitudes, abilities, and practices essential for conducting systematic inquiry, gathering empirical evidence, analyzing data, and effectively communicating findings within the context of scientific exploration. The following scoring procedure was used:

Rating	Range	Verbal Interpretation
5	4.20 – 5.00	Very Highly Evident
4	3.40 – 4.19	Highly Evident
3	2.60 – 3.39	Moderately Evident
2	1.80 – 2.59	Less Evident
1	1.00 – 1.79	Least Evident

Data Collection

The following procedures were made in gathering the pertinent data. The researcher began the study by securing permission from Filamer Christian University and the School Principal of the Regional Science High School for Region VI. Once the request letters were approved, consent forms were distributed by the research teachers to the student respondents, and later collected and returned to the researcher after being signed by the respondents' parents. Ensuring all consent forms were duly signed and retrieved, the teacher then distributed the questionnaires and tests during the students' research or science classes. Prior to this, the researcher conducted a brief orientation to explain the study's purpose, the participants' role, and the benefits, emphasizing ethical research practices and confidentiality. The questionnaires, each accompanied by an approved request letter, were personally administered by the researcher, with both the teacher and researcher providing guidance to maintain the quality and accuracy of responses. Upon completion, the questionnaires were collected, coded, encoded, and processed using the Statistical Package for Social

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Sciences (SPSS). Based on the results, a Learning Activity Guide was developed to enhance the design thinking and scientific research skills of Grade 7 students.

Treatment of Data

The following statistical tools for each statement of problems were applied in analyzing the data gathered.

1. Mean and Standard Deviation were used to determine the level of Design Thinking Skills.
2. Mean and Standard Deviation were used to determine the level of Scientific Research Skills.
3. Pearson r was used to determine the significant relationship between the Design Thinking Skills and Scientific Research Skills.
4. Regression Analysis was used in Design Thinking Skills to determine as the predictors of Scientific Research Skills.

Ethical Considerations

The following ethical guidelines were observed for the research period:

1. Protected the dignity and wellbeing of participants at all times.
2. The researcher obtained the participants' permission to use their responses in the research report.
3. Confidentiality was ascertained to the respondents adhering to Republic Act 10173 or the Data Privacy Act of 2012.

RESULTS AND DISCUSSION

This part presents the tabulated data of the study with corresponding analysis and interpretation.

The presentation of the significant findings followed the sequence of the statement of the problem namely: (1) What is the level of design thinking skills of the Grade 7 students? (2) What is the level of scientific research skills of Grade 7 students as a whole and in terms of scientific attitudes, observation skills, measurement, scientific inquiry, data analysis, and scientific communication? (3) Is there a significant relationship between the design thinking skills and scientific research skills of Grade 7 students? (4) Is design thinking skills a significant predictor of scientific research skills of Grade 7 students? (5) What Learning Activity Guide can be designed based on the result of the study?

Level of Design Thinking Skills of the Grade 7 Students

Table 1 presents the mean and standard deviation of the level of design thinking skills of the Grade 7 students.

It can be gleaned in table 2, that the level of design thinking skills of the Grade 7 students at Regional Science High School is "very high" (M= 4.26, SD= 0.44). This means that the Grade 7 students has the strong ability to engage in creative problem solving processes.

The students exhibited a strong capacity for empathy, as they were able to understand the needs, objectives, and challenges within a given situation. These skills are essential for designing solutions that are user-centered and effectively address real-world problems. Their ability to consider different perspectives plays a crucial role in producing solutions that are both functional and impactful. Additionally, the students showcased the ability to find creative solutions through collaboration.

They actively sought feedback from others to refine and improve their designs, demonstrating an understanding of the iterative nature of design thinking. This ability to work with others and continuously enhance their ideas is a key component of successful problem-solving.

Table 1

Mean and Standard Deviation of Design Thinking Skills

Variable	Mean	Description	SD
Design Thinking Skills	4.26	Very high	0.44

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Level of Scientific Research Skills of the Grade 7 Students

Table 2 presents the level of scientific research skills of Grade 7 students as a whole and in terms of scientific attitudes, observation skills, measurement, scientific inquiry, data analysis, and scientific communication.

