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The Students' Performance of Notre Dame of Cotabato in the Notre Dame Educational Association - Science Achievement Test: Basis for Improvement Plan

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Abstract

Aim: The study analyzed the performance of Notre Dame of Cotabato (NDC) on the NDEA Achievement Test - Science for grades 7 to 10 from 2015-2016 to 2018-2019. By studying the data, the school gained insights into student performance, which served as the basis for developing an improvement program or strategy.

Methodology: This is a descriptive-comparative study that highlighted how NDC fared on the NDEA Achievement Test-Science. It also examined its performance over a span of four school years and made a comparative assessment with other NDEA-member schools in the Cotabato Area. The data were analyzed descriptively and inferentially. The NDEA executive summary of the school was used to identify the contents which were least learned by the students.

Results: In Science 7, NDC performed well on the test from 2015-2016 to 2018-2019, with a 1.58% difference. There was a significant increase of 5.56% in Science 8 during 2017-2018, but it was slightly below the NDEA mean in 2018-2019. In Science 9, NDC students improved by 4.76% over the four years. Compared to the NDEA mean, NDC obtained the highest mean score in Science 10 (Mean=38.81 or 64.68%; SD= 8.88) during the SY 2017-2018. The least learned topics across Science 7 to 10 were Heredity, Waves, Electricity, Motion, Carbon Compounds, Climate, and Chemical Reactions.

Conclusion: NDC obtained significantly higher mean scores compared to the NDEA mean scores in Science 7, 9 and 10. The data also highlighted the least taught or learned lessons for each grade level, based on comparable mean scores and the lowest achieved mean scores among the topics per grade level, without necessarily being lower than the NDEA mean. An improvement plan was developed to improve students' performance on the NDEA Test in Science and their performance on any other examinations, whether teacher-made or standardized.

Keywords: Improvement Plan, Science Achievement Test, Student Performance

INTRODUCTION

International surveys, such as the 2003 Trends in International Mathematics and Science Study (TIMSS) conducted by the International Association for the Evaluation of Educational Achievement (IEA), revealed that the Philippines ranked near the bottom in both Mathematics and Science subjects, ranking 23rd out of 25 participating schools. Similarly, from the Philippine Education Sector Assessment Project prepared by the International Technology Management Corporation (INTEM) in July 2011, the country placed among the worst performers in East Asia and the rest of the globe in terms of basic education quality expectations. TIMSS and INTEM are both international assessments that provide information about students' conceptual understanding and skills in specific learning areas.

One of the primary goals of teaching and learning is to develop students' conceptual understanding (Edens & Shields, 2015) and skills. This goal, however, is sometimes hampered by the way students' learning is assessed. Academic achievement is a critical component of the educational process. It is reflected in the concepts acquired by students as measured by grading or quarterly assessments. It is considered as a major criterion for determining a person's full potential and capabilities. Although there is no definite way of measuring knowledge, a wide spectrum of processes, research-based tools, and mechanisms are used to assess learners' conceptual understanding.



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Learners acquire facts (declarative knowledge) that may or may not be integrated. With learning and experience, they can utilize these facts to solve issues more systematically (procedural knowledge); and eventually, they become independent and create skill-based behavior (skill tuning of procedural knowledge). Lee and Kirlik (2013) developed these three (3) stages of learning and retention. Learning improves performance (Lee & Kirlik, 2013), and the rate at which it occurs, the phases of learning, and how it can be transmitted.

The K-to-12 education system in the Philippines is still in its infancy, making it a constant challenge for educators to produce and look for appropriate materials and activities for effective and efficient learning to occur (Malto et al., 2018). Given the curriculum guide (CG), which was amended in May 2016, science curriculum is learner-centered and inquiry-based. It has an emphasis on giving evidence and explaining concepts and skills in Chemistry, Earth Sciences, Life Sciences, and Physics, with increasing levels of complexity at each grade level. Through a spiral progression, one can get a greater understanding of important concepts and a meaningful application of this knowledge to context (DepEd, 2012).

Filipino learners' low success levels are simply a reflection of the country's lowering quality of basic education. As a result, several schools have regarded it in a variety of assessments to measure students' performance. Generally, tests will not only provide solid support for a student's academic achievement but will also play a significant role in what happens to a student after school (Popham, 2003). Furthermore, test proponents argue that more frequent classroom testing encourages practice and review, providing students with more opportunity for feedback on their work (Krenn et al., 2013). At the same time, there has been a consistent emphasis on discovering emerging innovative student-centered pedagogy to improve academic performance according to Bizimana et al. (2022).

