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Leveraging Google Classroom for Science Education

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Abstract— This study determined the level of practice, strategies employed, extent of utilization, and challenges encountered by the 82 Junior High School Science teachers in the Sorsogon Cluster of Sorsogon City Division along with leveraging Google Classroom in Science education.

The results were analyzed using weighted mean and the Likert scale interval for the level of practice and extent of utilization. The weighted mean was used to quantitatively describe the overall level of practice and extent of utilization of individual respondents and it was interpreted using the Likert scale interval.

Moreover, for the teaching strategies employed, frequency count and ranking were used to identify the most frequent and most common teaching strategy or strategies employed by the respondents in using Google Classroom in Science teaching. In addition, for the challenges encountered, the sum of ranks was used to determine the most serious and least serious challenge(s) encountered by the respondent along with the integration of Google Classroom into their teaching practice in Science.

This study showed that the Junior High School Science teachers' level of practice is under the category of Proficient with an average weighted mean of 3.70, under this category, Science teachers are highly skilled in using Google Classroom, can integrate various tools, customize settings and provide seamless online learning experiences.

Additionally, the study showed that Science teachers employed Collaborative Learning in Google Classroom teaching. They maximize the potential of collaborative tools such as Google Docs, Slides, and Sheets making it easier for the students to work together on projects and assignments. Teachers assign group tasks and provide opportunities for students to collaborate.

In the context of Science Classes, Google Classroom's extent of utilization of Science teachers is of Moderate utilization, teachers under this category can utilize Google Classroom for distributing materials, assigning tasks, and facilitating discussions. Students, too, regularly access the platform to submit work and interact with their peers.

However, this study revealed that Science teachers' lack of appropriate digital learning devices such as laptops, smartphones, tablets, and iPads is the most serious challenge, and time management is the least serious challenge encountered in leveraging Google Classroom for Science education. Based on the findings, the researcher recommends designing Session Guides and Science prototype learning session plans by utilizing Google Classroom to leverage the potential of the platform as a digital classroom to enhance engagement and collaboration in the teaching-learning process of Science education, thus, elevating the level of practice to expert and extent of utilization to full integration of the platform.

Keywords— Google Classroom; Science Education; leveraging; level of practice; extent of utilization

I. INTRODUCTION

Teaching and learning have taken a lot of methodological leaps. What were once very relevant methods a decade ago are now nearly irrelevant. With the progress of mobile learning and a new normal of working and studying from home, the progress of teaching and learning has evolved tremendously since the beginning of the century and articulately enhanced at the onset of the COVID-19 pandemic until today, when the educational landscape adapts to blended learning modality due to inclement weather condition that prohibits onsite learning.

Learning is the acquisition of knowledge and information in various ways. Most people perceive learning as interactions that take place inside the school while some see it as realizations gained through prior experiences. In today's fast-changing world, technology has a big contribution to education and learning. As Randy David (2023) put it, "...but the reality is that every

teacher and professor today must learn to contend with the virtual world of inexhaustible information that is literally at the young people's fingertips. Now, more than ever, education has to go beyond the mere transmission of knowledge — i.e., the idea of learning as "banking," where knowledge is "deposited" through lectures and then "withdrawn" through examinations. If this is one's conception of learning, then one must know that no teacher can match what is available on Wikipedia alone." Henceforth, many technological advances offer new knowledge and resources in schools worldwide; thus, enriching curricula and altering the types of teaching available in the classroom. Schools' access to technology is increasing steadily every day and most of these technologies are now used in classrooms. Nidup (2022) further claimed that the difference in the quality of education in developed and developing countries could be attributed to the use of technology in education. This has created greater inequality in education in the developed and developing countries. Due to these circumstances, educators use technology in ways that can benefit not just the teacher but also the learners.

In a study conducted by Salavati (2016) on the use of digital technologies in education, he stated that digital technologies are applied to complement the traditional approach of teaching and foresee technology as an innovative pedagogy in teaching.

