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Scientific Beliefs, Science Skills, and Conceptual Understanding in Science Among Grade 9 Students in the Division of Aklan: Basis for a Learning Exemplar on Science 9

Georgina D. Francisco, EdD
Regional Science High School for Region VI, Old Buswang, Kalibo, Aklan, Philippines
Corresponding Author email: *georgina.francisco001@deped.gov.ph*

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Abstract

Aim: The study primarily assessed scientific beliefs, science skills, and conceptual understanding of Science among Grade 9 students in the Division of Aklan, forming the basis for a Lesson Exemplar.

Methods: This survey-correlational research design using researcher-made tests and adopted instruments were utilized as a tool on gathering data needed for the study. The study involved 370 out of 9,509 Grade 9 students. Descriptive statistics used in the study were mean and standard deviation and for inferential analyses were ANOVA, Pearson r, and linear regression.

Results: The overall scientific beliefs of Grade 9 students were "Highly Evident," with the top five beliefs rated as "Very Highly Evident." These included beliefs in the evolving nature of scientific knowledge, universal access to scientific education, the significant contributions of science to human progress, adherence to the scientific method, and enabling students to explore ideas through investigation. The science skills of students were also "Highly Evident" across all domains: Observation and Measurement, Critical Thinking and Analysis, Communication and Problem Solving, Scientific Knowledge and Application, and Scientific Inquiry and Ethics. Their conceptual understanding in Science was rated as "Approaching Proficiency." The findings revealed a significant difference in conceptual understanding across levels of scientific beliefs but not across science skills. Scientific beliefs significantly correlated with both science skills and conceptual understanding, while science skills and conceptual understanding showed no significant relationship. Scientific beliefs and science skills emerged as predictors of conceptual understanding, informing the development of the Science 9 Lesson Exemplar to enhance these areas.

Conclusion: The results revealed that scientific beliefs of grade 9 means the level of Scientific knowledge is constantly evolving and improving, science has made significant contributions to human progress and investigations should enable students to explore their own ideas. The science skills of the students possessed a solid foundation in key scientific skills that may lead to potential STEM (STEM-related topics) high increase on students' interest and aptitude pursuing strand in Senior High School. On the other hand, the conceptual understanding may yield that science teachers would improve teaching strategies they are using inside or outside the classroom and may also develop more effective instructional methods and curricula designed to address gaps in students' understanding of scientific concepts. In addition, regardless of their conceptual understanding of science, students exhibit consistent proficiency in executing science skills. Therefore, it can lead to emphasis on the welfare and capacity of learners with equal treatment and teaching strategies. Ensuring that students develop both the skills and the conceptual understanding necessary for success. Lastly, the results may lead that students' beliefs about science play a crucial role in shaping their development of science skills and their ability to understand scientific concepts sort of curricular adjustments. More so, students who hold more accurate and positive scientific beliefs may yield to perform better in science skills and demonstrate a deeper comprehension of scientific principles to create more comprehensive evaluations of student progress in science education. Teachers then may yield to focus on developing these two key areas, as strengthening students' beliefs and skills in science and could lead to a deeper and more meaningful understanding of scientific principles. Moreover, this could also involve creating a learning environment that encourages curiosity, critical thinking, and an open-minded approach to scientific inquiry that is suitable for learners to learn science.

Keywords: *Scientific Beliefs, Science Skills, Conceptual Understanding, Learning Exemplar*

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INTRODUCTION

In this dynamic high school, filled with eager minds and passionate learners, a seemingly simple problem has sparked widespread interest—it has everyone talking, from students to teachers. Rooted in a scientific concept, the issue has captured the attention of the student body, engaging them in the science skills needed to understand and solve it. Through captivating demonstrations, hands-on experiments, and insightful discussions, students are drawn into the exciting world of science. What once may have created division is now being replaced by a shared curiosity and thirst for knowledge, fostering a learning environment characterized by support and collaboration.

