SCIENCE INSTRUCTIONAL APPROACHES EMPLOYED BY TEACHERS IN SENIOR HIGH SCHOOL

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Abstract

This research delved into the identification of effective science instructional approaches employed by teachers within the secondary senior high schools of the 2nd Congressional District in the Province of Sorsogon. Employing a descriptive and quantitative methodology, the study assessed the extent to which teachers implemented these approaches and evaluated their impact on students' cognitive, affective, and psychomotor development. Additionally, the study identified challenges encountered in utilizing these approaches and proposed an in-house training program to address them. The findings revealed a variety of instructional approaches employed by teachers, including inquiry-based learning, cooperative learning, and hands-on activities. While teachers acknowledged the importance of these approaches in promoting student engagement, challenges such as time constraints, resource limitations, and a lack of training hindered their effective implementation. This research sheds light on the significance of employing effective science instructional approaches to enhance student engagement in senior high schools. By addressing the identified challenges and providing targeted training programs, educators can optimize their teaching practices and create an enriching learning environment conducive to students' cognitive, affective, and psychomotor development.

Keywords: *science instructional approaches, senior high school, cognitive development, affective development, psychomotor development*

INTRODUCTION

The implementation of the K to 12 Curriculum in the Philippine education system paves the way for the inclusion of senior high school level known as the key stage 4. In this stage, learners are exposed to the pre-collegiate learning contents and performance. Taking the core curriculum subjects is compulsory for these learners. These core curriculum subjects are obligatory for them to take including learning areas such as Language, Humanities, Mathematics, Science, Social Science, Philosophy, and Physical Education and Health (DepEd, 2019).

Science education is essential for students as it helps them comprehend the natural world, cultivate critical thinking abilities, and cultivate a curiosity for investigation. Nevertheless, educators continue to face the intricate challenge of fostering effective student engagement in science classrooms (Juuti et al., 2021). Inadequate science instructional methods can impede students' curiosity and enthusiasm for scientific inquiry, resulting in decreased interest, disengagement, and limited learning achievements. The issue of inadequate science instructional methods in terms of student engagement can manifest in multiple ways (Sökmen, 2021). A notable issue is the excessive dependence on conventional didactic approaches, such as teacher-centered lectures and textbook-based instruction.

The research on the influence of cultural relevance in science instruction at Talaonga National High School is limited. Incorporating students' cultural backgrounds and local contexts in science lessons can enhance inclusivity and relevance in learning (Tang & She, 2018). The approach taken by senior high school teachers in this school to incorporate cultural relevance into science instruction and its effect on student engagement remains uncertain. Studying the incorporation of cultural relevance in science classrooms can provide insights into effective strategies for establishing a culturally inclusive learning environment that promotes student engagement and enthusiasm. This is the very purpose why I have this study.

This study determined the extent of implementation of science instructional approaches by Senior High School teachers. Specifically, it answered the following sub problems:

1. What are the different instructional approaches employed by science teachers in teaching senior high school?
2. What is the extent of the utilization of the different instructional approaches in senior high school in terms of:
    a. cognitive
    b. affective and
    c. psychomotor development
3. What are the different resource materials employed by teachers in using different instructional approaches?
4. What are the challenges encountered by senior high school teachers in teaching science?
5. What in-house training may be designed along with science instructional approaches for an effective science education delivery?

MATERIALS AND METHOD

This study employed a descriptive and quantitative research design to achieve its objectives. Descriptive research was utilized to systematically describe the current practices of science instruction, while quantitative methods were employed to analyze the collected data quantitatively.

Participants

The study involved nine (9) senior high school teachers teaching science in the 2nd Congressional District of the Province of Sorsogon. The researcher utilized stratified random sampling to select participants for the quantitative phase. Stratified sampling involves dividing a population into smaller subgroups, or strata, based on common attributes or characteristics such as income or educational level (Harrison et al., 2020).

Instruments

The study utilized a researcher-designed survey questionnaire. The first section of the questionnaire focused on highlighting the instructional approaches employed by senior high school teachers in teaching science. Additionally, the second section assessed the extent to which these instructional approaches were utilized in terms of cognitive, affective, and psychomotor development. The third section examined the resource materials used by senior high school teachers, followed by an exploration of the challenges encountered in implementing these approaches. The survey questionnaire was distributed to selected participants either electronically or in print format, accompanied by clear instructions for completion, and assurances of anonymity and confidentiality.

RESULTS AND DISCUSSION

Science Instructional Approaches in Senior High School

Science being considered an ever-evolving learning area has been constantly updated to ensure that the required standards along with contents and performance have been met. Similarly, to cope with the trend, the delivery of instructions must keep pace with the needs of the learners and the movement of the science and technology-oriented society.

