Enhancing Science Concept Mastery of Challenged Grade 7 Learners Through PISA-Inspired Lessons: An Action Research

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ABSTRACT

According to current PISA findings, Filipino students continue to perform poorly in science, which highlights the need for teaching strategies that improve conceptual comprehension and scientific reasoning. A group of Grade 7 challenged students at Dalipuga National High School continuously showed signs of struggling to grasp important science skills, especially when it came to deciphering diagrams, describing particle motion, and applying ideas to practical contexts. The usefulness of PISA-Inspired Lessons in enhancing the science concept understanding of ten purposefully chosen challenged learners was investigated in this action research.

The learners were administered a validated PISA-aligned pretest before the intervention and a parallel posttest following several weeks of training using a one-group pretest–posttest design. The Wilcoxon Signed-Rank Test was used to assess quantitative data.

The findings demonstrated that learners' competence levels had significantly improved, as seen by the median scores rising from 9 on the pretest to 15 on the posttest. Significant benefits ascribed to the intervention were demonstrated by the Wilcoxon test, which showed a statistically significant difference ($p = .005$) with a large effect size ($r = 0.63$).

Results indicate that by encouraging inquiry, contextualized reasoning, and conceptual clarity, PISA-Inspired Lessons successfully assist challenged learners. To improve low-performing students' grasp of science ideas, the study suggests including PISA-aligned tasks into science education.

Keywords: Matatag Curriculum, Science Mastery, Experimental Research, PISA-Inspired Lessons, and Global Competence.

INTRODUCTION

The results of the Programme for International Student Assessment (PISA) show that the Philippines still has serious problems with scientific education. Filipino students received a science score of 357 in the 2018 exam, which was below the OECD average and among the lowest in the world. Compared to the OECD average of 76% OECD+1, just 23% of students in 2022 achieved Level 2 or higher in science, indicating little development. This ongoing underperformance emphasizes the necessity of focused initiatives to improve Filipino students' science literacy. Filipino students' insufficient ability to evaluate and comprehend scientific data was demonstrated by their scores, which were much lower than the Organization for Economic Co-operation and Development (OECD) average, especially in the science category (DepEd, 2019; Cayubit, 2020; OECD, 2019). The necessity of educational reforms that enhance higher-order thinking and problem-solving skills is highlighted by this finding (Guzman, 2022; King-Dominguez, 2020).

Even though the updated Matatag Curriculum (K–12) places more emphasis on conceptual understanding and underlying knowledge, classroom activities frequently still revolve around memorization rather than the real-world application of scientific ideas. An item analysis of Grade 7 students conducted during the first quarter of SY 2024-2025 at the school level showed enduring deficiencies in skills like describing the Particle Model of Matter, elucidating the constant motion of particles, and utilizing diagrams to show particle arrangement and

movement in various states of matter. The dearth of educational resources inspired by PISA concepts and designed for grade-level learning exacerbates these inequalities. While current methods, such removing students from the classroom for PISA review sessions, may encourage practice, they run the risk of compromising students' understanding of critical curriculum competencies.

This study presents PISA-Inspired lessons as a pedagogical intervention intended to improve science concept comprehension through context-based, real-world scenarios in response to these difficulties. The intervention is based on the Knowledge Integration Framework (Liu, Lee, & Linn, 2011), which encourages linking concepts and assessing evidence from various sources, and Constructivist Learning Theory (Ormrod, 2020; Zimmerman, 2002), which stresses active knowledge construction and reflective thinking. Students can acquire important skills without being taken out of the classroom by integrating inquiry-based activities, real-world applications, and illustrations into regular science classes. The researcher is qualified to create and administer these materials because she is a certified PISA coach with expertise leading review sessions and developing interactive PowerPoint courses.

This study's main goal is to raise the science proficiency of seventh-grade students by using PISA-inspired instruction. It seeks to build abilities in line with international standards while enhancing comprehension and application of scientific topics. Strengthening core science literacy and preparing pupils for the Philippines' future PISA participation in three years are the two expected outcomes.

The goal of this study is to present empirical data regarding the efficacy of PISA-Inspired lessons in comparison to the Revised K–12 Curriculum's Matatag Exemplars. The results will help science instructors develop globally competent students who can think critically, solve problems, and contribute to the country's future PISA performance.

METHODOLOGY

Research Design

This study employed a classroom-based action research design using a one-group pretest–posttest approach. The design was appropriate for evaluating the effectiveness of a targeted instructional intervention among a specific group of challenged learners.

Participants and Locale

The participants consisted of ten Grade 7 challenged learners from Dalipuga National High School. These students were purposively selected based on their consistently low performance in science, persistent difficulties in conceptual understanding, and limited engagement in class activities. No comparison group was included, and the small sample size justified the use of non-parametric statistical analysis.

Research Instruments

The primary instruments were a PISA-aligned pretest and posttest, both validated by science teachers and subject matter experts. Test items focused on real-world contexts, data interpretation, diagram analysis, and scientific reasoning rather than factual recall.

Intervention Procedure

PISA-Inspired Lessons were implemented over several weeks during targeted intervention time. The lessons integrated contextualized problems, inquiry-based activities, and visual representations using teacher-developed PowerPoint presentations and activity sheets aligned with the Revised K–12 Curriculum.

Data Gathering Procedure

The pretest was administered prior to the intervention to establish baseline mastery levels. Following the intervention, a parallel posttest was given to measure changes in learners' science concept mastery.

Data Analysis

Descriptive statistics (median, interquartile range, minimum, and maximum scores) were used to summarize performance. The Wilcoxon Signed-Rank Test was employed to determine the significance of differences between pretest and posttest scores. Effect size (r) was calculated to assess the magnitude of the intervention's impact.