People tend to hold firmly to their beliefs. A significant body of empirical research explores how humans respond when these beliefs are challenged. For instance, people often experience fear, stress, and anxiety when confronted with threats to their belief systems—evidence that beliefs serve an important psychological function. According to Madrigal (2019), beliefs—whether conscious or unconscious—help individuals cope with emotional distress and maintain mental well-being.

Furthermore, belief plays a crucial role in giving life meaning. Meaning, in this context, refers to the human tendency to make sense of the world in ways that influence personal and social motivation. Aghababaei et al. (2016) explain that the need for meaning is a fundamental human desire. People naturally construct mental models to interpret daily experiences and organize their perceptions of reality. These models, however, often diverge from objective reality. When events do not align with an individual's mental framework, it can pose a threat to their sense of meaning and stability.

As pointed out, scientific beliefs are part and parcel of human cognition that satisfy significant individual and social functions. For instance, such beliefs provide meaning and comfort with communality. More so with religious faith where several positive psychological benefits associate with it. Among others, these include lack-of-control-related negative moderating factors, reducing anxiety, and decreasing stress (Farias et al., 2013).

On the other context, the scientific method, scientific thinking and critical thinking have been terms used at various times to describe these science skills. Today the term "science skills" is commonly used. Popularized by the curriculum project, Science - A Process Approach, these skills are defined as a set of broadly transferable abilities, appropriate to many science disciplines and reflective of the behavior of scientists. Science - A Process Approach (SAPA) categorized process skills into two types—basic and integrated. The basic process skills are the simplest, thus serving as the building block to learn integrated skills, which are more complex (Padilla et al., 2018).

It is, therefore, the development of science skills, which is among the key points acted upon in the literature regarding the need to acquire science education through inquiry. Moreover, science skills are basically skills that are focused on the process of learning to develop students' skills in understanding the knowledge or concepts and independently discover and develop necessary facts, concepts, and values (Samsudin et al., 2015).

The other important aspect of conceptual understanding is that it can foster the retention of lessons learned. Jensen et al. (2015) described that mental connections that are formed when facts and algorithms are learned with deeper understanding, such things are easily remembered and used. The concept of mind-world connection in the construction of concepts takes its place in conceptual understanding. Application of an explanation to certain novel situations that are previously known entitled conceptual understanding according to Kong (2014).

The researcher found that this belief in scientific progress, can be seen more in students of the Regional Science High School for Region VI who experienced less personal control. As observed, this implication is a very important component of what he had come up with, and indeed it gives evidence that belief in science can be considered as a form of compensatory control. This low challenge in student achievement in these scientific skills is also observed at the international level in examinations that aim to measure these skills. Moreover, PISA 2015 and PISA 2018, TIMSS 2015, and TIMSS 2018 raise concerns about the need for a review in the barriers and variables holding the development of scientific skills and conceptual understanding. Various methods and techniques should therefore be applied and recalibrated in the lessons as help in developing scientific belief, skills, and conceptual understanding in science among students.

A Learning Exemplar in Science 9 includes scientific methods, conducts experiments, analyzes data, and draws conclusions in the context of Science for learners. In addition, the skills included critical thinking, problem-solving, observation, and communication skills that are essential for understanding and interpreting scientific phenomena and reflects students' comprehension and mastery of the fundamental concepts and principles covered in the Science 9 curriculum. By using learning exemplars, science teachers can provide students with practical, engaging, and memorable experiences that deepen their understanding of scientific phenomena and principles.

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Research Questions

This study was conducted to assess the level of scientific beliefs, science skills, and conceptual understanding of Science of Grade 9 Students in the Division of Aklan for the school year 2024-2025 which was the basis for making a lesson exemplar.