Table 2

Mean and Standard Deviation of Scientific Research Skills

Variable	Mean	Description	SD
Scientific Research Skills	4.37	Very high	0.48
Scientific Attitude	4.59	Very high	0.42
Observation Skills	4.44	Very high	0.52
Measurement	4.19	High	0.60
Scientific Inquiry	4.33	Very high	0.60
Data Analysis	4.40	Very high	0.58
Scientific Communication	4.26	Very high	0.68

Over all, the "very high" level of scientific research skills of the Grade 7 students suggests that they have the strong ability to engage with basic scientific inquiry and research processes. They possess strong critical thinking, problem-solving skills, and the ability to use technology and scientific tools. Their collaboration and reflection skills contribute to their effectiveness in group work and personal growth.

Moreover, this implies that the students possess a strong enthusiasm for inquiry, critical thinking, and a willingness to engage in the scientific process. Such a positive scientific attitude is essential for fostering creativity and innovation, which are crucial in today's rapidly changing world.

This also means that they possess a keen ability to notice details, identify patterns, and accurately gather information from their surroundings. Strong observation skills are foundational for effective learning, as they enable students to engage more deeply with scientific concepts and enhance their critical thinking capabilities.

In addition, this indicates that they are adept at formulating questions, designing experiments, and systematically investigating scientific phenomena. Their strong skills in scientific inquiry enable them to engage deeply with content and develop a thorough understanding of scientific concepts.

Significant Relationship Between the Design Thinking Skills and Scientific Research Skills of Grade 7 Students

Table 3 depicts that there is a significant relationship between the Design Thinking Skills and Scientific Research Skills of Grade 7 Students.

Table 3

Pearson r Between Design Thinking Skills and Scientific Research Skills

Variables	R	Sig
Design Thinking Skills and Scientific Research Skills	0.600*	0.000

* $p<0.05$ significant @ 5% alpha level

ns $p>0.05$ not significant @ 5% alpha level

This indicates a strong positive correlation, suggesting that as students' Design Thinking Skills improve, their Scientific Research Skills also enhance significantly.

Design Thinking is characterized by essential elements such as problem-solving, creativity, and iterative processes. These elements foster an environment where students learn to approach challenges from various angles and develop innovative solutions. Specifically, Design Thinking encourages students to empathize with users, which can translate to understanding the needs and perspectives of their research subjects. This empathetic approach is crucial in scientific research, where recognizing the context of a problem can lead to more relevant and impactful investigations.

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Furthermore, the iterative nature of Design Thinking—consisting of defining problems, ideating solutions, prototyping, and testing ideas—closely aligns with the steps involved in the scientific research process. In scientific research, students are required to observe phenomena, formulate hypotheses, design experiments, and analyze data to draw conclusions. The parallel between these two processes suggests that skills cultivated through Design Thinking can enhance students' abilities in hypothesis formulation and experimental design.

As students practice these iterative cycles in Design Thinking, they develop resilience and adaptability, which are essential when encountering setbacks in research.

Design Thinking Skills A Significant Predictor Of Scientific Research Skills Of Grade 7 Students

Table 4 shows the test if Design Thinking Skills is a predictor of Scientific Research Skills.

Table 4

Regression Analysis of Design Thinking Skills as Predictors of Scientific Research Skills

	Unstandardized Coefficients B	Standardized Coefficients Beta	t	Sig.
(Constant)	1.547		4.560*	0.000
Design Thinking Skills	0.662	0.6	8.357*	0.000

* p<0.05 significant @ 5% alpha level
ns p>0.05 not significant @ 5% alpha level

This finding suggests that students who possess higher levels of Design Thinking Skills are likely to demonstrate improved capabilities in Scientific Research Skills. Design Thinking, as a pedagogical approach, encourages a systematic and user-centered mindset, allowing students to engage more deeply with the scientific inquiry process.

A high level of design thinking skills among students establishes a solid framework for addressing complex problems, which is essential for conducting scientific research. Students proficient in design thinking are more likely to think creatively and explore unconventional avenues and hypotheses.

In addition, when faced with unexpected results or challenges, those trained in design thinking can constructively reassess their methods and hypotheses. Additionally, students who participate in collaborative design thinking activities develop vital interpersonal skills necessary for effective teamwork. This collaboration not only enhances their research skills but also enables them to integrate diverse perspectives and expertise into their projects, ultimately resulting in more comprehensive and multifaceted research outcomes.