Table 1 shows the different instructional approaches used in science education for senior high school students. The approaches were reported by teachers and educators in senior high schools, and the frequencies indicate their classroom utilization. The rank indicates the relative popularity of these approaches among educators.

Table 1. *Science Instructional Approaches in Senior High School*

Approaches	Frequency	Rank
Inquiry Based Approach	7	1.5
Problem – Based Approach	7	1.5
Collaborative Learning	6	3
Direct Teaching Approach	5	4
Practical Work Approach	4	5.5
Active Learning	4	5.5

Socratic Method	3	7.5
Simulations and Virtual Labs	3	7.5
Flipped Classroom	2	10
Case-Based Learning	2	10
Game-Based Learning	2	10

Table 1 displays Inquiry-Based Approach and Problem-Based Approach are the most commonly used approaches, both with a frequency of 7, and ranked 1.5. The Collaborative Learning and Direct Teaching Approach rank third and fourth, respectively, with frequencies of 6 and 5. The Practical Work Approach and Active Learning have a frequency of four, making them tied for 5.5 place. Socratic Method, Simulations and Virtual Labs share the 7.5 position with a frequency of three. The instructional approaches of Flipped Classroom, Case-Based Learning, and Game-Based Learning have a low frequency of two, ranking tenth in terms of usage. The Inquiry-Based Approach and the Problem-Based Approach are commonly employed instructional approaches.

Table 2.1 *Extent of Utilization of Science Instructional Approaches in terms of Cognitive Development*

Indicators	Weighted Mean	Description
Designing science lessons that encourage students to analyze and critically evaluate scientific concepts to deepen their understanding.	4.75	Always
Incorporating thought-provoking questions and complex problems that challenge students' ability to apply scientific theories to real-world situations.	4.625	Always
Using case studies and scenarios to stimulate students' higher-order thinking skills and encourage them to explore multifaceted scientific issues.	4	Frequently
Fostering active participation by prompting students to construct their own hypotheses, conduct experiments, and draw evidence-based conclusions.	4.75	Always
Encouraging students to explore diverse sources of information and evidence, promoting a well-rounded approach to understanding scientific phenomena.	4.5	Frequently
Guiding discussions that promote intellectual curiosity and prompt students to delve into the intricacies of scientific theories.	4.5	Frequently
Designing learning activities that require students to make connections between different scientific concepts, enhancing their holistic understanding.	4.5	Frequently
Using problem-based learning tasks that challenge students to collaborate, investigate, and propose innovative solutions to complex scientific problems.	4.625	Always
Facilitating critical debates among students, encouraging them to evaluate competing scientific viewpoints and evidence.	4.25	Frequently
Creating opportunities for students to present their research findings and engage in peer reviews, enhancing their ability to articulate and defend scientific arguments.	4.125	Frequently
General Weighted Mean	4.46	Frequently

Table 2.1 presents indicators that assess the contribution of science instructional approaches to students' cognitive development. The indicator "Designing science lessons that encourage students to analyze and critically evaluate scientific concepts to deepen their understanding" has the highest mean value in Table 2.1, with a weighted mean of 4.75, described as always. This finding indicates that science educators often prioritize the development of critical thinking and in-depth analysis skills in their teaching of the subject. This aligns with the current perspective on science education, which highlights the significance of students acquiring both factual knowledge and the ability to understand and evaluate scientific concepts (Lsme, 2023).

The cognitive domain had acquired a weighted mean value of 4.46, described as frequently, indicating that these approaches were frequently utilized to develop cognitive skills among students. This indicated that senior high school teachers consistently integrated these instructional approaches to enrich students' comprehension, fostered critical thinking, improved problem-solving abilities, and enhanced analytical skills within the field of science.

Table 2.2. *Extent of Utilization of Science Instructional Approaches in terms of Affective Development*

Indicators	Weighted Mean	Description
Cultivating a positive and inclusive classroom environment where students feel comfortable expressing their thoughts and emotions about science.	4.5	Frequently
Establishing trust and rapport with students, creating a safe space for them to openly share their feelings and experiences related to scientific topics.	4.375	Frequently
Incorporating activities that evoke emotional connections to scientific content, fostering a sense of wonder and personal relevance.	4.5	Frequently
Encouraging students to reflect on their own experiences and values as they relate to scientific concepts, promoting a deeper connection.	4.5	Frequently
Providing opportunities for students to collaborate and share their enthusiasm for science, cultivating a supportive and interactive learning community.	4.5	Frequently
Integrating real-life examples and stories that resonate with students' emotions, making scientific concepts more relatable and engaging.	4.75	Always
Recognizing and celebrate students' contributions and achievements in science, boosting their confidence and motivation.	4.375	Frequently
Promoting empathy and understanding by discussing the ethical and societal implications of scientific advancements with my students.	4.25	Frequently
Encouraging students to explore their personal interests within the realm of science, allowing them to pursue topics that resonate with them.	4.375	Frequently
Designing learning experiences that challenge students to confront misconceptions and preconceived notions, promoting cognitive dissonance and growth.	4.375	Frequently
General Weighted Mean	4.45	Frequently