Specifically, the study sought to answer the following questions:

1. What are the levels of the top 5 scientific beliefs of Grade 9 students in the Division of Aklan?
2. What is the level of science skills of Grade 9 students in the Division of Aklan as a whole and in terms of observation and measurement, critical thinking and analysis, communication and problem-solving, scientific knowledge and application, and scientific inquiry and ethics?
3. What is the level of conceptual understanding of Science of Grade 9 students in the Division of Aklan?
4. Is there a significant difference in conceptual understanding of science among the levels of scientific beliefs of Grade 9 students in the Division of Aklan?
5. Is there a significant difference in conceptual understanding of science among the levels of Science skills of Grade 9 students in the Division of Aklan?
6. Are there significant relationships among scientific beliefs, science skills, and conceptual understanding of Science of Grade 9 Students in the Division of Aklan?
7. Are scientific beliefs and science skills significant predictors of conceptual understanding of Science of Grade 9 students in the Division of Aklan?
8. What Learning Exemplar can be created 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 difference in conceptual understanding of science among the levels of scientific beliefs of Grade 9 students in the Division of Aklan.
2. There is no significant difference in conceptual understanding of science among the levels of science skills of Grade 9 students in the Division of Aklan.
3. There are no significant relationships among scientific beliefs, science skills, and conceptual understanding of Science of Grade 9 Students in the Division of Aklan.
4. The scientific beliefs and science skills are not significant predictors of conceptual understanding of Science of Grade 9 students in the Division of Aklan.

METHODS

Research Design

This survey-correlational method of research study was conducted to conducted to assess the level of scientific beliefs, science skills and conceptual understanding in Science among Grade 9 Students in the Division of Aklan which was the basis for the Lesson Exemplar. A survey is a methodical way to collect data from (a sample of) entities in order to create quantitative descriptors of the characteristics of the broader population that the entities belong to (Ayuso Fernandez, et al., 2022). On the other hand, correlational research is a non-experimental research design that looks into the relationships between variables. It looks at the combined changes of two or more variables, but it doesn't prove cause and effect.

Population and Sampling

There were 370 out of 9,509 students who participated in this study, identified using the Rao soft sample size calculator. Furthermore, the sample size of each school in different districts was determined using stratified random sampling.

Furthermore, they were selected at random using the stratified proportional sampling.

Instrumentation

The questionnaire was made up of three (3) parts. Part I, determine the Level of Science Skills Checklist Questionnaire. Part II was the Level of Scientific Beliefs and Part III, the level of Conceptual Understanding in Science 9 test.

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On Science Skills and Scientific Beliefs questionnaire, 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

On Conceptual Understanding in Science 9, the mean was arbitrarily categorized as follows:

Mean Score	Description
28.01- 35.00	Advanced
21.01- 28.00	Proficient
14.01- 21.00	Approaching Proficiency
7.01- 14.00	Developing
0.00- 7.00	Beginning

Data Collection

The necessary procedures were followed in collecting relevant data. The researcher first secured the necessary permissions from Filamer Christian University, Inc. and the Department of Education, Division of Aklan, as well as letters of support from school heads to ensure the smooth conduct of the study. Once approval was granted, consent forms were distributed to Grade 9 students through their teachers and subsequently signed by the students' parents or guardians before being collected by the researcher. Following the collection of consent forms, an orientation session was held to brief Science teachers and students regarding the study's objectives, ethical considerations, and potential benefits. To gather data, questionnaires attached to the approved request letter were personally administered by the researcher during Science classes, with both the researcher and teachers guiding the students to promote accurate responses. After completion, the questionnaires were retrieved, coded, and analyzed using SPSS software. Moreover, the qualitative data collected helped identify the students' level of scientific beliefs, science skills and conceptual understanding of science which served as the learning exemplar for Grade 9 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 Scientific Beliefs.
2. Mean and Standard Deviation were used to determine the level of Science Skills.
3. Mean and Standard Deviation were used to determine the level of Conceptual Understanding of Science.
4. Analysis of Variance was used to determine the significant difference of Conceptual Understanding of Science Among the Levels of Scientific Beliefs.
5. Analysis of Variance was used to determine the significant difference of Conceptual Understanding of Science Among the Levels of Science Skills.
6. Pearson r was used to determine the significant relationship between Scientific Beliefs and Science Skills.
7. Regression Analysis was used to determine as the predictors of Conceptual Understanding in Science Among Scientific Belief and Science 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. This presentation is divided into two parts: (1) Descriptive Data Analysis, and (2) Inferential Data Analysis. The first part, Descriptive Data Analysis, presents the descriptive data along with their analysis and interpretation, while the second part, Inferential Data Analysis, presents the inferential data together with their corresponding analysis and

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interpretation. Data necessary for this study were gathered using researcher-made, adopted, and modified questionnaires. To analyze the data, the statistical tools employed included percentage, mean, standard deviation, Pearson r, and regression analysis.