Learning Activity Sheet Designed

This learning activity sheet is designed to equip Grade 7 students with essential skills in Design Thinking and Scientific Research through structured, hands-on activities. By integrating problem-solving methodologies and scientific inquiry techniques, students will enhance their critical thinking, creativity, and research skills.

The activities are intended to foster a deep understanding of real-world problems and encourage students to apply systematic processes to explore, define, create, and evaluate potential solutions.

Variables	Activity	Skills Developed	Objective	Expected Outcome
Design Thinking	Empathy Mapping and Problem Identification	Empathy, Problem Identification	To develop empathy and understand user needs and challenges.	Students will empathize with users' needs, gaining a deeper understanding of the problem.
	Problem Definition Worksheet	Critical Thinking, Problem Framing	To clearly define and frame the problem for deeper understanding.	Students will practice identifying and framing the problem accurately.
	Brainstorming Solutions	Creativity, Idea Generation	To encourage diverse and creative solutions for the problem.	Students will generate and prioritize a variety of feasible and impactful solutions.

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	Prototyping a Solution	Prototyping, Model Creation	To create a tangible or visual prototype of the solution.	Students will develop a physical or visual representation of their solution.
	Testing and Feedback	Feedback Collection, Iteration	To test prototypes and gather feedback for improvements.	Students will refine their prototypes based on feedback and testing.
Research Skills	Scientific Observation	Observation, Data Recording	To observe and record data accurately and systematically.	Students will develop the ability to observe and record scientific phenomena.
	Hypothesis Formulation	Predictive Thinking, Hypothesis Testing	To formulate testable hypotheses based on prior knowledge.	Students will create and evaluate testable hypotheses.
	Designing an Experiment	Experimental Design, Variable Identification	To design controlled experiments, identifying key variables and procedures.	Students will develop an experiment design with clear variables and procedures.
	Data Collection and Organizing Data	Data Collection, Data Organization	To collect and organize data systematically for analysis.	Students will enhance their ability to collect, organize, and interpret data.

Conclusions

Based on the findings of the study stated above, the following conclusions were drawn:

1. Grade 7 students have a strong ability to engage in creative problem-solving processes. Therefore, the students demonstrated great empathy, creativity, and collaboration during problem-solving and addressing complex real-world problems in a user-centered way. This ability to view things from various perspectives and become recipients of feedback sparks creative thought and collaborative ability-qualities that modern technology, engineering, and social innovation crave. If students are keep being nurtured, this may lead to become proactive problem solvers capable of impacting sustainable design, community development, and technology-based solutions based on human-centered solutions and collaborative pathways.
2. The Grade 7 students excelled in various research skills. Therefore, the students may lead on to research-oriented projects foster young student's critical thinking, problem-solving, and analytical skills. It is these very traits in students that would render them capable of bringing sanity-based analysis to the study process, enabling passable analysis of drafts during scientific research studies and the proper decision-making atmosphere in themselves to back-up their arguments with evidence.
3. Findings indicate a strong relationship between the Design Thinking Skills and Scientific Research Skills of Grade 7 students. Therefore, it is essential to integrate Design Thinking Skills into educational activities to enhance the Scientific Research Skills of Grade 7 students. By embedding design thinking principles such as empathizing, defining, ideating, prototyping, and testing, students can approach scientific research with a more innovative and problem-solving mindset. This may lead to improved problem-solving abilities, enhanced creativity, and a stronger foundation in critical thinking and inquiry-based learning among Grade 7 students.
4. The study found that Design Thinking Skills are a key determinant of Scientific Research Skills among Grade 7 students. Therefore, fostering design thinking through targeted activities can enhance students' research abilities. Integrating design thinking into the curriculum helps develop critical skills like hypothesis formulation, experiment design, and data analysis. This approach encourages creative problem-solving and innovation,

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boosting students' confidence in scientific inquiry. As a result, students may improve their scientific reasoning, engage more in research activities, and be better prepared for future academic challenges, potentially fostering interest in STEM fields.