Table 2.2 displays the "Extent of Utilization of Science Instructional Approaches in terms of Affective Development." This table specifically examines the emotional and affective dimensions of learning in a science classroom. The indicator "Integrating real-life examples and stories that resonate with students' emotions, making scientific concepts more relatable and engaging" has the highest mean value in Table 2.2. The indicator obtained a weighted mean of 4.75, described as always, indicating that this practice is consistently utilized in science instruction. Educators' recognition of the significance of linking scientific content to students' lived experiences and emotions is indicated by their frequent use of real-life examples and emotionally resonant stories (Janna et al., 2019).

The affective domain obtained a weighted mean value of 4.45, indicating a high frequency of utilization. This implied that the instructional approaches effectively addressed students' attitudes, beliefs, values, and emotional responses towards science. Teachers were adept at employing strategies that engaged students emotionally, fostering enthusiasm, curiosity, and a positive disposition towards science learning.

Table 2.3. *Extent of Utilization of Science Instructional Approaches in terms of Psychomotor Development*

Indicators	Weighted Mean	Description
Designing hands-on experiments and activities that require students to manipulate materials and engage in physical interactions with scientific phenomena.	4.125	Frequently
Encouraging students to explore and test hypotheses through interactive activities that involve physical movement and experimentation.	4.5	Frequently
Integrating technology tools and simulations that allow students to visually and physically interact with complex scientific concepts.	4.25	Frequently
Promoting kinesthetic learning by incorporating role-playing, simulations, and model-building activities in my science lessons.	3.875	Frequently
Providing opportunities for students to engage in fieldwork, outdoor observations, and practical applications of scientific theories.	4.125	Frequently
Encouraging students to create physical models and prototypes to demonstrate their understanding of scientific principles.	4.5	Frequently
Facilitating interactive demonstrations and simulations that allow students to observe and manipulate scientific phenomena in action.	4.625	Always
Incorporating collaborative group projects that require students to physically work together to solve scientific challenges.	4.75	Always
Designing virtual labs and interactive online resources that enable students to conduct experiments and explore scientific concepts virtually.	3.375	Seldom
Organizing field trips and hands-on experiences that immerse students in real-world scientific environments, enhancing their learning through direct engagement.	3.5	Seldom
General Weighted Mean	4.16	Frequently

According to Table 2.3, the instructional approach that received the highest mean score is "Incorporating collaborative group projects that require students to physically work together to solve scientific challenges" has a weighted mean of 4.75 described as always. This approach highlights the significance of collaborative learning, wherein students actively interact with their peers, materials, and scientific phenomena to collectively tackle intricate challenges. Collaborative group projects promote the application of psychomotor skills through active teamwork and problem-solving, facilitating cooperation and motor skill development (Liu et al., 2021).

The psychomotor domain obtained a weighted mean value of 4.16 described as frequently, indicating that instructional approaches were utilized significantly. This shows that senior high school teachers were effective in incorporating strategies aimed at developing students' practical skills in the context of science education.

Table 3. *Resource materials in teaching science*

Approaches	Frequency	Rank
activity sheets	9	1
books	8	2
Textbooks	7	4
laboratory kits	7	4
educational applications	7	4
simulations	6	7
science kits	6	7

online learning platforms	6	7
science magazines	4	9.5
interactive e-learning activities	4	9.5
field guides	2	11

Table 3 provides a summary of the frequency and ranking of resource materials utilized in science instruction. Activity sheets are the most commonly utilized resource material, with a frequency of 9, and rank 1. These sheets serve as versatile tools for educators, providing a structured format for students to participate in various activities, ranging from basic exercises to intricate problem-solving tasks. Activity sheets are useful for improving students' cognitive development through hands-on activities because they can be customized to meet specific learning objectives (Hidi & Renninger, 2019).

