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Improving The Performance of Grade 9 Learners in Chemistry Using 7e Instructional Model-based Activity Sheets

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ABSTRACT
Chemistry is one of the least-learned areas in science. Oftentimes, students consider it as a difficult subject. Most science teachers apply traditional ways of teaching coupled with rote memorization and ineffective strategies in teaching the subject. This study was conducted to enhance the performance of Grade 9 students in Chemistry using relevant and modern instructional models. A total of 38 students participated in the study using pretest and posttest as primary tools to measure the effectiveness of 7E instructional model-based learning activity sheets. Data revealed a significant learning gap, with 57.89% of students scoring in the "Poor" range (0–4) and none reaching "Satisfactory" or higher levels during the pretest. The score suggested the ineffectiveness of traditional, teacher-centered instruction and the urgent need for an engaging, inquiry-based learning approach. After utilizing the 7E instructional model-based learning activity sheets as intervention during classroom discussion, posttest results showed substantial improvement. Twenty-one or more than fifty-five percent (55.26%) scored in the "Very Satisfactory" range, while 23.68% achieved an "Outstanding" performance. It was recorded that no students remained in the "Poor" category, clearly indicating the intervention's success. The mean score rose from 4.32 (pretest) to 14.37 (posttest), and the t-value of 2.03 with a highly significant p-value (5.22884E-19) confirmed the statistical significance of the gains. The findings of the study confirm the effectiveness of the structured phases of the 7E Model—Elicit, Engage, Explore, Explain, Elaborate, Evaluate, and Extend. These phases promote deeper understanding, critical thinking, and sustained engagement. The study recommends wider implementation of 7E-based strategies and further teacher training to maintain and expand these positive results in Chemistry instruction at the Junior High School level.

1. Introduction

Chemistry is one the broad fields of science alongside life sciences, physics, and earth science. In the Philippine K to 12 curriculum this branch of science is offered in a spiral progression wherein skills and competencies are presented gradually from grade 7 to grade 10. Chemistry concepts are typically introduced in the first quarter of grade 7, the third quarter of grade 8, the second quarter of grade 9, and the fourth quarter of grade 10. The spiral progression of the science curriculum aims to provide a deeper understanding of core chemical concepts and their applications.

The K to 12 curriculum aims to connect scientific concepts to real-world problems and applications, encouraging students to see the relevance of chemistry in their lives and the world around them. As encapsulated in RA 10533 or the Enhanced Basic Education Curriculum (K to 12), students are expected to become productive members of the society who are critical problem solvers, responsible stewards of nature, innovative and creative citizens. Informed decision makers, and effective communicators" (Official Gazette of the Republic of the Philippines, n.d., p.2).

While the purpose of spiral progression is good, several studies have shown that implementing a spiral progression approach in education has faced several challenges. These include teachers' competence in multi-disciplinary subjects, insufficient resources like teaching guides and learning modules, lack of qualified teachers, and insufficient time for professional development. Additionally, students may struggle with mastery of concepts due to topic spacing, and some teachers find it difficult to apply modern technologies in the classroom (Dunton and Co, 2020).

A study by de Guzman and Marcelo (2021) found that science teachers struggled with inadequate training, resulting in poor delivery of progressively complex concepts. Batoon (2020) highlighted the inefficient implementation of the spiral progression approach in the Philippine science curriculum among students due to frequent topic shifts without mastery.

As a result of the above enumerated problems brought by poor implementation of spiral progression, Philippines rank low, if not the lowest in international tests.

