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# Stem Science Teachers' Classroom Observation Performance And Students' Academic Achievement

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*Abstract*

The primary objective of this research endeavor was to scrutinize the impact of classroom observation performance exhibited by STEM Science teachers on the academic accomplishments of their students. Employing a mixed-method design, the study comprised two distinct phases. During the quantitative phase, a purposive sampling technique was utilized to collect responses from 107 teachers within the seven divisions falling under Region VII (Central Visayas), Philippines. The subsequent phase encompassed a Focus Group Discussion (FGD). The analytical framework encompassed statistical measures such as percentages, means, weighted means ($w\bar{x}$), and linear regression analysis. The findings from the quantitative analysis suggested that the Classroom Observation (CO) performance exhibited by Science teachers displayed limited predictive efficacy concerning students' academic achievements. However, the qualitative insights harmonized with the quantitative outcomes, offering supplementary corroboration. Furthermore, the FGD conducted as part of the study divulged a significant factor within the research's purview: the restricted interaction between educators and students stemming from the pandemic-induced circumstances during the covered academic year.

Keywords: Teaching Performance, Qualitative Research, Quantitative Research, Students' Academic Achievement, Classroom Observation Tool, Classroom Observation, Philippine Professional Standards for Teachers, Focus Group Discussion.

**Introduction**

Globally, science education faces challenges due to the scarcity of qualified STEM teachers, impacting access to high-quality education, including in the United States.

In the Philippines, the "Enhanced Basic Education Act of 2013" (Republic Act 10533) extended high school (SHS) by two years, offering academic and vocational paths, including the Science, Technology, Engineering, and Mathematics (STEM) track. This highlights the government's commitment to enhancing science education and nurturing students' skills in STEM disciplines.

The recent implementation of Senior High School (SHS) and the introduction of the Philippine Professional Standards for Teachers (PPST) address science education challenges in the country. The PPST incorporates the Classroom Observation Tool (COT), fostering lifelong competence among teachers with standardized criteria for evaluating performance and emphasizing student-centered instruction.

The adoption of the PPST, along with the mandatory COT implementation, demonstrates the Department of Education's

dedication to elevating teaching standards, led by Secretary Leonor M. Briones. It reflects the system's commitment to providing quality education to all learners in the Philippines, promoting professional development, and fostering accountability for the benefit of students and the education system.

Overall, integrating the COT within the PPST framework enhances education quality, promoting effective teaching practices and benefiting the education system as a whole.

Despite existing research on science teachers' management of PPST and STEM education, there remains a research gap in connecting COT to STEM instruction, particularly in light of the significant changes brought about by the pandemic. Further exploration of this connection would be valuable for enhancing science education.

As outlined by Dizon et al. (2018), the utilization of appraisal systems and performance management has gained paramount significance in aiding organizations to attain their productivity objectives. These systems furnish a structured framework for assessing employee performance while also offering guidance for professional development. Within the domain of education, Hamilton (2017) underscored the noteworthy correlation between teachers' efficacy and their approach to managing classroom dynamics. The author emphasized those proficient responses from teachers, characterized by sensitivity and self-discipline, in addressing disruptive students, can lead to enhanced student responses and teacher performance.

The study executed by Kagema and Irungu (2018) further supports the influence of teacher evaluations on teacher performance. The outcomes of their investigation revealed that teachers perceived governmental regulations as unfavorable concerning both career progression and policy implementation. This implies that external factors and imposed regulations on teachers could exert an impact on their motivational levels and overall performance. Coe, Aloisi, Higgins, and Major (2014) assert that highly effective teachers possess a deep understanding of the subjects they teach, while those lacking this knowledge face challenges in supporting student learning. Therefore, developing pedagogical content knowledge, which involves delivering content to students to expand their understanding, is of utmost importance (Chick; Shulman as cited in Hine, 2015).

In the classroom setting, teachers are responsible for imparting teachings or content to students, who then process the information and provide their responses or reactions (Roldan, 2015). Effective classroom communication techniques play a vital role in facilitating successful teaching and learning experiences by ensuring the effective delivery of subject matter to students, benefiting both teachers and students alike.

Wilujeng and Hastuti (2019) assert that Science teachers in particular need to have excellent ability in terms of effective learning strategies for the students—considering that many learners express difficulty dealing with this subject. This is in order to satisfy the respondents of this study who are the STEM Science teachers.