Table 4.1. *Teacher factor challenges encountered in teaching science*

Indicators	Frequency	Rank
Struggling with time constraints to cover extensive curriculum without achieving depth of comprehension.	9	1
Struggling to maintain effective science instruction amidst the challenges of diverse student needs.	8	2
Facing difficulty in keeping up with current research and pedagogical best practices.	5	4.5
Failing to balance the demands of standardized testing while fostering a deeper understanding of scientific principles.	5	4.5
Struggling to adjust teaching methods to tackle inconsistent levels of prior scientific understanding.	5	4.5
Struggling to reconcile pedagogical innovations with the integration of traditional scientific methodologies	5	4.5
Failing to cope with the changing landscape of scientific knowledge and advancements.	2	8
Struggling to adapt instructional approaches that cater to diverse learning styles and preferences.	2	8
Struggling to instill a love for science in students due to potential gaps in teacher confidence.	2	8
Failing to engage students in abstract and complex scientific concepts.	1	10

Table 4.1 shows the challenges faced by science teachers, along with their respective ranks. The issue of struggling with time constraints to cover an extensive curriculum without achieving depth of comprehension has a frequency of 9 and rank 1. This aligns to the study Banilower et al. on the pressure to cover a wide range of topics in the science curriculum which leads to a lack of depth in understanding. The challenge with the frequency of 8 is "struggling to maintain effective science instruction amidst diverse student needs," which rank 2. This challenge emphasizes the significance of catering to the varied needs, backgrounds, and abilities of students in science classrooms. Teachers must differentiate instruction to cater to diverse learning styles, abilities, and preferences (Brown, 2019). Culturally responsive teaching and inclusive practices play a crucial role in ensuring equitable access to science education (Kanaka et al., 2020).

Table 4.2. *Learner factor challenges encountered in teaching science*

Indicators	Frequency	Rank
Difficulties in balancing the workload of science assignments and assessments.	9	1
Difficulty in solving advanced mathematical problems within scientific subjects.	8	2
Difficulty to transition from memorization to applying scientific principles.	7	3
Lack of hands-on activities or interactive components.	6	4
Difficulty to grasp complex scientific concepts presented through traditional lecture-based methods.	4	6
Difficulty in understanding intricate scientific theories without practical examples.	4	6
Encounter challenges when scientific ideas are explained using an excessive amount of technical language.	4	6
Unable to visualize abstract scientific concepts without visual aids or diagrams.	3	8
Difficulty in keeping up with lessons caused by inadequate reading comprehension skills.	2	9
Difficult of using ICT in learning science, such as dealing with apps.	1	10

Table 4.2 shows the challenges faced by learners, along with their respective ranks. The highest rank has the highest indicator difficulties in balancing workload of science assignments and assessments with a frequency of 9 and rank 1. This is followed by difficulty in solving advanced mathematical problems within scientific subjects with a frequency of 8 and rank 2. The difficulty of incorporating Information and Communication Technology (ICT) in science education, especially when utilizing applications or apps which ranked last.

Table 4.3. *Support mechanism challenges encountered in teaching science*

Indicators	Frequency	Rank
Confronting difficulties securing funding for science supplies, experiments, and field trips.	9	1
Barriers in establishing partnerships with external science-related organizations.	6	3.5
Confronting potential barriers and constraints in accessing relevant and specialized science training.	6	3.5
Discrepancies between curriculum requirements and available resources.	6	3.5
Struggling to manage the overwhelming demand for interdisciplinary collaboration within tight time constraints.	6	3.5
Limited availability of updated resources and research in local contexts.	5	6
Struggles of fostering a science-focused school culture, with uncertain support for educators and students alike.	3	7.5
Struggling with restricted access to professional development opportunities for science educators.	3	7.5
Facing the risk of support gaps from administrators, mentors, or peers in science education.	2	9.5
Lack of support for incorporating innovative teaching strategies in science.	2	9.5

Table 4.3 shows the challenges associated with support mechanisms in teaching science, presenting their corresponding ranks. In this context, indicating the difficulty in obtaining funding for science supplies, experiments, and field trips obtained a frequency of 9 and rank 1. The challenge of potential support gaps in science education from administrators, mentors, or peers and lack of support for incorporating innovative teaching strategies in science both obtained a frequency of 2 and rank 9.5.

Proposed In-House Training Program for Senior High Science Teachers

Project Title: Empowering Educators: Enhancing Pedagogical Practices in Senior High Science Education

By the end of the training, participants will be able to enhance their knowledge and skills in effective instructional delivery processes of science content.

CONCLUSION AND RECOMMENDATION

Senior high school science teachers use both learners-centered and active-learning-centered approaches, focusing on cognitive, affective, and psychomotor development. They primarily use low-technological learning devices, facing challenges like time constraints, poor student assessment coping, and limited school-community partnerships. To address these issues, in-house training on instructional delivery processes, integrative assessment, technology learning devices, and science community partnerships is proposed.

The recommendations include adopting ICT-based science instructional approaches like virtual laboratories and interactive simulations by senior high school science teachers, ensuring holistic learning domain development through well-crafted lesson plans, allocating funds for hi-technological learning resources, involving science teachers in professional learning communities during LAC, implementing in-house training, and encouraging future research on teaching science using ICT tools and the impact of professional learning communities in science education.

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