Since then, education has undergone several curriculum reforms through research and established partnerships with foreign civic societies like UNESCO, USAID, Australian AID, SEAMEO, and the like to establish doable and apt ways and means for learners to learn and how teaching could and should be provided. According to Jerald (2019), a broader set of 21st-century skills must be provided in school to students to thrive in a rapidly evolving, technology-saturated world. In response to these challenges, the Philippines implemented the Republic Act 10533 known as the Enhanced Basic Education Act of 2013, which propelled curriculum experts and implementers to craft and design the country's educational landscape. The K to 12 Science curriculum explicitly envisions the development of scientifically, technologically, and environmentally literate and productive members of society who are critical problem solvers, responsible stewards of nature, innovative and creative citizens, informed decision makers, and effective communicators as stipulated in the Science Curriculum Guide ordered by the Department of Education (DepEd) (2016). These reforms propelled several studies in the Philippines that delved into teachers' readiness to use ICT in the classroom.

Needless to say, the integration of technology in Philippine education and the world has transformed traditional teaching methods, offering new avenues for enhancing student engagement and learning outcomes.

Beaumont (2018) claimed that one prominent platform that has gained traction among educators is Google Classroom, a virtual learning environment designed to streamline the teaching and learning process through the use of various digital tools and resources. Microsoft Team (2022) described Google Classroom as a set of online tools that allows teachers to create lessons, collect student work, grade, and return graded papers. Google Classroom is a learning management system (LMS) that aims to simplify creating, distributing, and grading assignments and engaging students in learning online or remotely. Google Classroom is a free application designed to help students and teachers communicate, collaborate, organize, and manage assignments, go paperless, and much more. It was introduced as a feature of Google Apps for Education (GAFE) following its public release on August 12, 2014. When it comes to integration, Google Classroom is proficient in connecting with other Google applications like Google Docs, Sheets, Slides, Sites, Earth, Calendar, and Gmail which are useful in lesson delivery, output submissions, and assessment of learning. Additionally, it has the option to be further enhanced by incorporating Google Hangouts or Meet for real-time teaching sessions or student inquiries.

Similarly, Maroof & Emran (2018) underscored that Google Classroom is expected to be effective for both teachers and learners due to its varied features available. It is useful in facilitating in teaching and learning process and is said to enhance the students' self-directed learning (SDL) cognitive skills. This has enabled the teachers to transform the teaching pedagogies and also to incorporate different teaching styles to cater to different learners in the classroom which helped to develop 21st-century skills such as creativity, innovation, analytical, reasoning, and the skills to do things at a faster pace. This claim was further proven by Iftikhar (2016) in his study on Google Classroom: What works and what's how? where he concluded that teaching in the 21st century does mean teaching the 21st generation. It means helping and monitoring the students to learn and implement 21st-century skills.

Among the disciplines benefiting from the utilization of Google Classroom is Science education, where innovative approaches to instruction and curriculum delivery are paramount to fostering scientific inquiry and critical thinking skills among students as claimed by Widiyatmoko (2021) in his study on the effectiveness of Google Classroom as a tool to support online science learning: a literature review, that Google Classroom plays an important role in the online science classroom and science instruction during the pandemic Covid-19 situation and was utilized as assistive technology in universally designed classrooms, proving effective in meeting diverse learner needs based on the study conducted in a Canadian Junior High School by Sharpe (2023).

Correspondingly, Rangkuti (2022) analyzed the results of the use of Google Classroom for biology in eleventh grade and found that the experience of using Google Classroom as a means of learning biology is excellent, the adoption of Google Classroom as a biology learning platform was good, and concluded that online biology learning through Google Classroom can complement classroom teaching.

Google Classroom, despite its advantages, faces several limitations. These limitations include challenges such as students' difficulties in understanding provided material, limited internet access affecting task completion, and issues with timely assignment submissions due to connectivity problems based on the study conducted by Suparjan (2022). Additionally, obstacles for teachers include students' lack of timely assignment collection and limited internet connectivity as shown in the study of Theresia (2022). Furthermore, in Ayu, et., al. (2022) study, the software has been noted to fall short in providing optimal assessment and interaction levels for complex topics like embryology, leading to high attrition rates among students. Sunita, et., al. (2022) also concluded that resistance from both students and teachers, along with issues like outdated computer labs and internet connectivity problems, also hinder the effective utilization of Google Classroom in educational settings.