Levels of the Top 5 Scientific Beliefs in Grade 9 Students

Table 1 displays the levels of the top 5 scientific beliefs of Grade 9 students in the Division of Aklan.

Table 1
Mean and Standard Deviation of Scientific Beliefs

Variable	Mean	Description	SD
Scientific Beliefs	*4.11*	*Highly Evident*	*0.41*
Scientific knowledge is constantly evolving and improving.	4.47	Very Highly Evident	0.76
Everyone should have access to scientific knowledge and education.	4.41	Very Highly Evident	0.81
Science has made significant contributions to human progress.	4.40	Very Highly Evident	0.79
Scientific investigation follows a scientific method.	4.32	Very Highly Evident	0.77
Investigations should enable students to explore their own ideas.	4.25	Very Highly Evident	0.78

The result signifies that most of the students have strong confidence and positive attitude toward the principles, methods and impact of science in life. Most students believe in the validity of science inquiry, the evolving nature of scientific knowledge and the importance of critical thinking and empirical evidence in understanding the natural world.

One key reason Grade 9 students cultivate strong scientific beliefs is the educational exposure, particularly in inquiry-based learning and the scientific method, fosters critical thinking and problem-solving skills, reinforcing students' scientific beliefs. Their curiosity about discoveries and recognition of science's contributions to progress further strengthen these views. Additionally, societal and cultural values that prioritize science and evidence-based innovation shape their understanding of the importance of scientific knowledge.

Level of Science Skills in Grade 9 Students

Table 2 presents the mean and standard deviation result of the level of Science skills of Grade 9 students in the Division of Aklan.

Table 2
Mean and Standard Deviation of Science Skills

Variable	Mean	Description	SD
Science Skills	*4.06*	*Highly evident*	*0.47*
Observation and Measurement	4.02	Highly evident	0.59
Critical Thinking and Analysis	4.07	Highly evident	0.58
Communication and Problem Solving	4.05	Highly evident	0.57
Scientific Knowledge and Application	3.91	Highly evident	0.59
Scientific Inquiry and Ethics	4.22	Very highly evident	0.54

The level of science skills of the Grade 9 students in the Division of Aklan signifies that they have a good foundation in scientific concepts and techniques. Additionally, this level of skills suggests that the Grade 9 students developed the essential science skills for understanding and exploring scientific phenomena, which will be valuable in daily classroom and real life application.

Moreover, this good result reflects the students' capability to approach scientific inquiry with curiosity and objectivity, making them well-equipped to explore and analyze various scientific challenges.

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Level of Conceptual Understanding in Science of Grade 9 Students

Table 3 shows the mean and standard deviation result of the level of conceptual understanding in science of Grade 9 students in the Division of Aklan.

Table 3

Mean and Standard Deviation of Conceptual Understanding of Science

Variable	Mean	Description	SD
Conceptual Understanding of Science	15.79	Approaching Proficiency	5.78

The approaching proficiency level of conceptual understanding in Science indicates that some students are developing a solid grasp of fundamental concepts but are not yet fully capable of independently applying them in more complex or novel situations. In addition, some students understand the basic principles and can perform basic tasks, such as identifying types of compounds or calculating molar mass but may struggle with more applications.

Significant Difference in Conceptual Understanding of Science among the Levels of Scientific Beliefs of Grade 9 Students

Table 4 below shows the Analysis of Variance result of the difference in conceptual understanding of science among the levels of scientific beliefs of grade 9 students in the Division of Aklan.