A study conducted by International Management Development revealed that among 63 countries, the Philippines ranked 49th in terms of talent competitiveness. The factors considered in the ranking were the following: investment and development factor which measures resources used to cultivate homegrown capital; appeal factor which evaluates the extent to which a country attracts and retains foreign and local talent; and readiness factor which was about the quality skills and competencies of a country's labour force. Among these three factors, it seems that the readiness factor is directly affected with the quality of education a country is giving its citizens. Bris (2018), the director of IMB, even stated that the Philippines' labour force is not equipped with skills that firms are looking for. He further stressed that the "Philippines witnessed the deterioration of its ability to provide the economy with the skills needed, which point to a mismatch between school curriculum and the demands of companies" (The ASEAN POST, 2019). With the findings of the research, it seems that the vision of the K to 12 Curriculum of having globally competitive citizens is still far from realization (Inveirno, 2020)

In connection to this, the Philippines standing in Programme for International Students Assessment (PISA) of the Organization for Economic Cooperation and Development (OECD) in 2022 was under satisfactory.

As published in the official website of the National Center for Education (2022) they defined Programme for International Students Assessment (PISA) as an international comparative study of 15-year old students' performance in reading, mathematics, and science literacy. Based from the result, science literacy's mean score is one of the lowest among PISA participating countries and economies (356 PISA Score, rank 78/80, 2022)

Scientific literacy, in particular, was assessed through contexts involving personal, local or national, global issues, both current and historical, which demand some understanding of science and technology. This requires the individual to display competencies which are influenced by the individual's acquired content, procedural, and epistemic knowledge and of course set of attitudes towards science (PISA 2022 International Report, 2022. Further it says that "the mean score of Filipino students is within Proficiency Level 1a; hence an average 15- year old student can use basic knowledge to recognize or identify explanations of scientific phenomena." Region 1 garnered 342 mean score categorized within Proficiency level 1a.

In another international test participated by six Southeast Asian countries including the Philippines, the Southeast Asia Primary Learning Metrics showed that Philippines registered poor performance along Mathematics, Science, Reading, and Global citizenship (SEA-PLM, 2020). The test was administered to grade five students of the participating countries during the last months of the school year 2019-2020.

The SEA-PLM and PISA results reflect the urgency of improving the quality of basic education in the Philippines. As a response, the Department of Education led this national effort through "Sulong Edukalidad", whereby it will implement aggressive reforms in four key areas: (1) upskilling teachers and school leaders through a transformed professional development program; (2) review and updating of curriculum; (3) continuous improvement of the learning environment; and (4) multi-stakeholder cooperation (PISA 2018 National Report of the Philippines, 2018).

In the district of Aguilar, the MPS in science for the school year 2024-2025 is far below the standard across all quarters. In chemistry, the MPS registered 48.16, 55.16, 58.38, and 61.73 during the first, second, third, and fourth quarter respectively. These numbers suggest that more intervention when it comes to teaching chemistry is needed.

In the school setting, chemistry remains to be one of the fields of science most difficult to master as reflected by the MPS across four quarters; 48.67 first quarter, 63.1 second quarter, 52. 40 third quarter, and 56.76 fourth quarter.

In order to address the low performance of students in science particularly in chemistry, modern approaches in teaching science should be utilized. One of these significant approaches is the use of the 7E instructional Model.

The implementation of the 7E model in science classes ranging from chemistry to environmental science has consistently improved students' conceptual understanding, inquiry skills, academic performance, motivation, and long-term retention of content (Lubiano and Magpantay, 2021).

In addition, using the 7E model enhanced student's theoretical knowledge, critical and clinical skills, self-regulated learning, empathy, and positive communication attitudes compared to traditional teaching methods.

With this, the researcher wanted to utilize 7E Instructional Model-Based Learning Activity Sheets in enhancing the performance of Grade 9 students of Bocboc East National High School during the academic year 2025-2026.

2. Literature Review

In 2013, the government of the Philippines passed a law (Republic Act No. 10533) requiring schools to adopt a new system for teaching Science in K through 12 grade levels, using a theme-based, spiral progression approach. Under this model, schools will no longer teach each discipline separately for one year at a time instead, students will be exposed to a spiraled curriculum that provides for the systematic learning of competencies across grade levels from 7th through 10th. Each year, students will revisit the same fundamental concepts previously taught, but with increased complexity (Antipolo & Rogayan, 2021; Espinosa et al., 2023).