The success of the online learning system, therefore, is very dependent on several components, including students, teachers, learning resources, internet networks, information, communication, and technology. Google Classroom can help science teachers manage classes, conduct laboratory activities, and make online tests. Findings from this article showed that Google Classroom is an effective learning tool to support online science learning with certain limitations.

This study examined the potential of Google Classroom in Science education as an innovative pedagogy for Junior High School Science teachers in the City Division of Sorsogon. Through an exploration of the experiences, perceptions, and outcomes of teachers who have incorporated Google Classroom into their science instruction, this research intends to illuminate the opportunities and challenges related to the implementation of this technology-driven learning platform. By conducting a thorough analysis of teaching practices, strategies for integration, level extent of utilization, and encountered difficulties with Google Classroom, this investigation strives to offer valuable insights and practical suggestions for Science teachers at the Junior High School level looking to leverage Google Classroom as a cutting-edge pedagogical instrument that will enhance engagement and collaboration in Science teaching and learning procedures.

II. OBJECTIVES

This study determined the Junior High School Science Teachers' leveraging of Google Classroom for Science education.

Specifically, it identified the level of practice of Junior High School Science teachers on the use of Google Classroom. The different strategies utilized by teachers in teaching Science through Google Classroom. The extent of the utilization of Google Classroom employed in science classes. The challenges encountered by Science teachers in using Google Classroom and learning Session Plans that can be designed to leverage Google Classroom for Science education.

III. METHODOLOGY

This study employed a quantitative-descriptive research design to systematically quantify and describe the utilization of Google Classroom in Science teaching.

Also, this type of research design aligns well with the research questions, enabling a systematic and numerical exploration of the level of practice, strategies, the extent of utilization, and challenges encountered by Junior High school Science teachers in integrating Google Classroom into their teaching practices in Science.

Moreover, a non-probability sampling method was used in the selection of the respondents to the study. A preformulated selection criteria was set by the researcher to identify the qualified members of the respondents. These respondents must meet certain requirements, such as having a Science education degree or a Secondary Education degree with a specialization in any Science area such as General Science, Biology, Chemistry, and Physics. Second, the respondent must be a Junior High School Science teacher handling Science subject (s) in any grade level from Grade 7 to Grade 10 in the present school year 2023-2024.

Furthermore, a survey method using a survey questionnaire and a 5-point Likert Scale was used to gather the relevant data necessary for the study. In addition, descriptive statistic such as mean, standard deviation, frequency count, percentage, and rank were used to statistically analyze and interpret the results of the study.

The respondents of this study are the 82 Junior High School Science teachers in the Sorsogon Cluster in the Sorsogon City Division. The researcher employed purposive sampling in identifying the respondents of this study.

IV. RESULTS AND DISCUSSION

The data were meticulously analyzed using various statistical treatments and analysis procedures. The presentation follows the level of practice of Google Classroom in Science Teaching, the employed teaching strategies by the respondents, the extent of utilization, and the challenges they have encountered while leveraging Google Classroom Science teaching.

1. Level of Practice of Junior High School Science Teachers on Google Classroom Utilization

The level of practice of Junior High School Science teachers on the use of Google Classroom was examined using a 5-point Likert-scale questionnaire comprised of ten (10) descriptive indicators along with the familiarity of the teacher respondents with Google Classroom, consistency in using it, efficient use of features, integration of other Google tools, creativity in assignments, collaboration with students, effective communication with students, utilization of Google Classroom for assessment, regular updates and improvements, and feedback and reflection. The 5-point scale has the following descriptive values: 5 is described as “Expert”, 4 as “Proficient," 3 as “Intermediate”, 2 as “Beginner," and 1 is described as “Novice”.

Table 1.1 presents the level of practice of Junior High School (JHS) Science teachers in utilizing Google Classroom, measured across various individual indicators. The weighted mean ($\bar{x}$) offers insights into the proficiency and consistency of teachers in specific dimensions of Google Classroom utilization. The descriptive values categorize the performance levels into different proficiency level.