5. In this study, the Research 7 Learning Activity Sheets (LAS) embodies a well-crafted plan for enabling Grade 7 students to acquire these fundamental design thinking and scientific research skills through a comprehensive hands-on learning approach. This may lead to not only does this method develop students' inquiry and problem solving, but it also enhances creative and critical thinking skills within them. In the long run, this Learning Activity Guide apparently is bound to have a long-range and lasting impact on the learners' growth, be it academic or personal that may lead to engaging in observing the natural world, specifying scientific problems, designing experiments, prototyping, testing, and analyzing results, students gain an early foundation for research methodology and the iterative design process.

Recommendations

Based on the finding and conclusions, the following recommendations are suggested.

1. Students may be encouraged to pursue design thinking activities that develop their empathy, creativity, and team spirit. Relevant courses should be supplied within school for students to address real-world problems through project-based learning and design thinking workshops, to allow further development of their ability to see challenges from multiple perspectives and respond with user-centered solutions. Fostering an attitude of curiosity and an openness to feedback would help the children in dotting their ideas and building resilience in problem-solving.

2. For the Education Program Supervisor in Science, the integration of design thinking into the science curriculum is encouraged. This may be achieved through activity designing, where students address community-based environmental challenges or technological problems through structured design thinking. The EPS in Science may also organize interschool competitions or collaborative projects that foster innovation and sustainability, enabling the students to extend their skills into the community.

Future researchers, may focus on determining the long-term impact of design thinking skills on students' academic performance, social development, and interest in STEM fields. Further research may follow on how these skills develop as students move on higher grade levels while identifying best practices for embedding design in various subject areas. A considerable amount of future work needs to go to studying the exciting role of technology in design thinking development-to-facilitate students' prototyping using digital tools and virtual collaboration platforms so they may develop their creativity and empathy within their problem-solving skills.

3. Teachers and students may further efforts to provide a structure and program for engaging and student-centered research to enhance Grade 7 students' good scientific inquiry skills. The incorporation of project-based learning that includes students' interests and real-world issues may cultivate enthusiasm and inquiry in the teachers. This may help create an environment where the learners can explore complicated problems and defend their positions with evidence, developing critical thinking and problem-solving skills through inquiry-based projects. It may be vital to enlist mentorship from teachers and peers whereby students can be helped in enhancing their inquiry skills. This may help foster a collaborative learning environment for the young learners that may encourage them to thrive and grow as aspiring researchers.

Research teachers may have students develop the skills to interpret and analyze complex data through real-life hands-on projects. By putting students in live environments where they interact with tables, charts, and even maps related to big data, teachers may promote their understanding of quantitative analysis, creating a mindset which joins descriptive insights with solutions to questions or problems. This may prepare students as flexible thinkers able to tackle complex societal issues across medicine, engineering, journalism, and law. The experience that enables students to explore data-based research and decision-making may improve their analytical skills and create changemakers into a more evidence-based and technology-savvy society.

4. Research teachers to promote placing equal weight on the development of effective communication skills along with scientific knowledge in the students. It may involve enabling students to present their research, engage in really thought-out discussions, and practice articulating highly serious concepts in a way their audience finds accessible. By creating a supportive setting for the students to confidently express their ideas; teachers may develop such a generation of learners who are both knowledgeable and capable of inciting inspiration in other generations. They may also focus on these opportunities themselves and accept the challenge of presenting their findings and being part of research teams. This communication focus may provide

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the impetus to assume leadership in career and personal development in the cadre of institutions of higher learning, present in business environments by driving change and innovation.

5. For The school principal may continue to promote hands-on and inquiry-based learning programs as indicated in Research 7 Learning Activity Sheets (LAS) to motivate students to further refine their scientific attitudes and prowess. Real-life applicability and the healthy fomenting of creativity and critical thinking set up an environment conducive to nurturing positive student dispositions towards inquiry in science. This may also be achieved through the establishment of sites for science associations and routine science fairs or innovation challenges, which further develop the culture of curiosity and innovation needed in students to access a fast-changing world.

6. For Future researchers, may consider focusing on the integrated impact of design thinking and advanced measurement skills for integration into learning. Understanding the depth of how these develop students' engagement towards science inquiry and real-life problem-solving that may be rich insights for continued evolution of future educational strategies. A wide range of learning settings and contexts in research may offer a more comprehensive view on the challenges and opportunities for nurturing a research-oriented mindset and molding into a science-driven innovative society.

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P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

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