Table 4

Analysis of Variance of Conceptual Understanding of Science Among the Levels of Scientific Beliefs

Source of Variation	SS	df	MS	F	Sig.
Between Groups	261.4	2	131	3.982*	0.019
Within Groups	12047	367	32.8		
Total	12308	369			

* p<0.05 significant @ 5% alpha level

ns p>0.05 not significant @ 5% alpha level

There is a significant difference in the conceptual understanding of Science among the levels of scientific beliefs of Grade 9 students in the Division of Aklan. The result suggests that the way students believe science works and their level of trust in scientific principles can influence how well they understand scientific concepts.

Moreover, students' conceptual understanding is not only determined by the classroom discussion and even teaching methods but also by their individual beliefs about science. For instance, students who have a more positive or stronger belief in the validity of scientific methods may be more engaged with the content, leading to better conceptual understanding.

Significant Difference in Conceptual Understanding of Science among the Levels of Science Skills in Science of Grade 9 Students

Table 5 presents the Analysis of Variance on the significant difference in conceptual understanding of science among the levels of science skills in Science of grade 9 students in the Division of Aklan.

Table 5

Analysis of Variance of Conceptual Understanding of Science Among the Levels of Science Skills

Source of Variation	SS	df	MS	F	Sig.
Between Groups	98.42	2	49.2	1.479^{ns}	0.229
Within Groups	12210	367	33.3		
Total	12308	369			

* p<0.05 significant @ 5% alpha level

ns p>0.05 not significant @ 5% alpha level

The result suggests that the level of science skills does not significantly make a difference in the students' conceptual understanding of science. This implies that the conceptual understanding of the Grade 9 students in science remains consistent across different science skills.

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In other words, whether students possess a least to very highly evident level of science skills, their ability to understand and apply key concepts in chemistry is consistent at all times.

This result may reflect that Grade 9 Science teachers use teaching methods and pedagogy ensures that Grade 9 students can really understand the different concepts in science specially in Chemistry regardless of their Science skills.

Significant Relationships among the Scientific Beliefs, Science Skills and Conceptual Understanding of Science of Grade 9 Students

Table 6 depicts the Pearson r result about the relationships among the scientific beliefs, science skills and conceptual understanding of science of grade 9 students in the Division of Aklan.

Table 6

Pearson r Among Scientific Beliefs, Science Skills and Conceptual Understanding of Science

Variables	r	Sig
Scientific Beliefs and Science Skills	0.611*	0.000
Scientific Beliefs and Conceptual Understanding of Science	0.141*	0.007
Science Skills and Conceptual Understanding of Science	(-)0.058^{ns}	0.266

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

The result suggests a moderately positive correlations. This means that as students' scientific beliefs become stronger or more aligned with scientific principles, their science skills (such as observation, experimentation, and analysis) also tend to improve.

In addition, this finding implies that students' scientific beliefs how they perceive and accept scientific principles play an important role in the development of their science skills. When students hold strong, evidence-based beliefs about science, they are more likely to engage meaningfully in scientific activities, enhancing their ability to perform scientific processes such as conducting experiments, analyzing data, and drawing conclusions.

Predictors of Conceptual Understanding of Science Between Scientific Beliefs and Science Skills of Grade 9 Students

Table 7 presents the regression analysis of the predictors of conceptual understanding of science between scientific beliefs and science skills of grade 9 students in the Division of Aklan.

Table 7

Regression Analysis of Conceptual Understanding of Science Between Scientific Beliefs and Science Skills

Variables	Unstandardized Coefficients B	Standardized Coefficients Beta	t	Sig.
(Constant)	10.855		3.470	0.001
Scientific Beliefs	3.996	0.280	4.371*	0.000
Science Skills	-2.832	-0.229	(-)3.572*	0.000

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

The result shows that if the Grade 9 students hold stronger scientific beliefs, they also tend to demonstrate a higher level of conceptual understanding. This finding emphasizes the critical role that students' beliefs about science play in their ability to grasp and apply scientific concepts effectively.