Table. 1.1 *Level of Practice of JHS Science Teachers on Google Classroom*

Indicators		**Weighted Mean**	**Descriptive Value**
Familiarity with Google Classroom		3.88	Proficient
Consistency in using Google Classroom		3.57	Proficient
Efficient use of features		3.49	Proficient
Integration of other Google tools		4.13	Proficient
Creativity in assignments		3.91	Proficient
Collaboration with students		3.83	Proficient
Effective communication with students		3.32	Intermediate
Utilizing Google Classroom for assessments		3.24	Intermediate
Regular updates and improvements		3.76	Proficient
Feedback and reflection		3.91	Proficient
Average		3.70	Proficient

Familiarity with Google Classroom, reflected by a weighted mean of 3.88, falls within the "Proficient" range, indicating that JHS Science teachers exhibit competence in their knowledge and understanding of the platform. Consistency in using Google Classroom (weighted mean = 3.57) and efficient use of features (weighted mean = 3.49) also demonstrate proficiency. The integration of other Google tools scores notably high, with a weighted mean of 4.13, suggesting adept utilization and a proficient level of integration.

Areas such as creativity in assignments (weighted mean = 3.91), collaboration with students (weighted mean = 3.83), regular updates and improvements (weighted mean = 3.76), and feedback and reflection (weighted mean = 3.91) all consistently fall within the "Proficient" range, showcasing a commendable level of competence among JHS Science teachers. However, some areas, such as effective communication with students (weighted mean = 3.32) and utilizing Google Classroom for assessments (weighted mean = 3.24), fall within the "Intermediate" range, indicating scope for improvement in these specific dimensions. Overall, the Junior High School Science teachers in the Sorsogon Cluster of Sorsogon City Division manifested a “Proficient” level of practice of Google Classroom with a 3.70 average weighted mean.

These findings hold significant implications for science teaching, emphasizing the need for targeted professional development to enhance teachers' proficiency, particularly in communication and assessment strategies within the Google Classroom platform. Junior High School students stand to benefit from improved instructional methods, and curriculum implementers may consider tailored support for teachers in areas identified as intermediate. Parents can be informed about the proficient use of technology in their children's education. For future researchers, these results suggest avenues for more in-depth investigations into specific dimensions of Google Classroom utilization and its impact on teaching and learning outcomes.

Moreover, the respondents who described themselves as "Proficient" in using Google Classroom may be from educational institutions where the online learning platform has been adopted as a choice for delivering teaching, especially during the pandemic times.

Conversely, students from schools where learning is delivered through printed modules may fall into the "intermediate" category. For future researchers, this data provides a baseline for further investigation into the factors influencing teachers' proficiency levels and the impact of varying levels of expertise on student outcomes.

In general, the distribution of proficiency levels among JHS Science teachers in Google Classroom utilization underscores both strengths and areas for improvement. This nuanced understanding contributes to informed decision-making for all stakeholders, fostering a collaborative effort to enhance the quality of science education in Junior High Schools.

However, this proficiency demonstrated by Junior High School Science teachers in utilizing Google Classroom also reflects their adaptability to digital tools, a crucial skill in the evolving landscape of education. As schools increasingly adopt blended learning models, where both traditional and digital methods coexist, the demonstrated proficiency suggests that teachers are well-positioned to navigate and contribute to the success of blended learning environments. To optimize this, continuous professional development programs can be tailored to further enhance teachers' digital competencies, ensuring they are adept at leveraging technology for effective instruction. Continuous professional development programs play a crucial role in enhancing teachers' digital competencies for effective instruction Anatastasiya, et. al (2022). These programs are essential in equipping educators with the necessary skills to integrate technology into teaching practices, especially in the current digital era. Therefore, tailored continuous professional development programs are vital in ensuring teachers are adept at leveraging technology for effective instruction in the classroom.

2. Employed Teaching Strategies by the Junior High School Teachers in using Google Classroom

Table 2.1 outlines the teaching strategies employed by science teachers in utilizing Google Classroom, providing valuable insights with implications for science teaching, Junior High School students, Science teachers, curriculum implementers, parents, and future researchers.

The most frequently employed teaching strategy in Science teaching through Google Classroom is Collaborative Learning, utilized by a significant frequency of 74 and is ranked 1.