RESULTS AND DISCUSSION

The findings of this study provided strong evidence that the PISA-Inspired Lessons significantly enhanced the Science concept mastery of Grade 7 learners, while also presenting both challenges and opportunities in classroom implementation.

What were the median pretest and posttest scores of Grade 7 Science learners using the PISA-Inspired Lessons?

This table presents the descriptive statistics of the challenged learners' pretest and posttest scores after receiving PISA-Inspired Lessons.

Table 1. Descriptive Statistics of Pretest and Posttest Scores (n=10)

Test	Median	IQR	Min	Max
Pretest	9	3	5	12
Posttest	15	4	10	20

Significant progress was shown by the learners' median score, which increased from 9 to 15. The posttest's larger score range indicates that a number of students attained greater mastery. These findings are consistent with studies that demonstrate how inquiry-based, contextualized assignments help low-performing students grasp concepts (Liu et al., 2011).

After PISA-Inspired Lessons were implemented, learners' science performance clearly improved, as shown by the results in Table 1. Prior to the intervention, the students' median pretest score was 9, indicating a low level of comprehension of the science subjects evaluated in Grade 7. The minimum score of 5 and the narrow interquartile range (IQR = 3) further indicate that most students had trouble answering questions correctly and performed toward the bottom of the scoring range.

Following the intervention, there was a significant improvement of 6 points, with the posttest median rising to 15. This significant change in the median score shows that students had superior concept comprehension, reasoning, and scientific knowledge interpretation skills. Additionally, the posttest's broader IQR (IQR = 4) indicates that although most students did better, some achieved very high improvements, with scores as high as 20. This widening of the score range indicates diverse but significant growth, with multiple students reaching mastery levels not previously seen in the pretest.

The significant rise from the pretest to the posttest is consistent with research showing that inquiry-based, contextualized learning fosters deeper conceptual comprehension, particularly in low-performing students (Liu et al., 2011). PISA-Inspired Lessons, which prioritize problem-solving, data interpretation, and real-world application, seem to have given the struggling students organized and significant chances to comprehend and use scientific ideas. The findings show that these teaching strategies can be especially successful in raising the proficiency levels of students who have historically struggled with science.

Is there a significant difference between the pretest and posttest scores of learners taught using PISA-Inspired Lessons?

This table presents the Wilcoxon Signed-Rank Test used to determine whether the improvement from pretest to posttest was statistically significant.

Table 2. Wilcoxon Signed-Rank Test Results (Within Group Differences)

Comparison	Z-value	p-value	Interpretation	r
Pretest vs. Posttest	-2.81	.005	Significant improvement	0.63 (large)

To determine whether there was a statistically significant difference between the pretest and posttest scores, the Wilcoxon Signed-Rank Test was used. The Wilcoxon test was the best non-parametric substitute for a paired t-test because of the small sample size (n = 10) and the likelihood that the score distribution would satisfy normality assumptions.

The improvement in scores is statistically significant at the 0.05 level, according to the resulting Z-value of -2.81 and p-value of.005. This indicates that learners' development in science competence was significantly aided by the PISA-Inspired Lessons and that the observed increases were not the result of chance.

Additionally, the effect size (r = 0.63) is categorized as big, indicating that the intervention had a significant practical impact on students' performance. A substantial effect size in educational research indicates that the instructional technique was not only statistically beneficial but also resulted in significant and discernible improvements in the knowledge and abilities of the learners.

These outcomes are in line with worldwide research showing that PISA-style assignments improve students' capacity for data interpretation, information analysis, and application of conceptual knowledge in practical settings (Guzman, 2022; OECD, 2019). For challenged learners, who frequently need concrete settings and scaffolded reasoning chances to improve scientific literacy, the organized yet exploratory aspect of PISA-Inspired Lessons is especially helpful. The notable improvement in posttest results attests to the fact that this teaching strategy successfully met the academic requirements of underachievers.

Notable improvements in science mastery are indicated by the Wilcoxon results, which demonstrate a significant improvement (p =.005) with a substantial effect size (r = 0.63). This confirms research showing that PISA-inspired tasks improve conceptual understanding, reasoning, and analysis (Guzman, 2022; OECD, 2019).

The quantitative results consistently show that PISA-Inspired Lessons are effective across all analyses. In line with national and international demands for education that equips students for real-world scientific issues, the intervention enhanced both the degree of mastery and the caliber of learners' reasoning (Guzman, 2022; OECD, 2019; DepEd, 2019).

The considerable and statistically significant increase in median scores (Z = -2.81, p =.005) attests to the PISA-Inspired Lessons' efficacy in enhancing the challenged learners' comprehension of science concepts. The underperformance observed in PISA-like abilities is immediately addressed by this improvement. These results imply that using components found in PISA-aligned tasks, such as inquiry-based and contextualized reasoning, is a practical and successful method for helping challenged learners achieve deeper conceptual clarity. To improve overall mastery, it is advised that this method be incorporated into the standard science curriculum.

CONCLUSION

The findings of this action research demonstrate that PISA-Inspired Lessons significantly improved the science concept mastery of challenged Grade 7 learners. The integration of contextualized, inquiry-based tasks within intervention time proved effective in addressing persistent learning gaps. The statistically significant gains and

large effect size highlight the potential of PISA-aligned instructional strategies to support low-performing learners and strengthen scientific literacy.

RECOMMENDATIONS

It is recommended that science teachers integrate PISA-Inspired tasks into regular instruction to promote deeper conceptual understanding. School administrators may support professional development initiatives focused on PISA-aligned pedagogy. Future studies may involve larger samples or comparative groups to further validate the effectiveness of this instructional approach.

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