A study by van Middelkoop, Ballafkih, and Meerman (2017) revealed that approximately 40% of teachers rejected the notion that student diversity affects academic performance, and thus did not account for diversity in their teaching methods. They believed that

issues related to groups of students' academic achievement should be handled by the students, educational institutions, or society as a whole, rather than by teachers themselves. However, the authors also noted that such beliefs did not always translate into actual teaching practices because some teachers lacked the necessary skills, knowledge, or time to do so. It appeared that teachers were more likely to incorporate diversity into their teaching when certain conditions were present.

Empirical support provided by Mahande, R. D., Malago, J. D., Abdal, N. M., & Yasdin, Y. (2022) underscores that students' performance is influenced by their attitude, anxiety, and motivation during web-based learning in the context of the COVID-19 pandemic.

Aligned with the principles of Outcome-Based Education (OBE), which encompass clarity of focus, design down, high expectations, and expanded opportunities, the outcomes derived from this study carry substantial validity. It is posited that if students fail to acquire knowledge, the deficiency is not necessarily attributable to ineffective teaching methodologies; instead, it might stem from their lack of requisite skills, absence of inspiration, cultural differences, or other non-academic factors, which instructors are not obliged to address (Biggs & Tang, 2011).

Furthermore, the true essence of achievement in the realm of teaching is derived from the fulfillment of tasks and the attainment of elevated benchmarks. When a task can be accomplished by anyone with ease, its significance diminishes. This facet can serve as a pivotal motivator for educators. The landscape of education is permeated with challenges, and parents and the wider community harbor elevated expectations for their ethnically diverse progeny (Schwahn, C. & Spady, W., 2010). As underscored by Killen (2000), as cited in Ghandi (2012), the provision of a flexible approach encompassing timeframes and instructional strategies tailored to the learner's requirements, coupled with multiple avenues for achievement, is imperative. The role of the teacher necessitates affording students numerous opportunities to manifest their learning, encompassing a range of methodologies.

Moreover, according to Biggs and Tang (2011), pivotal strategies for enhancing teaching encompass: (1) recognizing that effective teaching emerges not solely from individual prowess but is equally molded by institutional structures. It is imperative for institutions to institute policies and protocols that (1) pivot the emphasis from the teacher to the learner and (2) delineate the intended learning outcomes for students when educators cover their designated subjects. The adoption of these two approaches can substantially ameliorate teachers' dispositions toward fostering a successful teaching-learning milieu. This study aimed to investigate if the STEM Science teachers' classroom performance significantly predicts the students' academic achievements.

Specifically, the study sought to answer the following questions:

1. What is the teaching performance of the STEM Science teachers in terms of the S.Y. 2021-2022 Classroom Observation Tool (COT)?

2. What is the students' academic performance in Science for S.Y. 2021-2022?

3. To what extent does teachers' COT performance predict/influence students' performance?

**Methodology**

The study used both quantitative and qualitative approaches. In the first step, the gathering of data relative to STEM Science teachers' classroom observation performance and the students' academic achievement was done. Patterns have been examined and if one variable could predict another. While in the second phase, the researcher conducted a Focus Group Discussion to validate the result of the quantitative data.

This method synergistically combined various forms of information to enhance overall comprehension. Quantitative data substantiated findings, while qualitative interviews provided profound insights into the underlying causative factors.

Data collection was executed through a multifaceted approach, accommodating digital and traditional preferences. Participants were allowed to complete forms either online or on paper, the latter being enclosed in envelopes to ensure confidentiality. Precise directives were provided to ensure clarity, and avenues for clarification were readily available through text, phone, email, and online communication channels. Upon completion by each school's participants, the responses were securely collected and stored to safeguard privacy. The collected information was subsequently comprehensively reviewed and analyzed. Furthermore, stringent adherence to COVID-19 safety protocols was maintained throughout the entire process, prioritizing the health and well-being of all involved parties.

**Results and Discussion**

Following an in-depth examination of the study, the researcher formulated the subsequent discoveries:

1. Teaching Performance of STEM Science Teachers in Classroom Observation

| **Rating** | **Level Name** | **1st Semester** | | **2nd Semester** | |
|---|---|---|---|---|---|
| | | **f** | **(%)** | **f** | **(%)** |
| 3.00 – 3.59 | Organizing | 0 | 0.00 | 0 | 0 |
| 3.60 – 4.59 | Developing | 25 | 23.37 | 22 | 20.56 |
| 4.60 – 5.59 | Applying | 14 | 13.08 | 13 | 12.15 |
| 5.61 – 6.59 | Consolidating | 40 | 37.38 | 44 | 41.12 |
| 6.60 – 7.00 | Integrating | 28 | 26.17 | 28 | 26.17 |
| Total | | 107 | 100.00 | 107 | 100.00 |
| | | | | | |
| Mean | | **5.71 (Consolidating)** | | **5.76 (Consolidating)** | |
| sd | | 1.03 | | 1.01 | |

The table above provides an insightful breakdown of STEM Science Teachers across different levels of proficiency. The analysis of the table reveals distinct patterns and proportions within each level, shedding light on the pedagogical approaches employed by these teachers and their impact on student development.