Although research supports the theory that spiraled curriculum develops mastery of content over time; research has also identified systemic obstacles to the successful implementation of such approach. For example, teachers face challenges in managing multi-disciplinary rotations of science, due to inadequate preparation in all core disciplines and lack of both adequate instructional materials as well as sufficient space and equipment to conduct hands-on laboratory experiments (Antipolo & Rogayan, 2021; Padilla et al., 2025). Moreover, the transition from one core discipline to another every quarter creates challenges for both educators and students, because of the absence of a sufficient number of competency-based assessments, and therefore students are often required to move on to new, higher-order competencies without having achieved a sufficient level of mastery of earlier, lower-order fundamental competencies (Espinosa et al., 2023).

The lack of cohesion in the operational aspects of the science curriculum relates closely to the poor performance of Filipino students on international assessments. Numerous international assessments show a significant lack of scientific literacy and critical inquiry skills among students in the Philippines (Espinosa et al., 2023). The results for Filipino 15-year-olds showed that their average performance in science literacy was 356 points, which puts them among the lower performing countries out of all those tested in the PISA (Padilla, et al., 2025). This score puts Filipino students at a level of proficiency defined as Proficiency Level 1a, which means that the average 15-year-old in the Philippines can identify some basic scientific phenomena, but cannot interpret complex data, make conclusions based on evidence collected through inquiry, or apply the concepts of chemistry to problems they encounter in the real world (Espinosa et al., 2023; Morales & Diola, 2026).

The pattern of poor performance starts earlier in the academic career of the students. The SEA-PLM Test items have documented that Grade 5 students in the Philippines are significantly behind the students in other SEA countries in math, reading, and basic science (Espinosa et al., 2023). Secondary analysis shows that many students are unable to meet the low standards on these assessments due to their socio-demographic status, and, in addition, other factors are also impacting the students' ability to perform at higher levels. These include low levels of financial support for the schools, misalignment of the curriculum being taught in the schools with the needs of the students attending those schools, and differences in the availability of educational resources from region to region (Morales & Diola, 2026; Tan & Villaluz, 2024).

To address the systemic gaps in performance as well as science proficiency among students, educational scholars strongly recommend a shift away from teacher-centered, memorization practices to active, inquiry-based examples of learning (Demelash et al., 2024; Lubiano & Magpantay, 2021). The 7E Instructional Model--consisting of seven sequential phases: Elicit, Engage, Explore, Explain, Elaborate, Evaluate, and Extend--is a highly effective constructivist framework to assist in bridging these gaps (Lubiano & Magpantay, 2021). By requiring students to build representations internally of complex phenomena from their own experiences and then to compare those internal representations to the external realities of those same complex phenomena, the 7E model encourages learners to think like active researchers instead of passive receivers of knowledge.

In chemistry education, where abstract, submicroscopic concepts frequently challenge young learners, the 7E framework significantly enhances academic engagement and retention (Demelash et al., 2024). Empirical studies in secondary science classrooms demonstrate that structuring material around the 7E phases drastically improves academic performance, sparks self-regulated learning habits, and builds essential science inquiry skills (Lubiano & Magpantay, 2021; Santos & Castro, 2024). When combined with contextualized tools like targeted learning activity sheets or interactive simulations, the 7E approach helps students navigate fluidly between macroscopic observations and chemical symbols, ultimately fostering a functional, long-term mastery of chemistry concepts (Demelash et al., 2024).