Students with more sophisticated scientific beliefs are likely to approach science learning with a deeper level of curiosity, critical thinking, and understanding, which can lead to better outcomes in grasping complex scientific concepts. This age is also a time when students start to question the reliability of scientific knowledge and begin to understand the nature of scientific inquiry, which makes it an ideal time for educators to target these beliefs to enhance learning.

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Learning Exemplar on Grade 9 Science

This lesson exemplar integrates various activities designed to strengthen students' understanding of scientific beliefs, skills, and conceptual understanding. By focusing on interactive and inquiry-based learning, the exemplar aims to enhance students' analytical, investigative, and communication skills while fostering a deeper appreciation of science's evolving nature and its real-world applications.

The activities promote active participation, critical thinking, and collaboration, ensuring that students not only acquire knowledge but also develop essential skills for scientific inquiry and application.

Variables	Activity Title	Description	Expected Output
Scientific Beliefs	Gallery Walk: Evolution of Scientific Knowledge	Students rotate through stations highlighting major scientific discoveries, answering reflection questions, and presenting findings.	Completed worksheet and a 2-minute group presentation on one discovery.
	Debate: Accessibility of Science Education	Students engage in a debate on whether access to science education a basic human should be right, presenting arguments and rebuttals.	Participation in the debate and class discussion with justified perspectives.
	Investigation Planning: Designing an Experiment	Groups design a plan to test the quality of drinking water in their community, detailing steps like hypothesis, materials, and procedures.	A one-page investigation plan with clear components: research question, hypothesis, materials, procedure, and data collection methods.
Science Skills	Scientific Inquiry Challenge	Students brainstorm and draft solutions to reduce plastic waste, including an action plan and success measurement.	A draft of a solution plan presented to the class with peer feedback.
	Data Analysis Task	Students analyze a dataset on air pollution, calculate statistical measures, identify trends, and write a summary with suggested interventions.	One-paragraph conclusion summarizing findings and suggested intervention.
	Measurement and Communication	Groups conduct a density experiment, calculate densities, create a bar graph, and present their findings.	Bar graph of densities recorded data, and a 2-minute oral presentation.

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Conceptual Understanding	Interactive Mole Concept Lab	Students use online simulations to balance equations and calculate moles of hydrogen gas, submitting their work.	Screenshot of completed simulation with calculations.
	Real-World Chemistry Case Study	Students analyze a nutritional label, calculate macronutrient percentages, and reflect on real-world applications.	One-page report on percentage composition and reflection on its application in daily life.
	Quantum Mechanical Model Visualization	Groups create physical models of electron orbitals, label and explain them, and record a video presentation.	Physical models of s, p, and d orbitals, and a 2-minute explanatory video uploaded to a shared platform.

Conclusion

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

1. The overall Scientific Beliefs of Grade 9 was "High." The results may yield to create culture of scientific literacy among Grade 9 students. Possibly, this may lead the science teachers to incorporate or integrate science beliefs that play in advancing society with discussions about emerging technologies into the classroom, as well as highlighting the use or interconnected of science with other disciplines. Moreover, the schools can also implement programs or projects where students have the freedom to choose topics or interest in science for investigation, collaborate with peers and self-directed approach in science for learning.
2. The result of the overall level of science skills of the Grade 9 students was "high". This result suggest that the students possess a solid foundation in key scientific skills that may lead to potential STEM (STEM-related topics) high increase on students' interest and aptitude pursuing strand in Senior High School. Potentially, this may also yield encouraging and engaging students to participate in different science-related fairs and competitions, research programs in which would further enhance their scientific knowledge and skills in science. Moreover, this can further prepare them for higher levels of education, foster their problem-solving abilities, and inspire future careers in STEM fields.
3. The level of Conceptual Understanding of Science of Grade 9 students in the Division of Aklan was "approaching proficiency". This result may yield that science teachers would improve teaching strategies they are using inside or outside the classroom. In addition, teachers may also develop more effective instructional methods and curricula designed to address gaps in students' understanding of scientific concepts. In addition, this also highlights the need for additional support for students who are struggling. Thus, this may lead to implementation of remedial programs inside the school to boost students' concept understanding in science.
4. The result revealed that there is a significant difference in conceptual understanding of science among the levels of scientific beliefs of Grade 9 students in the Division of Aklan. This may strongly suggest that both variables play a crucial role in shaping the understanding of science concepts. This may lead for teachers to integration of scientific beliefs into teaching practice. Incorporate activities and discussions that help shape and positively influence students' scientific beliefs with fostering a growth mindset and address misconceptions in science. Moreover, this may prompt different changes in students' beliefs overtime.
5. The result revealed that there is no significant difference in conceptual understanding of science among the levels of science skills of Grade 9 students. Therefore, this suggests that regardless of their conceptual understanding of science, students exhibit consistent proficiency in executing science skills. Therefore, it can lead to emphasis on the welfare and capacity of learners with equal treatment and teaching strategies. Ensuring that students develop both the skills and the conceptual understanding necessary for success.