The "consolidating" level stands out with the highest percentage of STEM Science Teachers at 41.12%, surpassing other levels. This finding suggests that teachers at this level consistently employ well-connected pedagogical aspects that align with student

development. By utilizing these effective strategies, they provide valuable support to their students, enabling them to become successful learners. The significant representation of teachers at the consolidating level indicates a strong commitment to utilizing pedagogical practices that foster positive educational outcomes.

Following the consolidating level, the "integrating" stage comprises 26.17% of STEM Science Teachers. Educators at this level demonstrate the use of interrelated pedagogical components associated with the indicator under consideration. By establishing a conducive learning environment, they cater to the diverse learning objectives of both individuals and groups. The presence of a substantial proportion of teachers at the integrating level underscores their ability to create an inclusive setting that promotes holistic student growth.

In the "developing" level, which encompasses 20.56% or 22 teachers, educators exhibit a range of pedagogical aspects associated with the indicator. Although their proficiency may not be as comprehensive as that of teachers at the consolidating level, they demonstrate efforts to incorporate teaching methods that occasionally align with the developmental requirements of their students. This indicates a positive trajectory towards further refinement and advancement in their pedagogical practices.

Interestingly, only a small proportion of 12.15% of participants were classified as exhibiting an "applying" level of proficiency. This finding suggests that these teachers displayed a variety of correlated pedagogical factors that typically correspond with the developmental requirements of the learners. While their representation is relatively low, their pedagogical approaches demonstrate a deeper understanding of how to effectively address student needs and support their overall growth.

When relating it to the result of the interview, 14/15 of the chosen respondents answered the question relative to the STEM Science teachers' view of the connection between their Classroom Observation Tool (COT) performance and the desired learning outcomes in the school year 2021-2022. Out of 14 responses, 10 of them said that the COT was done without the presence of the students. This suggests that teachers may feel that the current assessment process does not adequately capture the true impact of their teaching on student learning outcomes. It highlights a potential misalignment between the evaluation method (COT) and the desired learning outcomes, emphasizing the need for further examination and potential adjustments in the assessment approach.

2. Students' Academic Performance in Science

| | | **1st Semester** | | **2nd Semester** | |
|---|---|---|---|---|---|
| **Rating** | **Verbal Description** | **f** | **%** | **f** | **%** |
| 90% - 99% | Outstanding | 81 | 75.70 | 87 | 81.31 |
| 85% - 89% | Very Satisfactory | 24 | 22.43 | 19 | 17.76 |
| 80% - 84% | Satisfactory | 2 | 1.87 | 1 | 0.93 |
| Total | | 107 | 100.00 | 107 | 100.00 |
| **Mean** | | **91.26 (Outstanding)** | | **91.94 (Outstanding)** | |
| sd | | 3.13 | | 3.22 | |

The table shows the distribution of student performance in the field of Science across different proficiency levels. The table

provides valuable insights into the proportions of students achieving various levels of proficiency.

According to the data presented, a significant proportion of students, specifically 75.70% in the first semester and 81.31% overall, were classified as "outstanding." This indicates that the majority of students demonstrated exceptional proficiency in the field of Science. Their performance surpassed expectations and showcased their advanced understanding and skills in the subject matter.

In the initial semester, 22.43% of students received a rating of "very satisfactory." This proportion slightly decreased to 17.76% in the subsequent semester. These results indicate that a moderate level of achievement was observed among the students. While not reaching the same exceptional standards as the "outstanding" category, these students still demonstrated satisfactory competence and understanding of the subject matter.

Overall, Table 4 highlights the high level of performance among the students in Science, with a significant majority classified as "outstanding." The remaining students achieved a satisfactory level of proficiency, albeit not reaching the same exceptional standards as the top performers. This data provides valuable information about the distribution of student performance and proficiency levels in the field of Science.