This suggests a widespread acknowledgment of the benefits of fostering collaborative interactions among students through digital platforms.

For science teaching, this finding implies a positive shift towards more interactive and engaging pedagogical approaches, potentially enhancing the learning experiences of Junior High School Science students.

Table 2.1 Employed Teaching Strategies by the Science Teachers in Using Google Classroom

Teaching Strategies	Frequency	Rank
Collaborative Learning	74	1
Inquiry-Based Learning	68	2
Differentiated Instruction	54	3
Formative Assessment	47	4
Flipped Classroom	31	5
Gamification	21	6
Mind Mapping	19	7
Self-Paced Learning	18	8
Virtual Field Trips	13	9
Total	345	

Inquiry-based learning follows closely, with 68 science teachers incorporating this strategy. This suggests a commitment to promoting critical thinking and problem-solving skills among students, aligning with contemporary educational principles. The prevalence of Differentiated Instruction at 54 reflects an effort to cater to diverse learning needs, potentially contributing to more inclusive and effective teaching practices.

Formative Assessment, implemented by 47 teachers, signals a commitment to ongoing evaluation and feedback within the virtual classroom environment. Flipped Classroom with 31, Gamification with 21, Mind Mapping with 19, Self-Paced Learning with 18, and Virtual Field Trips with 13 are also employed, albeit to varying extents, showcasing a diverse array of innovative teaching strategies.

Future researchers may find inspiration in exploring the effectiveness of these strategies in promoting student engagement and achievement within the Google Classroom context. Additionally, the data lays the groundwork for discussions on professional development initiatives tailored to enhance teachers' proficiency in employing a range of teaching strategies.

Overall, the prevalence of collaborative learning, inquiry-based learning, and differentiated instruction strategies within Google Classroom signifies a shift towards student-centered and interactive pedagogies. In the future of education, this indicates a potential transformation in teaching methodologies, with an increased focus on personalized and collaborative learning experiences. The data offer valuable insights for stakeholders such as curriculum developers and educators, emphasizing the importance of fostering a dynamic and adaptable educational landscape that aligns with the diverse needs of junior high school students. They can leverage these insights to design instructional materials that align with these strategies, fostering a more engaging and effective learning environment.

3. Extent of the Utilization of Google Classroom Employed in Science Classes

Table 3 presents the extent of Google Classroom utilization in Science classes, dissecting various indicators to unveil the nuances in implementation. The weighted mean ($\bar{x}$) coupled with descriptive labels, provides an in-depth understanding of the platform's impact on science teaching, Junior High School students, Science teachers, curriculum implementers, parents, and future researchers.

Table 3. Extent of Utilization of Google Classroom as Employed in Science Teaching

Indicators	Weighted Mean	Descriptive Value
Google Classroom promotes a paperless classroom	4.18	High Utilization
Google Classroom allows easy communication	3.12	Moderate Utilization
Google Classroom promotes collaboration and teamwork	3.00	Moderate Utilization
Google Classroom offers a variety of assessment options	3.10	Moderate Utilization
Google Classroom provides a platform for virtual field trips	2.24	Minimal Utilization
Google Classroom integrates with other Google tools	3.36	Moderate Utilization
Google Classroom offers a safe and secure learning environment	2.82	Moderate Utilization
Google Classroom allows for personalized learning	2.84	Moderate Utilization

Google Classroom facilitates quick feedback and grading	4.16	High Utilization
Google Classroom promotes digital literacy	4.20	High Utilization
Average	3.30	Moderate Utilization

For Science teaching, the indicators Google Classroom promotes digital literacy, Google Classroom promotes a paperless classroom and Google Classroom facilitates quick feedback and grading all achieve a High Utilization status, with weighted means of 4.20, 4.18, and 4.16 respectively. These findings underscore the platform's potential to streamline assessment processes and enhance students' digital competencies.

Junior high school students stand to benefit from the High Utilization of Google Classroom in promoting a paperless environment, facilitating quick feedback, and fostering digital literacy. Science teachers, with a focus on collaboration and efficient grading, can optimize the platform for enhanced instructional outcomes. Curriculum implementers may consider reinforcing the High Utilization indicators in professional development initiatives to leverage the full potential of Google Classroom.