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6. The results showed that there is a significant relationship between scientific beliefs and science skills. In addition, there is also a significant relationship between scientific beliefs and conceptual understanding of Science. This result may lead that students' beliefs about science play a crucial role in shaping their development of science skills and their ability to understand scientific concepts sort of curricular adjustments. More so, students who hold more accurate and positive scientific beliefs may yield to perform better in science skills and demonstrate a deeper comprehension of scientific principles to create more comprehensive evaluations of student progress in science education. While there is no significant relationship between the science skills and conceptual understanding. This may lead also to remodel of the well-being and potential of students through equal treatment and teaching methods, ensuring that learners acquire both the skills and the conceptual knowledge required for success.
7. The results revealed that both scientific beliefs and science skills are predictors to conceptual understanding in Science among Grade 9 students. These variables possibly have directly influenced their ability to comprehend and apply scientific concepts. Teachers then may yield to focus on developing these two key areas, as strengthening students' beliefs and skills in science and could lead to a deeper and more meaningful understanding of scientific principles. Moreover, this could also involve creating a learning environment that encourages curiosity, critical thinking, and an open-minded approach to scientific inquiry that is suitable for learners to learn science.
8. The learning exemplars for science 9 are developed as a comprehensive instructional material aimed at integrating scientific beliefs with essential science skills, thereby promoting a deeper conceptual understanding of key specific concepts. In addition, this may result to increase student interest and motivation in science. When students connect their personal beliefs to scientific inquiry and see the relevance of science in their daily lives, they may be more engaged in learning. This innovative approach enables science teachers to adjust the content and pace of instruction to meet the diverse learning styles and abilities of their students. Ultimately, this investment in the learning exemplar may support every student's right to quality science education that is equitable and culturally relevant.

Recommendations

Based on the findings and conclusions, the following recommendations are requested:

1. Teachers may be encouraged by the researcher to regularly highlight how science is used to solve real-world problems. This could involve bringing in guest speakers, showing documentaries, or having students research how scientific concepts apply to different fields like medicine, agriculture, or environmental conservation, etc. Students may develop and practice art of questioning the science behind new advancements or scientific discoveries to their science teachers. Engage and reflect on how these advances impact society, ethics, and the environment by participating in debates or write essays discussing the ethical implications with supported evidence and basis. The School administrators may prioritize strengthening teachers' professional development by offering training, seminars, and curriculum updates, along with ensuring proper resource allocation. This approach will enhance science education for teachers, equipping them with the essential skills required to meet the needs of Grade 9 students.
2. Teachers may continue to foster an environment where students can engage in hands-on experiments, research projects, and real-world problem-solving activities by implementing inquiry-based lessons and fostering independent critical thinking. Also, teachers may organize group discussions, debates, or presentations where students share their scientific findings and ideas with peers, focusing on clear communication and effective problem-solving strategies. For students, may take initiative to conduct independent research projects that challenge their scientific knowledge and ethical considerations. This will help them continue developing their inquiry skills. Moreover, they may also engage in leadership roles in group activities, fostering stronger collaboration and improving both communication and problem-solving skills. For Department of Education, they may ensure that the science curriculum is regularly updated to reflect the latest advancements in science and technology, as well as incorporating more opportunities for scientific inquiry, ethics, and real-world application.
3. For teachers, it is recommended to anchor teaching methods to address individual learning needs, recognizing that some students may need more support to fully grasp key scientific concepts. This can be done by providing differentiated instruction through group work, individualized assignments, or additional resources for students struggling with specific concepts. For students, if happen to struggle with conceptual understanding, it is recommended to seek help from their teachers or use additional resources such as online