To gain further insights into this study, the respondents of the interviews were questioned about their methods of assessing students' academic performance in Science. The findings indicate that a significant majority, 75% (11/15) of the respondents, based students' grades on modules or written outputs. Additionally, two (2) respondents mentioned the implementation of recorded videos and research projects as part of the assessment process.

The implication of these findings is that the assessment methods used by the teachers in this study predominantly revolved around written outputs and modules. This suggests a reliance on traditional forms of assessment that primarily focus on knowledge recall and written work. However, the inclusion of recorded videos and research projects indicates a recognition of the importance of alternative assessment methods that promote creativity, critical thinking, and practical application of knowledge.

These findings highlight the need for further exploration and consideration of diversified assessment approaches to provide a more comprehensive evaluation of students' academic performance in Science. Incorporating a variety of assessment methods can foster a more holistic understanding of students' abilities, skills, and knowledge in the subject area.

During the research focus group discussion, 87% of the participants (13/15) stated that a grade requirement of not less than 85% in Math and Science subjects is used to select STEM students. Two respondents mentioned following a specific DepEd Order (DO 55, s.2016) for the selection process. These findings indicate that academic performance, particularly high grades in Math and Science, is a key criterion for admission into STEM programs. Additionally, the mention of a DepEd Order suggests the influence of educational policies in ensuring fairness and consistency across institutions. Overall, academic achievement and adherence to educational policies shape the criteria for selecting STEM students, underscoring their significance in determining eligibility for STEM programs.

3. STEM Science Teachers' COT Performance and Students' Academic Performance

The data show that the students' academic achievement can be predicted by teachers' CO performance with 1.07% certainty. It implies a relatively weak predictive relationship between teachers' COT performance and students' academic performance. This means that while there may be some connection between the two variables, the predictive power of teachers' COT performance alone is limited and explains only a small portion of the overall variance in students' academic outcomes. Other factors not captured by the COT or variables beyond teachers' performance are likely to have a more significant influence on students' academic performance.

It's important to note that interpreting the statement in context requires a deeper understanding of the methodology, data, and statistical analysis used to arrive at the stated certainty percentage. Additionally, the specific definition and measurement of both teachers' COT performance and students' academic performance may also impact the validity and generalizability of the statement.

The data analysis of the interview results further corroborated the quantitative findings. A significant majority (79%) of the interviewees emphasized that COT performance alone cannot predict students' grades due to the multitude of factors involved. Through comprehensive analysis, the study identified several influential factors on academic performance, including teacher impact and attitudes, student attitudes and motivation, family and parental support, digital access and resources, as well as health and well-being.

Supporting evidence from Mahande, R. D., Malago, J. D., Abdal, N. M., & Yasdin, Y. (2022) reveals that attitude, anxiety, and motivation during web-based learning amid the COVID-19 pandemic affect students' performance.

Based on one the principles (clarity of focus, design down, high expectations, and expanded opportunities) of Outcome-Based Education (OBE), the result of this study is valid. If students don't learn, it's not because the teaching is ineffective; rather, it's because they lack the necessary skills, are uninspired, are foreigners, or have some other non-academic flaw that the instructor is not obligated to address (Biggs & Tang, 2011).

Moreover, the true meaning of success in teaching comes from accomplishing tasks and meeting high expectations. If work routine that anyone can do, there's little significance in it. This can be a key motivator for educators. Challenge is everywhere in education, and parents and the public have high expectations for their highly diverse children (Schwahn, C. & Spady, W., 2010). According to Killen (2000), referenced in Ghandi (2012), the supply of a flexible approach in time and instructional approaches matched to the demands of the learner and enabling more than one opportunity to succeed. The teacher must provide students plenty of opportunity to exhibit their learning in order to ensure that they are given the chance to do so in a variety of ways.

In addition, Biggs and Tang (2011) said that the most crucial approaches to enhance teaching are: (1) acknowledging that effective teaching is as much a result of institutional architecture as it is a talent bestowed upon a select few fortunate academics. The institution as a whole need to implement policies and procedures that (1) shift the

emphasis from the teacher to the learner and (2) define the learning outcomes that students are expected to achieve when teachers cover the subjects they are supposed to teach. These two methods can improve the teachers' attitudes toward a successful teaching-learning process.

**Conclusion**

Based on the findings provided, the following general conclusion is made:

The findings revealed that the STEM Science teachers' performance shows a weak ability to predict students' academic achievement. The qualitative findings align with these quantitative results and emphasize the impact of reduced class interaction during the pandemic. Overall, the study highlights other significant factors that influence STEM education and student outcomes.

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