Locally, Notre Dame Schools make use of the Notre Dame Educational Association Achievement Test, or NDEA Achievement Test, to assess students' academic achievement. This form of achievement test is teacher-made, and the items are subjected to internal validity and reliability testing by specialists in the field. Thus, the study focused on analyzing the academic performance of Notre Dame of Cotabato in the NDEA Achievement Test - Science. The test results were examined for the academic years from 2015-2016 to 2018-2019. By studying the data, the school would be provided with valuable insights into how their students fared on the NDEA Science Test over the different school years. This information could help the school evaluate their teaching methods, curriculum, preparation, and overall educational approach and identify any patterns or trends in the test scores that could offer useful indicators of strengths and areas for improvement.

Research Questions

This study analyzed how well students at Notre Dame of Cotabato performed on the NDEA Achievement Test in Science from S.Y. 2015-2016 to S.Y. 2018-2019 and suggested ways to improve student scores. Specifically, it sought to provide answers to the following questions:

1. How do the Notre Dame of Cotabato students fare on the NDEA Achievement Test in Science from S.Y. 2015-2016 to S.Y. 2018-2019?
2. What is the performance of Notre Dame of Cotabato in the NDEA Test in Science compared to other NDEA-member schools in the Cotabato Area?
3. Based on the obtained mean scores, which learning areas/topics are the least learned by students per grade level?
4. What improvement plan may be derived from the NDEA Test in Science results?

Hypothesis

The following hypotheses were set at 0.05 level of significance:

- H_{a1}: Notre Dame of Cotabato (NDC) has a significantly higher mean score than the NDEA mean in Science 7 from S.Y. 2015-2016 to S.Y. 2018-2019.
- H_{a2}: Notre Dame of Cotabato (NDC) has a significantly higher mean score than the NDEA mean in Science 8 from S.Y. 2015-2016 to S.Y. 2018-2019.
- H_{a3}: Notre Dame of Cotabato (NDC) has a significantly higher mean score than the NDEA mean in Science 9 from S.Y. 2015-2016 to S.Y. 2018-2019.
- H_{a4}: Notre Dame of Cotabato (NDC) has a significantly higher mean score than the NDEA mean in Science 10 from S.Y. 2015-2016 to S.Y. 2018-2019.



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METHODS

Research Design

This is a descriptive-comparative study that highlighted how NDC fared on the NDEA Achievement Test-Science. It also examined its performance over a span of four school years and made a comparative assessment with other NDEA-member schools in the Cotabato Area.

Locale of the Study

The locale of the study is a private Catholic high school in the Bangsamoro Autonomous Region in Muslim Mindanao (BARMM). It is the country's first Marist school and the only Marist school in Cotabato City. Notre Dame of Cotabato (NDC) is an educational institution owned and run by the Marist Brothers and has been in operation since 1948. It is one of the Notre Dame Educational Association (NDEA)-member schools and an affiliate of the Catholic Educational Association of the Philippines (CEAP). NDC is a Level III accredited secondary school by the Philippine Accrediting Association of Schools, Colleges, and Universities (PAASCU). Level III status is the highest level of accreditation for basic education program given by the PAASCU, which means the school upholds a certain level of academic quality. It is also certified by the Private Education Assistance Committee (PEAC), a DepEd-contracted body that monitors schools' adherence to DepEd standards, policies, and regulations. It has a student population of around 2,000 and offers day and afternoon shift classes in Junior and Senior High School.

Data Collection

Prior to conducting the study, the researcher sought permission by sending a communication letter to the academic head of the school. This step was taken to ensure that it is with the knowledge and approval of the relevant authorities within the school. The data used for the analysis was obtained solely from the NDEA main office. The guidance and testing center then forwarded these data to the office of the principal. Since only the existing data were acquired and reviewed with the highest confidentiality to develop a valid improvement plan, there was no need to develop any data gathering instrument or tool. Thus, only unobtrusive data were utilized, the researcher worked with data that were only available for analysis and no participants were directly involved in the study. The importance of data privacy was recognized and strict compliance with privacy regulations was ensured. Safeguarding the confidentiality of the data was a priority, and appropriate measures were taken to protect the personal information of individuals and maintain the privacy of the students whose test scores were being studied and reported in aggregate.