In this study, Table 4 showed the pre-determined challenges encountered by the Science teachers in using Google Classroom in Science teaching, the most serious and the least serious challenge (s) encountered by the teacher-respondents determined through the sum of ranks.

Table 4. *Challenges encountered by Science Teachers in using Google Classroom*

Challenges Encountered	**Sum of Ranks**	**Rank**
Lack of appropriate digital learning devices (laptop, smartphones, tablets, iPad))	243	1
Inadequate student engagement	347	2
Difficulty in assessing Performance-based tasks	421	3
Poor Internet connectivity/coverage	358	4
Limited student-teacher interaction	399	5
Dishonesty in accomplishing written outputs	415	6
Lack of training of teachers and students	461	7
Low peer interaction	512	8
Time Management	698	9
Total	3854	

Table 4 provides a sum of ranks assessment of the challenges encountered by Science teachers in utilizing Google Classroom, with a rank of one (1) being the most serious challenge encountered and a rank of nine (9) being the least serious challenge encountered by Science teachers in using Google Classroom in teaching.

Lack of appropriate digital learning devices such as laptops, smartphones, tablets, and iPads emerge as the most serious challenge with a Sum of Ranks of 243 and interpreted as the most serious challenge faced by Science teachers in using Google Classroom in Science teaching. On the other hand, Time Management with a sum rank of 698 emerges as the least serious challenge encountered by Science teachers in teaching Science through Google Classroom. Other challenges encountered by Science teachers in integrating Google Classroom in Science classes include inadequate student engagement with the sum of ranks 347, difficulty in assessing Performance-based tasks with 421, Poor Internet connectivity/coverage with 358, Limited student-teacher interaction with 399, Dishonesty in accomplishing written outputs with 415, Lack of training of teachers and students with 461, low peer interaction with 512 and time management with the sum of ranks of 623.

In summary, the implications of the study on science teaching using Google Classroom extend beyond the present context, offering valuable insights for the future of education. Stakeholders, including educators, curriculum implementers, and policymakers, can leverage these findings to inform strategic decisions, interventions, and policies that promote the successful integration of technology and blended learning practices in the evolving landscape of education.

The results offer valuable insights into the severity of each challenge, influencing Science Teaching, Junior

High School students, Science teachers, curriculum implementers, parents, and future researchers.

Session Guide and prototype Science learning session plans on Google classroom utilization in Science teaching may guide Science teachers to leverage the potential of the platform to enhance engagement and collaboration in Science learning.

V. CONCLUSIONS AND RECOMMENDATIONS

Based on the preceding findings, the researcher concludes that the public Junior High School Science teachers in the Sorsogon Cluster of the City Division of Sorsogon are on a Proficient level of Practice in the utilization of Google Classroom in Science teaching. To make the most of the features of Google Classroom as a learning platform, Collaborative teaching is the most common teaching strategy used by the public Junior High School Science teachers in the Sorsogon Cluster of the City Division of Sorsogon. The public Junior High School Science teachers in the Sorsogon Cluster of the City Division of Sorsogon are of Moderate utilization of Google Classroom in Science teaching. Lack of appropriate digital learning devices is a pressing concern for science teachers in leveraging the potential of Google Classroom in Science teaching. The Session Guide and the prototype Science learning session plans for Google classroom Science teaching are suggested to be utilized as guide for science teachers to leverage the potential of the platform to enhance engagement and collaboration in Science learning.

Finally, the researcher offers the following recommendations based on the findings and conclusions made: (1) Professional Development programs on Leveraging Google Classroom must be aligned to the current Science teaching and learning situation. (2) Recognize and support collaborative learning through Google Classroom as a key teaching strategy in Science education as this can be an avenue for developing information literacy and digital citizenship. (3) Selective utilization of Google Classroom on Science topics that can best be taught by integrating Google Classroom. (4) Partnerships and collaboration with external and internal stakeholders may pave avenues for the provision of digital devices for students and teachers. (5) The suggested Session Guide and Prototype Learning Session Plans will direct Science teachers on how to execute Science teaching through Google Classroom to enhance engagement and collaboration between teachers and students; students and students.

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