3. Methodology

The study "Improving the Performance of Grade 9 Learners in Chemistry using 7E Instructional Model-Based Activity Sheets" used a Pre-experimental Design which specifically employs the One-Group Pretest-Posttest Design. The research employs a One-Group Pretest-Posttest Design which enables researchers to observe how 38 Grade 9 students develop over time. The design works well for educational research because it uses students as their own control group which enables researchers to assess how the intervention affected student knowledge through pre- and post-treatment evaluations. The students studied for one week by using the 7E Instructional Model-Based Activity Sheets which required them to move beyond rote memorization into active inquiry. The researchers needed to explore cause-and-effect relationships which they regarded as essential scientific knowledge. The Posttest stage of the narrative determines how the 7E model affects the final results.

This study used thirty eight Grade 9 learners enrolled in a heterogeneous class of Bocboc East National High School for the school year 2025-2026.

On the other hand, 7E experts served as evaluators and validators of the test questions and 7E Instructional Model-Based Learning Activity Sheets to assure its content quality.

The following were the data gathering tools in this study.

3.1 Pretest and Post-test

A 20-item pretest was constructed based on the competencies in the second quarter, specifically along chemical bonding. The pretest consisted of 20 multiple-choice items based on Bloom's Learning Domains. The posttest was parallel to the pretest. The test items were validated by science teachers.

3.2 7E Instructional Model-Based Learning Activity Sheets

The 7E Instructional Model-Based Learning Activity Sheets were prepared in accordance to the competencies from the Second Quarter lessons in science 9. The Learning Activity Sheets were checked and evaluated by the school head and a grade 9 science teacher of Bocboc East National High School for face and content validity. The 7E Instructional Model was implemented in a span of one week.

3.3 Evaluation Tool for the 7E Instructional Materials

This was a 5-item rating scale which was adapted from the works of Valdez (2005). The tool specifically asks the rater for their level of agreement or disagreement. The factors looked into the 7E Instructional Model-Based Learning Activity Sheets are the (1) objectives, (2) content and organization, (3) exercises and learning activities, and (4) meaningfulness. The researcher asked the validators to check the pretest and posttest for content and face validity. At the same time, they were asked to evaluate the 7E Instructional Model-Based Learning Activity Sheets using the evaluation tool discussed earlier. These were done prior to the actual intervention phase. The respondents were asked to take the pretest. And then for a period of one week, the 7E Instructional Model-Based Learning Activity Sheets were used to grade 9 students during classroom discussion. After the intervention, the posttest was administered.

The researchers obtained permission from both students and their parents to conduct their research because the study involved Grade 9 students who were underage. The researchers must demonstrate that they obtained written consent from parents or guardians together with the students' independent willingness to join the study. True ethical practice requires more than securing permission because the young learners needed to understand that their participation was optional and they would face no consequences for choosing to leave the study.

The Data Privacy Act currently protects student score information, which requires careful handling by school authorities. The study protects its 38 participants from potential stigma because it tracks their progress from "Poor" to "Outstanding" performance. The data was presented in a completely anonymous manner which prevents any name-based identification of individual scores. The study uses aggregate data reporting to protect student confidentiality while demonstrating the success of the intervention through its table results.

4. Findings

This portion contains the discussion and interpretation of results of the data gathered about the performance of grade 9 learners in Chemistry using 7E Instructional Model-Based Learning Activity Sheets.

Table 1: Performance of the students before the implementation of 7E Instructional Model-Based Learning Activity Sheets

Score Range	Frequency	Percentage	Description
17-20	0	0.00 percent (%)	Outstanding
13-16	0	0.00 percent (%)	Very Satisfactory
9-12	0	0.00 percent (%)	Satisfactory
5-8	16	42.11 percent (%)	Fair
0-4	22	57.89 percent (%)	Poor
TOTAL	N=38	100 percent (%)	

Table 1 summarized the scores of the students during the pretest. The data revealed a learning gap in Chemistry among 38 Grade 9 students of Bocboc East National High School before the introduction of 7E instructional model-based learning activity sheets. It can be gleaned from the table that over 99% of the students were performing below expected competency levels in Chemistry, pointing to difficulties in comprehension, lack of engagement, or ineffective traditional instructional strategies. The majority of the students scored a range of 0-4 which corresponds to 57.89% or 22 out of 38 students, while 42.22% or 16 out of 38 fell into the fair range. It is notable that no students reach the satisfactory, very satisfactory, or outstanding levels.