Treatment of Data

The obtained mean scores were submitted to group distribution to determine the overall mean (μ) and standard deviation (σ). The researchers used a scale of descriptive equivalents of scores in % to observe parity in the change of the number of items in each subject area to further analyze the data. Graphs were used to supplement data analysis by presenting a peek of comparisons or patterns to improve the interpretation of results. To compare the different means to the NDEA means, t-test (for independent/unpaired samples) was utilized. To identify the least learned topics or concepts, the researchers relied on the NDEA executive summary of the school. This summary provided an overview of the obtained mean score of the subject comparable to the NDEA mean score and the lowest achieved mean score from among the topics per grade level. By examining these scores in aggregate, the researcher could find the areas or competencies where students performed relatively poorly. These areas may require additional attention and improvement in the school's teaching and learning strategies and are pivotal in making the improvement plan.



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RESULTS and DISCUSSION

Trend of the Performance of NDC on the NDEA Test- Science

Figure 1 and Table 1 show how NDC students and other students from NDEA schools performed on the Science 7 Test. NDC performed better from SY 2015-2016 to SY 2018-2019, with a 1.58% difference (Mean=23.37 or 38.95%; SD=5.53). It also increased at a 0.5% from school 2017-2018 to 2018-2019. Because some grade 7 students, particularly those from non-private schools, experienced NDEA tests for the first time, students' readiness (Snow, 1991) and test preparedness can influence achievement test performance. As a result, the rigid review conducted by the school at their level may have an impact on their performance. Table 3 on the other hand reveals the least learned contents in Science 7 from the four (4) school years, which are Heredity: Inheritance and Variation (0.56), Waves, Sounds, and Lights (3.05), Electricity (1.04), and Diversity of Materials in the Environment (2.17). The emphasis of science education has shifted from memorization to in-depth understanding of core scientific concepts such as matter-energy relationships (Uhl et al., 2021). High school students frequently struggle with conceptual understanding when studying the topics Inheritance and Variation, as well as physics concepts such as Electricity, Motion, Sound, and Light Waves citing Achor et al. (2022). In addition, some essential concepts in biology that students tend to find difficult to study are basic genetics concepts (Myers et al., 2014).

Figure 1

Performance of NDC compared to other NDEA Member Schools in Science 7

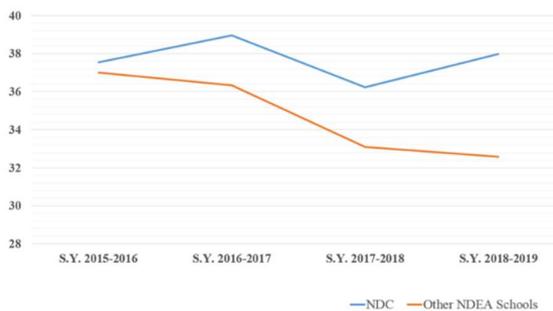


Figure 2

Performance of NDC compared to other NDEA Member Schools in Science 8

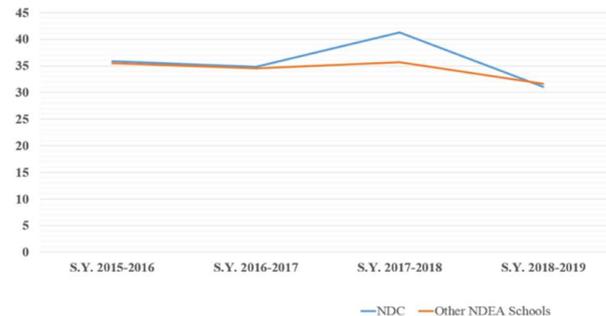


Figure 2 and Table 1 show how NDC performed on the Science 8 Test in comparison to other NDEA member schools. During the SY 2017-2018, a huge leap of 5.56% difference was recorded for Notre Dame of Cotabato (Mean=24.77 or 41.28%; SD= 6.86). However, the school performed 0.57% below the NDEA mean during the SY 2018-2019. Low achievement test performance may reveal areas where students need assistance academically (Darling-Hammond, 2017). According to Cohen et al. (2009), low test scores may prompt interventions and reforms aimed at improving educational outcomes. Heredity: Inheritance and Variation (1.12); Work, Power, and Energy (1.92); Electricity (1.31) and Laws of Motion (1.48) are the least mastered contents in Science 8 from the four given school years, as detailed in Table 3. This was also found in the study by Achor et al. (2022), which reported that learners find physics topics such as Work, Power and Energy, and Motion difficult.