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tutorials, videos, and science apps to reinforce learning. Moreover, utilize online educational platforms or attend office hours to clarify any misunderstandings or review difficult topics. For school administrators, it is recommended to implement systems to monitor students' progress in conceptual understanding, with targeted interventions for those who may be struggling. Develop a system for regular progress tracking using assessments and individualized learning plans, offering additional support to students who are approaching proficiency but need further reinforcement. For future researchers, may explore the factors that contribute to the variation in students' conceptual understanding of science, such as teaching methods, classroom environment, or students' prior knowledge. In addition, future researchers should explore the impact of integrating technology, such as virtual labs, interactive simulations, and science-related educational apps, on enhancing students' conceptual understanding.

4. For teachers, may engage the ongoing professional development for science teachers on how to effectively address students' diverse scientific beliefs and foster critical thinking skills. For students, it is recommended to prioritize engagement and active participation by gaging in project-based learning, inquiry-based learning and other strategies that encourage them to explore and question scientific concepts deeply. For school administrators, they may initiate work with parents to promote science education at home by offering workshops or informational sessions on the importance of scientific literacy that can help parents better support their children's learning.
5. For teachers, it is recommended to ensure that practical science skills (e.g., experimentation, observation, analysis) are not taught in isolation but are closely integrated with the conceptual content thus, it will help students connect theory with practice and may enhance their understanding. For students, they may focus on strengthening their foundational understanding of science concepts, regardless of their current skill level. Understanding the "why" and "how" behind scientific principles is essential for meaningful learning. For school administrators, may promote collaboration among science teachers in other subject areas, such as mathematics or technology, to help students see how science skills are applied across different contexts. This can help improve both the understanding of scientific concepts and the development of practical skills.
6. For teachers, may create opportunities for students to reflect on how their beliefs about science influence their approach to learning and problem-solving. For students, may actively engage in hands-on activities that require both conceptual knowledge and practical skills. For example, rather than simply memorizing the steps of an experiment, students should understand the underlying scientific principles and theories that explain why the experiment works. Parents, it is recommended to encourage a positive attitude toward science by praising curiosity, critical thinking, and problem-solving rather than just memorization or "getting the right answer."
7. For teachers, they may create an environment where curiosity, inquiry, and critical thinking are valued. Students should feel that making mistakes is a natural part of the learning process, which will help them develop a more open and positive belief system about science. For students, they may seek out additional learning opportunities beyond the classroom. This might include science-related projects, videos, or extracurricular activities like science clubs or fairs that allow students to apply what they've learned in new contexts. For parents, it is recommended to model a positive attitude toward science by expressing curiosity, asking questions, and demonstrating how to think through problems. This reinforces the idea that science is a lifelong learning process.
8. For teachers, they may use the Learning Exemplar to address the varied levels of scientific beliefs and skills in the classroom. By differentiating instruction and using the exemplar as a guide, teachers can tailor activities to meet the needs of students with varying levels of conceptual understanding and practical skills. For students, they may use exemplar as an opportunity to engage in both practical experiments and the theoretical understanding of concepts. Try to connect the skills learned in the lab or through activities to the bigger picture of the scientific concepts they are based on. For school administrators, they may set up systems to regularly monitor how effectively the Learning Exemplar is being used in the classroom. This includes observing students' performance, tracking their progress in science skills and conceptual understanding, and ensuring that the integration of scientific beliefs is having the intended impact.

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