The data suggest that students fail to develop conceptual understanding prior to the implementation of the instructional model. This observation is rooted from a teaching approach that relied heavily on rote memorization and teacher-centered methods (Lawson, 2000). This aligns with findings by Bybee et al. (2006), who stated that the inadequacy in developing higher-order thinking skills in Chemistry was rooted from a passive learning strategy. Moreover, the under achievement of the students during pretest suggests an urgent need for reform in instructional strategies—one that shifts towards learner-centered, inquiry-based models like the 7E approach, which has been shown to foster active engagement and improved scientific literacy (Yılmaz & Morgil, 2015). According to Erinosho (2013), students have difficulty understanding specific topics in the curriculum that are usually characterized as lacking concrete examples and requiring a lot of analysis or visualizations. Therefore, there was really a need for designing activity sheets to help learners address least-learned competency which they need as they go to higher level.

These pretest findings, therefore, serve as both a diagnostic and a call to action to implement innovative, student-centered pedagogies in Chemistry instruction.

Table 2: Performance of the students after the implementation of 7E Instructional Model-Based Learning Activity Sheets

Score Range	Frequency	Percentage	Description
17-20	9	23.68 percent (%)	Outstanding
13-16	21	55.26 percent (%)	Very Satisfactory
9-12	4	10.53 percent (%)	Satisfactory
5-8	4	10.53 percent (%)	Fair
0-4	0	0.00 percent (%)	Poor
TOTAL	N=38	100 percent (%)	

Table 2 showed the summary of the test scores garnered by the students during a test after exposure to 7E Instructional Model-Based Learning Activity Sheets. The overall performance of 38 Grade 9 students in Chemistry revealed a major improvement after the implementation of the 7E Instructional Model-based learning activity sheets. A majority of students, 21 out of 38 (55.26%), achieved a "Very Satisfactory" rating with scores ranging from 13–16, while 9 students (23.68%) attained "Outstanding" performance (17–20). Only a small portion, 8 students (21.06%), fell within the “Satisfactory” and “Fair” ranges. Notably, no students scored in the "Poor" category (0–4), highlighting the intervention’s success in lifting all students above the lowest performance level. This distribution demonstrates that the majority of students met or exceeded expectations, validating the instructional effectiveness of the 7E instructional model-based learning activity sheets in Chemistry.

The activities in the 7E Instructional Model-Based Learning Activity Sheets were organized and were set to the level of understanding of the learners to master the competency that must be achieved in learning by playing an active role (Fatimah & Anggrisia, 2018). The high percentage of students in the “Very Satisfactory” and “Outstanding” categories reflects the positive impact of these phases, particularly in helping students apply scientific concepts. Yılmaz & Morgil (2015) further emphasized that the 7E model improves achievement by encouraging exploration and evaluation, which aligns with the results of this study.

Moving forward, consistent implementation and teacher training on 7E instructional model-based strategies are recommended to sustain and replicate these gains (Lawson, 2000; Gay, Mills, & Airasian, 2011). This approach not only enhances academic performance but also promotes lifelong scientific thinking skills.

Table 3: Comparison of the Test Scores of the Students before and after the implementation of 7E Instructional Model-Based Activity Sheets

	N	Mean	Standard Deviation	t-value	p-value
Pretest	38	4.32	1.56	-2.03	0.00 (5.22884E-19)
Posttest	38	14.37	3.35		

Table 3 showed the comparison of the test scores of 38 Grade 9 students who were assessed before and after the implementation of the 7E instructional model-based learning activity sheets. The pretest had a mean score of 4.32 (SD = 1.56), while the posttest mean significantly increased to 14.37 (SD = 3.35). This substantial gain in mean scores suggests a marked improvement in students' understanding of the Chemistry concepts taught during the intervention. The t-value of -2.03 and a p-value of 0.00 (5.22884E-19) statistically confirm that the increase in scores is highly significant.