Furthermore, Figure 3 and Table 1 compare NDC's performance in Science 9 to that of other NDEA member schools. NDC performance was better by mean scores, with an average of 4.76 percent over the four (4) school years. From SY 2017-2018 to SY 2018-2019, there was however a decrement in the performance of NDC (Mean= 26.70 or 44.50%; SD= 5.18) as well as other NDEA member schools (Mean= 23.49 or 39.15%; SD= 7.85). Compared to previous school years, NDC's performance increased during the SY 2016-2017 (Mean= 29.54 or 49.23%; SD= 5.84). Prior knowledge and skills acquired by students in previous grades could have contributed to their performance in subsequent grade levels and this might have improved their achievement test scores (National Research Council, 2000), and could explain their test performance. Likewise, Table 3 shows that the least learned contents in Science 9, which include Variety of Carbon Compounds (1.34, 2.61, and 1.73) and Climate and Constellations (1.75). Chemistry may be



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viewed as a difficult, dry, and uninteresting science subject. This is most likely due to the traditional teaching method, lack of interaction, and challenges in visualizing abstract chemical concepts such as Carbon Compound Varieties from the study of Hsiung (2018). Climate and constellations are not necessarily difficult topics for all students to study, but some may find them not easy too due to the intertwining and overlapping nature of these concepts. Students may struggle with climate because it involves understanding complex interactions between the environment, water systems, and land areas.

Figure 3

Performance of NDC compared to other NDEA Member Schools in Science 9

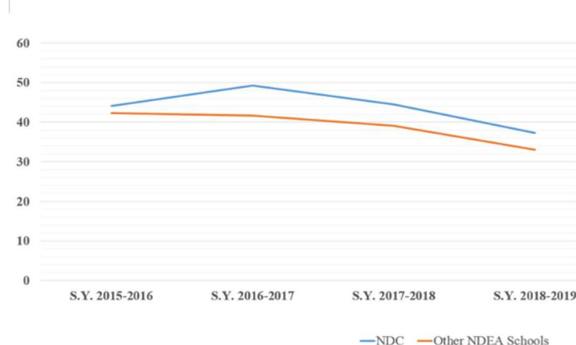


Figure 4

Performance of NDC compared to other NDEA Member Schools in Science 10



Figure 4 and Table 1 reveal the performance of NDC in Science 10 when compared to other NDEA member schools. It showed a positive increase in mean scores of NDC during the SY 2017-2018 (Mean=38.81 or 64.68%; SD= 8.88) compared to NDEA, which obtained a mean score of 27.02 or 45.03% and an SD of 8.69. On the same school year, NDC had the highest mean in Science 10 in the NDEA Science Test. Their performance may be attributed to effective teaching practices such as prepared instruction, active learning, and feedback, all of which resulted in higher student achievement test results (Carter, 2009). Further, Table 3 lists the contents on which students scored the lowest on the test, which are Heredity/Biodiversity and Evolution/Ecosystem (2.08, 3.66, and 1.38, respectively); Light (3.01); and Chemical reactions (1.77). According to Hsiung (2018), chemistry topics such as Formula Naming and Writing, and Balancing Chemical Reactions may be hard for students, especially if they lack the basic understanding and prerequisite competencies of the concepts from the previous grade level.

Table 1 shows the mean scores of the school (NDC), alongside the NDEA mean scores. They are presented per grade level and each school year. Because the NDEA Achievement Test is not yet available for administration in the Senior High School program, data is only available up to grade 10. Due to the pandemic, there was also no NDEA test administration from SY 2020-2021 to SY 2022-2023. It reveals that only the acquired mean scores in Science 8 of NDC students have non-significant difference from that of the mean score of the NDEA member schools ($P=0.2643$). However, the obtained mean scores of the school in Science 7, 9, and 10 differ significantly from the NDEA mean ($P=0.0187$, 0.0384 , and 0.0192 , respectively). These therefore show that NDC students performed well on the NDEA Test in Science from 2015- 2016 to 2018-2019.

Moreover, Table 2 provides the trend of NDC performance on the NDEA Achievement Test in Science. The mean scores and percentages attained across grade levels were included. Similarly, Figure 5 draws a review of the performance of three (3) batches of students who took the examination. Batch A consists of grade 10 students who were in Grade 7 during the school year 2015-2016; Batch B students were in Grade 7 during the school year 2016-2017; and Batch C students are in Grade 7 during the school year 2017- 2018. It could be observed that there was a decrement of test performance across grade level in every batch, which has to be addressed and considered in the improvement plan.



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Table 1

Comparison of the NDEA Achievement Test Results

Grade Level		2015-2016		2016-2017		2017-2018		2018-2019		p	t
		School	NDEA	School	NDEA	School	NDEA	School	NDEA		
7	μ	22.52	22.20	23.37	21.79	21.73	19.85	22.79	19.55	0.0187	2.308*
	σ	6.07	6.89	5.53	6.22	5.81	6.14	7.04	6.34		
8	μ	21.52	21.32	20.88	20.74	24.77	21.43	18.63	18.97	0.2643	0.656 n.s.
	σ	5.31	6.45	5.29	6.09	5.18	6.86	5.10	5.82		
9	μ	26.50	25.36	29.54	25.01	26.70	23.49	22.40	19.47	0.0384	1.915*
	σ	7.69	7.95	5.84	7.52	5.80	7.85	4.97	5.19		
10	μ	29.00	25.17	34.02	26.66	38.81	27.02	22.87	20.53	0.0192	2.414*
	σ	7.21	7.77	7.49	8.33	8.88	8.69	4.86	5.59		

Note: μ .- Mean σ .- Standard Deviation n.s.- non-significant *.- significant at 0.05

Table 2

Summary of NDEA Results of NDC on the NDEA Achievement Test

S.Y.	2015-16		2016-17		2017-18		2018-19	
	Mean	%	Mean	%	Mean	%	Mean	%
7	22.52	37.53	23.37	38.95	21.73	36.22	22.79	37.98
8	21.52	35.87	20.88	34.80	24.77	41.28	18.63	31.05
9	26.50	44.17	29.54	49.23	26.70	44.50	22.40	37.33
10	29.00	48.33	34.02	56.70	38.81	64.68	22.87	38.12

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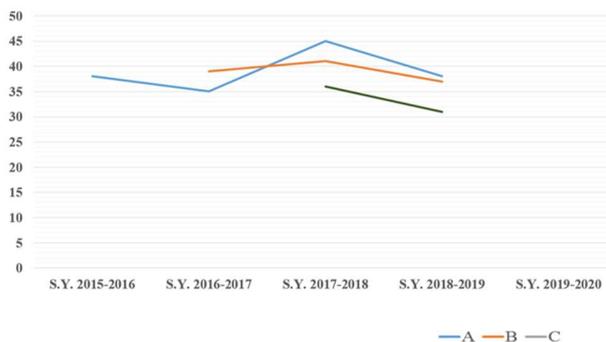
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Figure 5

Trend of Performance by Batch



Least Learned Contents of NDC Students in the NDEA Achievement Test

Table 3 highlights the content standards based on the curriculum guide that must be considered in instructional preparation for each grade level. They are regarded the least taught or learned lessons based on two (2) conditions: (1) the obtained mean score of that subject is comparable to the NDEA mean score; and (2) it is the lowest achieved mean score from among the topics per grade level (but not exclusively lower than the NDEA mean). These topics therefore must be given attention during the instruction and review sessions.

Table 3

Least Learned Contents across grade level in Science

Grade	7	8	9	10
2015-2016	reproduction being both asexual or sexual waves as carriers of energy; the characteristics of sound and light	how cells divide to produce new cells; meiosis as one of the processes producing genetic variations of the Mendelian Pattern of Inheritance current- voltage- resistance relationship, electric power, electric energy, and home circuitry the propagation of sound through solid, liquid, and gas; some properties and characteristics of visible light; heat and temperature, and the effects of heat on the body	the type of bonds that carbon forms that result in the diversity of carbon compounds factors that affect climate, and the effects of changing climate and how to adapt accordingly; the relationship between the visible constellations in the sky and Earth's position along its orbit	how evolution through natural selection can result in biodiversity