The positive improvement from pretest to posttest aligns with existing literature that supports the 7E Model's impact on science learning (Bybee et al., 2006). In this study, the structured phases—Elicit, Engage, Explore, Explain, Elaborate, Evaluate, and Extend—helped learners build from prior knowledge and engage in deeper learning experiences. The 7E Instructional Model-Based learning activity sheets designed around these phases provided guided inquiry and concept reinforcement, contributing to the sharp rise in test scores. As referenced by Veloo, Krishnasamy, & Harun (2015), models like 7E enhance student motivation and comprehension when properly implemented.

The use of 7E Instructional Model-based activity sheets also significantly improved student engagement. During the "Explore" and "Elaborate" phases, students participated in hands-on activities that encouraged inquiry, collaboration, and peer discussion. These phases, coupled with the "Evaluate" and "Extend" stages, prompted learners to reflect and apply their knowledge in new contexts. Consistent with the findings of Yılmaz & Morgil (2015), such practices help students form meaningful connections with scientific concepts—reflected in the posttest mean increase of 10.05 points from the baseline.

The statistical data strongly support the hypothesis that the 7E Instructional Model-based Learning Activity Sheets has a positive effect on student learning outcomes. A p-value less than 0.05 typically indicates a statistically significant result; in this case, the p-value of 5.22884E-19 confirms a very strong level of significance. The large difference between the pretest and posttest means is not only statistically relevant but educationally meaningful as well (Gay, Mills, & Airasian, 2011). Such a result reinforces the reliability of using the 7E Instructional Model-Based Learning Activity Sheets in Chemistry instruction for Junior High school students.

In conclusion, the research findings affirm that the 7E Instructional Model-Based Learning Activity Sheets, when delivered through structured learning activity sheets, can significantly improve student performance in Chemistry. The statistically significant improvement in scores demonstrates the model's effectiveness in enhancing understanding and retention. Beyond the numbers, the strategy fostered active learning, critical thinking, and higher engagement. As educators reflect on instructional practices, adopting models such as 7E could lead to more effective science education and help bridge learning gaps among students.

5. Conclusion and Recommendations

Sheets in enhancing the Chemistry performance of Grade 9 learners at Bocboc East National High School. The research data shows that the inquiry-based method successfully closed all learning gaps which existed before the research began. The study started with most students at the "Poor" level but the final assessment showed every student had reached mastery while no one stayed in the failing category. The complete transition demonstrates that students achieve actual conceptual understanding when educational resources follow the Elicit, Engage, Explore, Explain, Elaborate, Evaluate, and Extend process.

The research results deliver essential real-world evidence which supports the ongoing academic discussion about science education practices in the Philippines especially regarding difficulties related to the spiral progression curriculum. The research shows that the 7E model acts as an effective educational instrument because it helps teachers solve "least-learned" competencies through its practical application in actual classroom environments. The study strengthens Constructivist Learning Theory through evidence which shows that students develop scientific literacy best when they engage in active learning activities that build their knowledge. The results of this study provide school administrators and practitioners with a proven framework which they can use to enhance National Achievement Test (NAT) and PISA results through the implementation of student-centered learning modules that include scaffolded support.

Science educators should implement the 7E model as their primary method for creating lesson plans and developing local learning materials according to the recommendations from this assessment. School administrators need to establish professional development programs which teach their instructors inquiry-based teaching techniques because this will help them maintain academic progress. The future research should examine how well people maintain these concepts through delayed posttests or through testing the model in difficult scientific disciplines such as Physics and Earth Science. The research study demonstrates how educational design transforms academic experiences by creating new pathways for students to reach their highest scientific achievement.

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