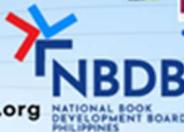


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Grade	7	8	9	10
2016-2017	waves as carriers of energy; the characteristics of sound and light	work using constant force, power, gravitational potential energy, kinetic energy, and elastic potential energy the propagation of sound through solid, liquid, and gas; some properties and characteristics of visible light; heat and temperature, and the effects of heat on the body current- voltage- resistance relationship, electric power, electric energy, and home circuitry	factors that affect climate, and the effects of changing climate and how to adapt accordingly; the relationship between the visible constellations in the sky and Earth's position along its orbit	how evolution through natural selection can result in biodiversity; the influence of biodiversity on the stability of ecosystems; an ecosystem as being capable of supporting a limited number of organisms
2017-2018	charges and the different charging processes	current- voltage- resistance relationship, electric power, electric energy, and home circuitry	the type of bonds that carbon forms that result in the diversity of carbon compounds	the images formed by the different types of mirrors and lenses
2018-2019	organisms interacting with each other and with their environment to survive	Newton's three laws of motion and uniform circular motion the propagation of sound through solid, liquid, and gas; some properties and characteristics of visible light; heat and temperature, and the effects of heat on the body	the type of bonds that carbon forms that result in the diversity of carbon compounds	the information stored in DNA as being used to make proteins; how changes in a DNA molecule may cause changes in its product; mutations that occur in sex cells as being heritable; how evolution through natural selection can result in biodiversity the chemical reactions associated with biological and industrial processes affecting life and the environment



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Improvement Plan

The proposed improvement plan includes the challenges and issues that may have been observed and could explain the test performance of students. This also covered the success indicator, the strategic mechanisms for addressing the corresponding challenge, the time frame, and the individuals or groups directly and indirectly involved.

Table 4

Improvement Plan

Problems/ Issues	Target/ Indicator of Success	Strategies or Activities	Time Frame	Focal Persons/ Office	
Low Performance in Science	Improved scores by 5%- 10%	Instruction in a mixed classroom focused on discipline	Entire School year	Science Department Coordinator	
		Remedial classes that can be completed at one's own time (self-pacing and/or asynchronous)		Science Teachers	
		Giving priority to genuine face-to- face consultation sessions		Advisers	
Continuous downhill of scores	Improving scores over time	Teachers receive consistent curriculum and pedagogical training	Entire School year	Principal	
		Localized and simplified instructional planning		Science Department Coordinator	
				Science Teachers	
Online Review Program for Least Learned Contents	Improved review and actual test scores	Intensified development of review materials for least learned content in Science	Entire School year	Principal	
		Effective use of social media networks as learning platforms		Science Department Coordinator	
	Merit System	Development of Teacher-made discussion videos	A school-based merit or reward system for top-performing students, subject teachers and department		Science Teachers
			Use of Inverted Learning Approach (online flipping)		Parents/ Guardians
			Subscription to a Learning Management System (LMS)		



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Summary, Conclusions, and Recommendations

From SY 2015-2016 to SY 2018-2019, Notre Dame of Cotabato (NDC) students fared well on the NDEA Achievement Test in Science. Despite a decrease or decline in scores in some subjects and/or grade levels, the school was able to achieve significantly higher science mean scores than the NDEA mean. Only the mean scores in Science 7, 9, and 10 of NDC students showed a significant difference from the mean scores of NDEA-member schools in the Cotabato Area. The least learned topics from Science 7 to 10 include Heredity: Inheritance and Variation, Waves, Sounds and Lights, Electricity, Work, Power and Energy, Motion, Variety of Carbon Compounds, Climate and Constellations, and Chemical reactions. An improvement program is hereby proposed to improve students' performance (scores) on the NDEA Test in Science and their performance on any other examinations, whether teacher-made or standardized. This program also addresses the continual decline in test scores and recommends an online or virtual platform or modality to assist students in coping with the new normal. It is suggested that NDEA Achievement Test will be administered to the Senior High School program to monitor or trace how well students do in the next rung of their academic ladder. The use of relevant and up-to-date assessment strategies to capture academic achievement of students should also be considered. The implementation of innovative instructional pedagogy such as the flipped or inverted learning may be highly encouraged as well to address congestion of the competencies in the curriculum guide and to cater the different types of learning needs among students. Lastly, the proposed Improvement Plan will be considered for evidence-based planning or research-oriented decision-making.

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